of the pumpkins and squashes, see De Candolle, Origin of Cultivated Plants; Gray and Trumbull, Amer. Journ. Sci. 25:372; Sturtevant, Amer. Nat. 1890:727; Wittmack, Ber. der Deutschen Bot. Gesell. 6:378 (1888).

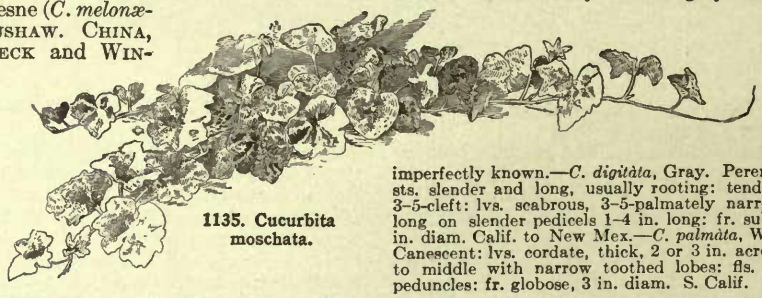


1134. Cucurbita Pepo var. ovifera.

Var. **condénsa**, Bailey. Bush Pumpkins. Scallop and Summer Crookneck Squashes. Plant compact, little or not at all running. Of horticultural origin.

Var. **ovífera**, Bailey (*C. ovífera*, Linn.). Gourd. Fig. 1134. Plant slender, running: lvs. smaller than in *C. Pepo*, usually very prominently lobed: fr. small, hard and inedible, egg-shaped, globular, pear-shaped, oblate, often striped. R.H. 1894:429.—Sold in many vars. by seedsmen, under the names of *C. Pepo* vars. *pyriformis, depressa, annulata*, etc. See *Gourd*.

moschàta, Duchesne (*C. melonæfórmis*, Carr.). Cushaw. China, Canada Crookneck and Winter Crookneck Squashes. Figs. 1135–37. Annual: long-running, less prickly and sometimes soft-hairy: lvs. more rounded than those of *C. Pepo*, but lobed, often grayish: fl. with a widening tube, and large, erect lobes; calyx-lobes large, often lf.-like; peduncle becoming deeply ridged and much enlarged next the fr. Possibly of E. Asian origin.



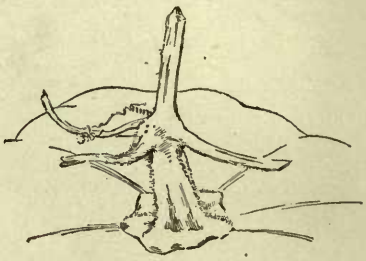
1135. Cucurbita moschata.

bb. *Lvs. not lobed (except sometimes on young shoots): stalks of frs. not prominently ridged.*

máxima, Duchesne. Squash. Figs. 1138–41. Annual: long-running, the sts. nearly cylindrical, little prickly and often hairy: lvs. orbicular or kidney-shaped, commonly not lobed, the basal sinus wide or narrow, the margin shallowly apiculate-sinuate: corolla-tube nearly the same diam. at top and bottom (Figs. 1139, 1140), the corolla-lobes large and soft, and wide-spreading or drooping: peduncle at maturity soft and spongy, not ridged nor prominently enlarged next the fr.: fr. very various, but not light yellow nor warty nor crookneck-shaped, usually late-ripening, the flesh orange and not stringy. Nativity undetermined. Var. **sylvéstris**, Naudin. A form found wild in the Himalayan region, with fr. as large as a man's head.

aa. *Plant with perennial root.*

fœtidíssima, Kunth (*C. perénnis*, Gray. *Cùcumis perénnis*, James). Calabazilla. Fig. 1142. Perennial: long-running, scarcely prickly: lvs. large, cordate-triangular, grayish pubescent, the margin shallowly apiculate-crenate: fl. nearly as large as in *C. Pepo* and similar in shape, the pistillate on a peduncle 2–3 in. long: fr. size and shape of an orange, smooth, green and yellow splashed, not edible. Sandy arid wastes, Neb. and Colo. to Texas and Mex. and westward to Calif. R.H. 1855:61; 1857, p. 54.—In its native haunts, the root is tuberous, 4–7 in. diam. and penetrating the earth 4–6 ft. Roots at the joints. The plant has a fetid odor. Sold by seedsmen as a gourd, but the fr. does not often ripen in the northern states. Useful on arbors and small trees, when coarse vines are wanted.



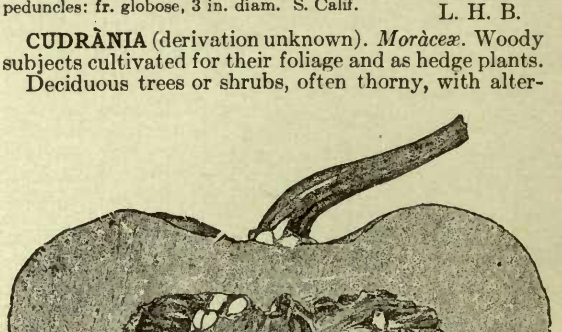
1136. Stem of Cucurbita moschata. Large Cheese pumpkin

ficifòlia, Bouché (*C. melanospérma*, A. Br.). St. very long, stout, becoming somewhat woody: lvs. pale green, often marbled, in outline ovate or suborbicular, cordate at base, roundly 5-lobed and the sinus rounded: calyx-tube short and campanulate: fr. large (often 1 ft. long), fleshy, round-ovoid, white-striped, the flesh white; seeds ovate, black. E. Asia, but widely cult. in warm countries for its ornamental watermelon-like frs. A var. *mexicàna*, Hort. (*C. mexicàna*, Spreng.), is mentioned, with seeds twice the size of those of the type, and said to grow wild in the neighborhood of Mazatlan, Mex.

C. Andreàna, Naudin. Allied to C. moschata: sts. long and rooting at the nodes: lvs. large, marbled with white: fls. of the form of those of C. maxima but much smaller: fr. obovoid, 8 in. long, marked with white and yellow. Uruguay. R.H. 1896, pp. 542–3.—*C. califórnica*, Torr. Canescent: lvs. thick, 2 in. across, 5-lobed, the lobes triangular and mucronate: tendrils parted to the base: fls. 1 in. or more long on pedicels ½–1 in. long. Calif.; imperfectly known.—*C. digitàta*, Gray. Perennial, the root fleshy: sts. slender and long, usually rooting: tendrils short and weak, 3–5-cleft: lvs. scabrous, 3–5-palmately narrow-lobed: fls. 2–3 in. long on slender pedicels 1–4 in. long: fr. subglobose, yellow, 2–4 in. diam. Calif. to New Mex.—*C. palmàta*, Wats. Mock Orange. Canescent: lvs. cordate, thick, 2 or 3 in. across, palmately 5-cleft to middle with narrow toothed lobes: fls. 3 in. long on stout peduncles: fr. globose, 3 in. diam. S. Calif.

L. H. B.

CUDRÀNIA (derivation unknown). *Moràceæ*. Woody subjects cultivated for their foliage and as hedge plants. Deciduous trees or shrubs, often thorny, with alter-



1137. Fruit of Cucurbita moschata—Tonasu, a Japanese variety.

nate, petioled and stipulate lvs.: fls. dicœcious, in axillary globular heads; staminate with 4 sepals and 4 stamens and 2–4 bracts at the base; pistillate with 4 sepals inclosing the 1-ovuled ovary, growing into a fleshy subglobose fr. with a crustaceous rind.—About 3 species, in S. and E. Asia and Trop. Austral., of which only one is sometimes cult. It requires protection in the N. and is usually prop. by greenwood cuttings in summer under glass.

tricuspidàta, Bureau (*Maclùra tricuspidàta,* Carr. *C. tríloba,* Hance). Shrub, or small tree, to 20, rarely to 60 ft., with slender, thorny branches: lvs. elliptic-ovate, acuminate, entire, sometimes 3-lobed at the apex and on young plants even tricuspidate, nearly glabrous, 1½–3 in. long: fl.-heads axillary, solitary or in 2's, on short peduncles: fr. globose, about 1 in. across. China. R.H. 1864, p. 390; 1872, p. 56; 1905, p. 363 (habit). H.I. 18:1792.—Recently recommended as an excellent hedge-plant for the S. In China the lvs. are used as a substitute for mulberry lvs. and it is called silkworm thorn; the fr. is edible. Between this species and *Maclura pomifera,* a hybrid has been raised, described as *Macludrània hýbrida,* André. R.H. 1905:362. ALFRED REHDER.

CULINARY HERBS are those herbs used for flavoring in cookery, but the term has a wide application, including species used for garnishing and sometimes as potherbs. The culinary herbs are of very minor importance in American gardens, and yet a few of them, as anise, caraway and coriander, are well and favorably known. The species are mostly aromatic. They are largely of the Umbelliferæ and Labiatæ. No special



1139. Staminate flower of Cucurbita maxima—Hubbard squash. (×⅛)



1140. Pistillate flower of Cucurbita maxima—Hubbard squash. (×⅛)

difficulty attaches to their cultivation, and little more may be said here than to present an alphabetical list with statements as to uses, duration of plant, and means of propagation. They all thrive in mellow fertile garden land. Usually they are grown at the side of the main garden plantation, and they may add a certain charm to the garden as well as to supply an agreeable aroma to the kitchen products. See the little book on "Culinary Herbs" by M. G. Kains, 1912.

Angelica (*Archangelica officinalis*). *Umbelliferæ.* Biennial or perennial. *Uses:* Stems and leaf-stalks as salad, or roasted like potatoes; garnish; as "candied angelica;" stems blanched and used as vegetable; leaves as spinach; seeds for flavoring; oil of angelica obtained from seeds for flavoring. Propagated by seeds in late summer or early autumn.

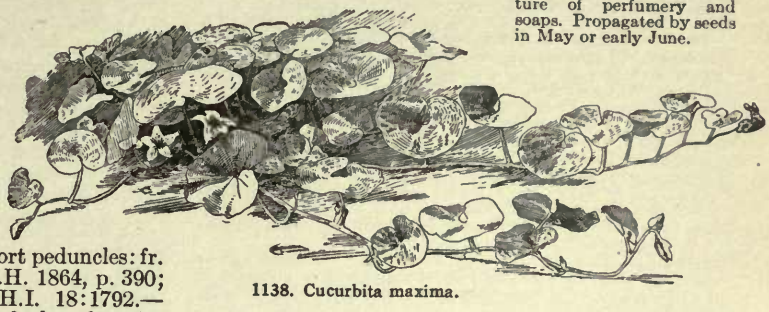
Anise (*Pimpinella Anisum*). *Umbelliferæ.* Annual. *Uses:* Leaves as garnish, flavoring, and potherb; seeds and oil for flavoring and perfumery. Propagated by seeds in early spring.

Balm (*Melissa officinalis*). *Labiatæ.* Perennial. *Uses:* Foliage for flavoring and salad; oil for perfumery and flavoring beverages. Propagated by divisions, layers, cuttings and seeds.

Basil (*Ocymum basilicum*). *Labiatæ.* Annual. *Uses:* As flavor in highly seasoned dishes; oil as perfumery. Propagated by seeds.

Borage (*Borago officinalis*). *Boraginaceæ.* Annual. *Uses:* Herbage as potherb and salad; garnish; flavor in beverages. Propagated by seeds in spring.

Caraway (*Carum Carvi*). *Umbelliferæ.* Biennial or annual. *Uses:* Herbage eaten cooked or as salad; roots as vegetable; seeds for flavoring; oil in manufacture of perfumery and soaps. Propagated by seeds in May or early June.



1138. Cucurbita maxima.

Catnip or catmint (*Nepeta Cataria*). *Labiatæ.* Perennial. *Uses:* As bee forage; leaves as condiment; formerly a medicinal remedy. Propagated by seeds in autumn or spring.

Chervil (*Anthriscus Cerefolium*). *Umbelliferæ.* Annual. *Uses:* Leaves for seasoning and for mixed salads. Propagated by seeds.

Chives (*Allium Schœnoprasum*). *Liliaceæ.* Perennial. *Uses:* Leaves for flavoring. Propagated by individual bulbs or division of clumps in early spring.

Clary (*Salvia Sclarea*). *Labiatæ.* Perennial. *Uses:* Leaves in cookery; wine made from plant when in flower. Propagated by seeds in spring.

Coriander (*Coriandrum sativum*). *Umbelliferæ.* Annual. *Uses:* Seed in confectionary and as ingredient in condiments; flavor in beverages. Propagated by seeds in spring or autumn.

Cumin (*Cuminum odorum*). *Umbelliferæ.* Annual. *Uses:* Seeds as ingredient in curry powder; for flavoring pickles, pastry and soups. Propagated by seeds in spring.

Dill (*Anethum graveolens*). *Umbelliferæ.* Annual. *Uses:* Seed as seasoning, extensively for commercial pickles; oil for perfuming soap; young leaves as seasoning and salads; dill vinegar as condiment. Propagated by seeds in spring.

Fennel (*Fœniculum vulgare*). *Umbelliferæ.* Biennial or perennial. *Uses:* Herbage as garnishes and flavors; as salads; seeds for flavoring beverages, and for confectionary; oil as perfumery. Propagated by seeds, and grown as an annual.

Finocchio or Florence fennel (*Fœniculum dulce*). *Umbelliferæ.* Annual. *Uses:* As a vegetable. Propagated by seeds.

Fennel Flower (*Nigella sativa*). *Ranunculaceæ.* Annual. *Uses:* Whole plant or seed used in cookery. Propagated by seeds in spring.

Hoarhound, or horehound (*Marrubium vulgare*). *Labiatæ.* Perennial. *Uses:* Formerly in cookery and medicine; now for candy only. Propagated by seeds in spring.

Hyssop (*Hyssopus officinalis*). *Labiatæ.* Perennial. *Uses:* Herbage in salads; oil in preparation of soaps, etc. Propagated by divisions, cuttings and seeds in spring.

Lavender (*Lavandula angustifolia, L. Spica*). *Labiatæ.* Perennial. *Uses:* Flowers and oil in perfumery; sometimes as condiment and in salads. Propagated by divisions or cuttings, or rarely seeds.

Lovage (*Levisticum officinale*). *Umbelliferæ.* Perennial. *Uses:* Young stems in confectionary. Propagated by division or seeds in late summer.

Marigold (*Calendula officinalis*). *Compositæ.* Annual. *Uses:* Flower-heads as seasoning; fresh flowers to color butter. Propagated by seeds in spring.

Marjoram (*Origanum vulgare* and *O. Marjoram*). *Labiatæ.* Perennial (*O. Marjoram* treated as annual). *Uses:* Herbage for seasoning; oil in perfuming soaps, etc. Propagated by cuttings, division or layers and seeds in spring.



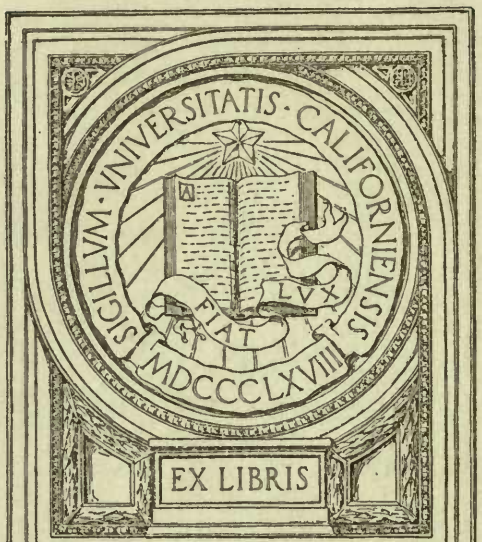
1141. Stem of Cucurbita maxima—Hubbard squash.

Mint (*Mentha spicata*). *Labiatæ.* Perennial. *Uses:* Herbage as seasoning; leaves in jelly. Propagated by cuttings, offsets and divisions in spring.

Parsley (*Petroselinum hortense*). *Umbelliferæ.* Biennial. *Uses:* Roots as vegetable; top as potherb; leaves for seasoning and garnish. Propagated by seeds in spring.

Pennyroyal (*Mentha Pulegium*). *Labiatæ.* Perennial. *Uses:* Leaves as seasoning; pennyroyal oil. Propagated by division, or rarely cuttings.

Peppermint (*Mentha piperita*). *Labiatæ.* Perennial. *Uses:* Oil as flavoring; perfume in soaps, etc. Propagated by division or running rootstocks.



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THE STANDARD CYCLOPEDIA OF HORTICULTURE



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XXI. Cherry.—Specimen fruits of one of the heart cherries

THE STANDARD CYCLOPEDIA OF HORTICULTURE

Univ. of California

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

VOL. II—C–E

PAGES 603–1200. FIGS. 701–1470

THIRD EDITION

New York

THE MACMILLAN COMPANY

LONDON: MACMILLAN & CO., LTD.

1919

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Set Up and Electrotyped. Published July 22, 1914
Reprinted May, 1917; March, 1919

Mount Pleasant Press
J. HORACE MCFARLAND COMPANY
HARRISBURG, PENNSYLVANIA

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C

CABBAGE. The more or less compact leaf-formed head of *Brassica oleracea;* also applied, with designations, to related forms of the same species, as Welsh cabbage, tree cabbage. Closely related plants are the kales (Fig. 706), collards, Brussels sprouts, cauliflower. See *Brassica.*

The Chinese cabbage of this country is a wholly different species from the common cabbages. It does not form a compact and rounded head, but a more or less open and soft mass of leaves, after the manner of Cos lettuce. It is of easy culture, but must be grown in the cool season, for it runs quickly to seed in hot and dry weather.

The culture of the cabbage antedates reliable historical record. Writers of Pliny's time or before refer to variations in growth and character which must have resulted from selections and cultivation for many generations, under conditions very different from those which seem to be the natural habitat of the plant on the comparatively barren chalk cliffs of England, and in similar locations in Europe.

It is indeed hard to realize that the scrawny and somewhat starved-looking plant shown in Fig. 628 (Vol. I) could be the ancestral origin of such corpulent, overfed individuals as are shown in Figs. 701 to 704. Such a change in habit of growth can be accounted for only by the plant's possession of exceptional capacity for using the more abundant food-supply furnished by cultivation for many generations, and the storing of it in a way that makes it available for man's use rather than for the mere perpetuation and multiplication of the parent plants.

Characteristics of the plant and requisites for best development.

The cabbage is classed by botanists as a slow-growing bi-annual, and has three distinct periods of life: First, the more or less rapid growth of leaf and plant. Second, a more or less distinct resting period during which the formation of embryonic blossoms is started. Third, the growth and development of the flower and seed. The cultivated cabbages retain very persistently these distinct growing periods, but have added what might be classed as another, that of head-formation, which is in reality simply a distinct division of the first. This additional head-forming period, although essential to the plant's value as a cultivated vegetable, is not at all necessary for the growth and perpetuation of the plant, which, when it has been held in check by long-continued severe frost or drought, will often revert to the original order of growth and pass directly from the growing to the seeding stages with no attempt at head-formation.



701. Conical form of cabbage—Jersey Wakefield.



702. Round-headed type of cabbage.



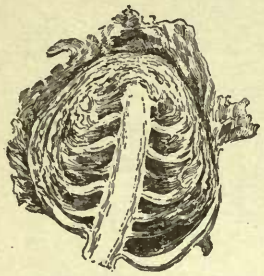
703. Savoy cabbage.



704. A modern cabbage plant in head—Early Flat Dutch.

Cultivated cabbage thrives best in a moist and comparatively cool climate, and will not reach its best and rarely a satisfactory or profitable development in a hot dry one, nor where there are likely to be even occasional days of high temperature or hot dry winds. Even if there is abundant moisture in the soil, a few hot dry days, such as corn and tomato plants would delight in, will often not only check but permanently prevent any vigorous or profitable growth. This sensitiveness to over-heat is most pronounced during the second or unnatural period of growth, and the least so during the first. Young plants will often thrive in temperatures in which it would be quite impossible to induce older ones to form a solid head. Excessive heat is quite as injurious, and often more so, than freezing, but the latter is especially injurious to the younger plants, particularly if they are growing rapidly, the older ones being little injured by frost which would kill rapid-growing seedlings. One notable effect of exposure of young plants to severe or long-continued low temperature is that it takes the place of the resting period, and thus cuts out the second or head-forming period, so that the plant, as soon as established in the field, begins to shoot to seed without forming any head. The degree to which the plant suffers from unfavorable temperature seems to vary not only with different varieties but in different locations. In the Puget Sound country, cabbage plants are often killed by exposure to low temperatures, which those of the same variety and age growing in similar soil and exposure on Long Island would endure with little apparent injury. In the United States, favorable climatic conditions are most likely to occur in succession during the winter, spring and fall months, as one moves northeast along the Gulf and Atlantic coasts, or in the West along the coast north from Portland, Oregon, and in isolated sections south of that point. Some of the finest cabbages ever produced in America have been grown at points on the Pacific coast as far south as Los Angeles, California. There are also locations,

especially in New York, Ohio, Indiana, Michigan and Wisconsin, near the Great Lakes, or where smaller but deep inland lakes abound, in which cabbage does exceptionally well, but generally, in common with most cruciferous plants, they do better near the sea, in such locations as the Eastern Shore of Maryland, Long Island and Puget Sound regions, than in the interior or on the borders of even very large bodies of fresh water.



705. Section of cabbage head, showing the thickened rachis and leaf-stalks, and the buds in the axils.

As the plant is a native of the temperate zone, and thrives best in it, and cannot long endure high temperatures, one does not think of it as particularly sun-loving; but there are few garden plants to which abundant sunlight is more essential and shade more detrimental than the cabbage. In its native habitat, the plants are found growing alone or in small open groups where they are fully exposed to the sun. Similar conditions are essential to its best development under cultivation so that it can rarely be profitably grown in the shade or in crowded groups or rows, and "shooting to seed" or other failure to form a head is often due to the crowding of the seedlings in the seed-row.

The cabbage is one of the grossest and least fastidious feeders of cultivated plants, and while an abundance of easily accessible food is essential for its profitable culture, it is less particular than most plants as to its proportions and physical condition, if only it has an abundance. Large crops of the best quality are often produced by the use of fresh green and uncomposted manures in almost limitless quantities. Some growers object to the use of manure from hog-pens, yet some of the largest, healthiest and best crops ever seen have been grown by the liberal use of hog manure. Strange as it may seem, abundant fertilization hastens rather than retards the plant reaching marketable condition.

The plant is more particular as to its water-supply than its food-supply, and suffers even more quickly than most vegetables from a lack of sufficient moisture in the air or soil. On the other hand, it cannot long endure an excess, particularly in the soil, and soon succumbs to wet feet. A well-drained soil which at the same time is fairly retentive of moisture is essential to profitable cabbage-culture.

Even more than with most garden vegetables, the physical condition of the soil is a most important factor in determining the development of the cabbage. Large and often very profitable crops may be grown on soils which would be classed as clay, loam, gravel, sand or muck, provided they are rich and friable, but seldom a large, or profitable crop can be grown on even a very fertile soil which after rains quickly hardens and bakes so as to be impervious to air. Permanent friability rather than superior fertility makes some soils exceedingly profitable for cabbage, while it is difficult and often impossible to grow a paying crop on others which are even richer and better watered, but which are liable to cake after every rain. This is especially true of some soils that are generally classed as a very rich clay or muck. Permanent friability is the most essential quality for profitable cabbage-culture, and the want of it the most common cause of failure to grow a profitable crop.

Varieties of cabbage. Figs. 701–704, 707.

Few vegetables show a wider range of variation. There are sorts that can be grown to edible maturity on a square foot and in 90 to 120 days from the seed, while others can hardly be crowded into a square yard or reach prime edible maturity in less than 200 days; sorts so short-stemmed that the flat head seems to rest on the ground, others in which the globular head crowns a stalk 16 to 20 inches long; kinds in which the leaves are long, round, or broad, smooth, or savoyed, light yellowish green, dark green or so dark red as to seem black, with surfaces which are glazed, smooth, or covered with thick bloom. There are many early-maturing kinds, each having characteristics adapting them for different cultural conditions and uses, that will, in fertile soil and a temperature between 60° and 80° by day, and never below 40° at night, form salable heads in 90 to 110 or 120 days from the germination of the seed; others that mature in mid-season; still others that grow the entire season and increase in solidity even while stored for winter.

American seedsmen offer cabbage seed under over 500 more or less distinct varietal names, a large proportion of which stand for different stocks rather than for distinct varietal forms: here only the most distinct types and the most commonly used names are mentioned.

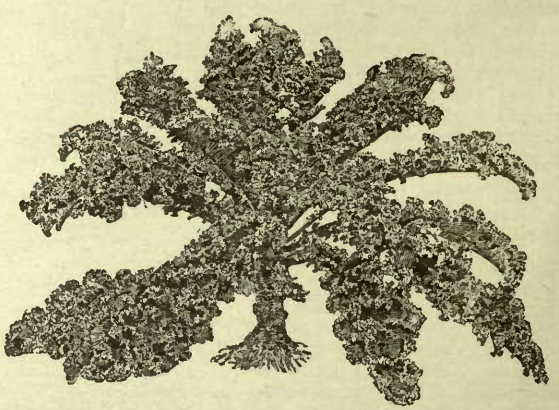
Early York, Etampes, Large York, etc.—Very compact, upright-growing smooth-leaved sorts which are comparatively tender to both heat and cold, and form vertically oval comparatively soft heads of excellent quality, but better suited to European than American climatic conditions and market requirements.

Early Jersey, Large Wakefield, Winnigstadt, etc.—Compact-growing, very sure-heading sorts which are very hardy to both heat and cold and form comparatively small, but closely wrapped hard sharply conical heads which are of attractive appearance, but not of the best quality. Well suited to the general soil and climatic conditions and very popular in America.

Enkhuizen Glory, Early Summer, Fottler's Drumhead, etc.—Second-early sorts, forming small compact to large spreading short-stemmed plants, and nearly round to distinctly flat heads which mature quickly, are of good quality but not well adapted for distant shipment or winter storage.

Flat Dutch, Drumhead, Ballhead or *Hollander,* etc.—Large spreading comparatively slow-growing plants, forming round to oval hard heads, having the leaves very closely wrapped and overlapping in the center. They are generally good keepers, often improving not only in solidity but in quality during storage.

Savoys.—A class in which the leaves of both plant and head are crumpled or savoyed instead of smooth as in the preceding. There are varieties of all the forms of smooth-leaved sorts. The plants are hardy, butsare slow to form heads, which are likely to be small and more or less open or loose-centered, but they are of superior flavor, and this class is worthy of more general cultivation in the home-garden and for local market.



706. Curled kale.—Brassica oleracea var. acephala.

Red cabbage.—A class of which there are many varietal forms, and in which the plants and heads vary from purple shaded green to deep red. The heads are generally small, but very solid and are especially suited for use as "cold slaw."

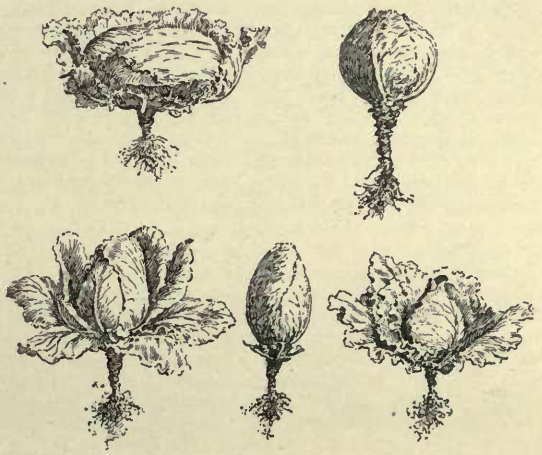
Portugal Sea-Kale, Tronchuda or *Chinese cabbage.*—These are distinct classes and species of cabbage, intermediate in character between the more common sorts and the more distant kales. They have never become generally popular in America, though they are rather largely grown and used by the Asiatics, particularly on the Pacific coast. The sea-kale cabbage is not to be confounded with sea-kale, which is a very different plant.

These are but a few of the almost limitless, more or less distinct variations offered by seedsmen, yet each of them was thought by someone to be superior in some location, under some conditions, or for some purpose. The general recognition of the value of each variation, and the consequent popularity of the sorts in which the variation is best developed, are constantly changing, partly because of local conditions of climate, but more largely because of changes in transportation and market facilities and conditions.

Cultural methods.

Ideal climatic conditions are found only in very limited areas, and the common cultural practice in each locality is largely shaped by the degree to which local conditions approach them. In the country north of Washington in which a well-lighted and heated greenhouse and experienced help are available, the simplest method, and one by which the very best of early cabbage can be grown, is to plant the seed in flats some sixty to ninety days before danger of killing by frost is past, and as soon as the central bud or leaves appear (which should be in ten to fourteen days) to "prick out" the plants, setting them 2 to 4 inches apart in other flats, according to the relative importance in that particular culture of earliness and cost of production. The house should be given abundant ventilation, and temperatures exceeding 70° or 85° by day and 50° or 60° at night carefully avoided. Often it will be found very advantageous, as soon as the plants are well established, to remove them to well-lighted coldframes. These should be carefully tended in order to give all the air possible, and to avoid over-heating by the sun or falling below 35° at night, and the plants transferred to the open ground as early as this can be done without danger from killing frosts. Some very successful growers plant seed in well-protected coldframes so as to secure a thin, even stand, and by careful attention secure a slow but steady growth through the winter, and the seedlings are first transplanted to the open ground as soon as danger from killing frosts is over. A common practice from Philadelphia or Baltimore southward is to sow the seed in the fall in carefully prepared beds in sheltered locations, and, as soon as the plants are large enough, to transplant them to flat-topped ridges about 30 to 36 inches from center to center and as high as can be formed by two or three back-furrows. These ridges usually are run east to west and the plants are set on the south, the north or the top, or sometimes in the furrow between them, depending upon the judgment of the planter as to which location will give the best result on that particular farm and exposure and in that particular season, as sometimes one and sometimes another location gives the best results. In some sections and often only on certain farms of a section this method gives large very early-maturing and profitable crops, while in different fields, even on the same farm, a large proportion of the plants so handled will be killed by frost or will shoot to seed without heading. In certain locations, notably in the vicinity of Charleston, South Carolina, cabbage-plant farms have been established, from which plants in prime condition for setting in the field can be secured by the million. The location and exposure, and the character of the soil of the most successful of these farms is such that the plants are rarely killed or seriously checked by frost, but make a constant but slow growth all winter and can be pulled at any time so as to retain abundant root and vigor and be safely shipped long distances. The seed is sown and the plant-beds treated much as one would treat a bed of onions for sets or pickles, except that in many cases the rows are as close as 3 inches and the bed receives little or no cultivation after the seed is planted.

Objections that are sometimes well founded to plants from such farms are, that they are slow "taking hold" and a large proportion of them "shoot to seed" without heading, or the heads are small and of poor quality; but such failures often come from the use by the plant-raiser of cheap and inferior seed, or from the crowded rows and careless handling, or from the farmer sending for and setting the plants too early, or from holding them too long before setting. Some plant-raisers take pains to advertise that they do not guarantee plants shipped by them before December 1 to give satisfactory results (though they often do), but that they are willing to guarantee that plants shipped by them from December 1 to April 1 will, in suitable soil and exposure and with good cultivation, produce full crops of marketable cabbage. Most farmers who use 20,000 to 30,000 plants could grow on their own farms as good plants or better than they could buy from even the best and most reliable growers, and often at materially less cost; but it is



707. Cabbage shapes: Flat; round or ball; egg-shaped; oval; conical.

questionable whether many of them would do so, and it is not surprising that the practice of buying plants, particularly when earliness in market maturity is desirable, is rapidly extending.

The best distance between plants will depend not only upon the variety used but upon the character of the soil, kind of labor available and the condition and way in which the crop is to be marketed. Such small upright-growing sorts as Early York, Etampes, or true Jersey Wakefield, which are to be marketed when still quite soft, can be well grown set as close as 6 or 8 by 18 to 24 inches, requiring 20,000 to 30,000 plants to the acre; but in America such close planting necessitates so much hand labor that it is seldom profitable, and 8 to 12 by 28 to 30 or 36 inches, requiring from 8,000 to 15,000 or 20,000 plants to the acre, is usually found the more profitable distance.

The best method of setting, whether by hand, hand-planters, or machine, will be determined by local conditions. The plants should "take hold" in two to four days and start into vigorous growth in ten days to three weeks, the time depending upon the condition of the plants, and the way they are handled, quite as much as upon the weather. After active growth has commenced, it should continue at a constantly accelerated rate until the head begins to harden, and although toward the last the plants may not seem to increase in size, the heads will gain in weight. The cabbage suffers less than most vegetables from mutilation of the root, yet deep cultivation is undesirable because unnecessary. The essential thing is to prevent any crusting over, and the keeping of the surface in such good tilth as to permit of the free aëration of the soil.

One of the best crops of early cabbage on record was secured from what was regarded as naturally a rather unfavorable soil that was not very heavily fertilized, but received a shallow cultivation with a harrow tooth cultivator every day (except Sundays and on four days when the surface was so wet from rain that it would puddle) after the plants were set until the crop was in market condition.

The time of planting for fall and winter cabbage and the general cultural methods most likely to give good results in any particular location are the same for both seasons, the time of maturity being determined more by the varietal character of the seed than by method of culture. The cultural practice usually followed by neighboring and equally successful growers is often radically different. One planter may always, on some fixed day in May or June, sow seed in flats and as soon as the seedlings are well started pick them out into other flats, and then again into a plant-bed and wait for a favorable day, if necessary until August, before putting them in the field. An equally successful neighboring grower may wait until as late as the last of June and sow thinly in well-prepared seed-beds and transplant from them to the field, while still another may wait for favorable weather even until the last of July and then plant seed in place as is the usual practice of some most successful growers. In New England, growers often drill the seed in place, and when the plants are well established chop out the superfluous ones.



708. An outdoor method of storing cabbage.

The weight or quantity of seed used for a given area varies greatly, as the size of the individual seeds vary, not only with different varieties but with different lots of the same sort. Some growers expect to get plants enough for an acre from less than an ounce, while others require two to five times as much, and those who sow in place often will use four to eight ounces to the acre. Superlative crops have been known to be grown by radically different methods, and very often successful growers have some peculiarity of practice which they deem essential to the best results, but which a neighboring and equally successful grower regards as a foolish waste of labor; but, however the practice of successful growers may differ, there are some points in which they all agree. Among these are, the use of the best obtainable seed of some particular variety which they have found by experience, or which they believe is best adapted to their conditions and is uniform in time of maturity, so that all the heads are in prime condition and may be gathered at the same time, which is an important factor in determining cost of production, while uniformity in shape, form and color are equally important in determining salability. The quality of the seed used, while not the only factor, is generally the most important one in determining the uniformity of product of any particular culture. Unchecked and constantly accelerated rate of growth are most important factors in securing the best possible development of any particular culture. Every check, whether it come from overcrowding of the seedlings, careless transplanting, or the caking and want of friability in the surface soil, tends to divert the energy of the plant from the unnatural and excessive leaf-formation upon which its value as a cultivated vegetable depends to the more natural but less useful formation of blossoms and seed. Just how on any particular farm the most favorable conditions can be secured cannot be told in general cultural directions, but must be decided by the grower from his knowledge of the character and wants of the plant, the condition of the soil, and last, but by no means least, his facilities for controlling the conditions upon which the growth of the crop depends.

Harvesting.

This is the simplest and easiest part of cabbage-growing. With an easily acquired dexterity, each head in five or six rows can be cut, trimmed and tossed into a central windrow by a single well-directed stroke of a well-sharpened spade or heavy hoe. Occasionally, because of some unnatural growth of the plant, or want of attention, a head will need retrimming, but by the exercise of a little care, practically all of them can be kept in marketable shape. From the windrows, the heads are gathered and loaded loose into cars, delivered to factories or placed in storage. Yields secured vary greatly, being influenced by the sort, the quality of the seed, the character of the soil, loss from insects and disease; they generally range from five to twenty tons to the acre. The crop is usually readily salable in the fall, delivered at factory or on board cars at prices ranging from $4, or even less, to $10 to $20 a ton.

Marketing.

Cabbage greens.—In some sections, notably southern Mississippi and Louisiana, considerable acreage is grown and marketed as cabbage greens. The seed is sown in place or the plants are set quite close in the row, and as soon as they have commenced active growth and long before they have formed a distinct head, they are cut and marketed much in the same manner as spinach or kale, but this method of culture and use is very limited.

Early cabbage is generally considered marketable as soon as the leaves have closed into a head, even if this is still so soft and loose that it would be quite unmarketable later in the season. If cabbages are cut when soft and immature, they soon wilt and lose all crispness and palatability; to avoid this, the earlier shipments are made in small open crates containing less than a score of heads, or sometimes in larger closed ones carrying ice, and often in refrigerator cars. Later in the season, as the heads become larger and harder, they are shipped in slat crates about 12 by 18 by 38 inches, or in ventilated burlap-covered barrels holding about two and three-fourths bushels.

Fall and winter cabbages are usually sold by the ton, of much more closely trimmed heads than are considered marketable earlier in the season, and are commonly shipped in open and well-ventilated cars without special container or packing, except as may be necessary to protect from hard freezing. Many acres are grown on contracts with shippers, packers of sauerkraut, and the like, who contract for the delivery direct from the field to factory or on board cars, of the usable product of a certain acreage at an agreed price per ton. While this is sometimes a very satisfactory arrangement, many careless and incompetent growers are induced to contract, and their neglected crops become infected with disease and insects which spread to the fields of even the most careful growers, and the crop in the vicinity of such factories and shipping-points soon becomes unprofitable.

Storing.

Formerly the most common practice was to let the plants stand until danger of hard freezing, then pulling, allowing the roots to retain what earth they would, but breaking off some of the most spreading leaves and crowding the plants together (with heads all up or all



709. Cabbage in winter storage in cabbage-house.

down and at a uniform height), with earth packed between them, in long shallow trenches that were gradually covered with sufficient coarse straw or litter to protect from severe freezing. A variation of this method is to pull, leaving what roots and earth adheres, and set as closely and level as possible in a shallow cellar not over 3 feet deep, which after filling is covered with a roof of boards, tarred paper and litter sufficient to keep out rain and frost, and high enough in the center to allow of handling the cabbage. It is essential to success with either trench or cellar that they be located where there is the least possible danger from standing water, rats and other vermin, and as well protected as possible from severe winds and cold. Advantages of this method are that heads quite too soft to be salable become hard and firm, and that cabbages so stored retain to a remarkable degree their crispness and flavor, and are thought by some to be even better than when fresh from the field; but when taken from the trench or cellar, they soon lose their crispness and will not stand shipment so well as heads which were trimmed before storing. A very common method is to cut and partially trim the heads and place in piles 4 to 6 feet high and broad, and of convenient length, built over a board-covered trench which is ventilated by open ends and tiles up through the cabbage, the piles being gradually covered and the openings closed so as to prevent hard freezing (Fig. 708).

In certain sections a large proportion of the cabbages grown for late winter and early spring market are trimmed and stored in bins or on shelves in frostproof storehouses (Fig. 709).

Diseases.

Clubroot (*Plasmodiophora brassicæ*).—A soil parasite affecting cabbage and other cruciferous plants. It thrives best in acid soils and in some cases can be checked by a liberal use of lime, but its presence in any field in destructive abundance is seldom suspected until too late to save the crop. Planting cabbage or other cruciferous crops on such a field should not be repeated for several years, during which it should have continued dressings of lime and ashes. Care should be taken to secure uncontaminated soil for seed-beds, and to destroy all affected plants before cattle have access to them, as the disease may be carried by such refuse in the manure from cattle who have eaten it.

Wilt or *Yellows, Black-rot, Stem-rot, Fusarium, Phoma.*—Infectious diseases which sometimes become so abundant in certain sections as to prevent the profitable culture of cabbage. They are all distributed by means of contaminated seed, by manure from cattle fed on diseased refuse, by soil carried on tools from affected fields; distribution in this way should be carefully avoided. All diseased plants should be destroyed by fire as soon as noticed. The soil used in the seed-beds should be sterilized by live steam or soaked in a weak solution of formaldehyde (one part to 260 of water). The seed should be soaked fifteen minutes in the weak solution of formaldehyde, then rinsed in clear water and immediately planted.

Animal pests.

Flea beetles.—The securing of vigorous plants is sometimes prevented by the attacks of innumerable flea beetles, *Phyllotreta vittata*. This may be prevented by surrounding the beds with frames made of 10- to 12-inch boards connected across the top with 2-inch strips and then covered with 20- to 40-thread to the inch cheesecloth. This should be put on as soon as the seed is planted and be removed, in order to harden the plants, four to six days before they go to the field.

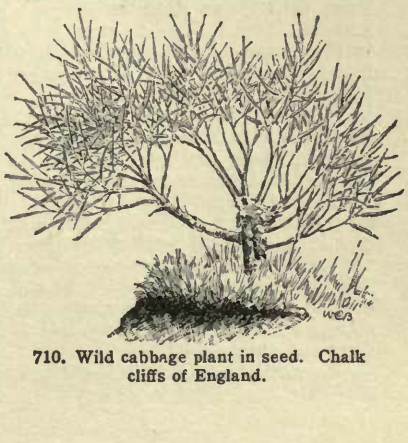
Cut-worms.—These are best guarded against by keeping the field perfectly clear of all vegetation for six to ten days before setting, then mix four quarts of bran meal or flour, one cup of molasses or sugar, and two tablespoonfuls of paris green, with water enough to make about the consistency of milk, and sprinkle on twenty to fifty times its bulk of fresh-cut grass and scatter over the field the night before setting the plants.

Cabbage worm.—Keep careful watch of the plants and if the green worms appear in abundance and seem to reach full size, sprinkle or spray the plants with kerosene and whale-oil soap emulsion, or paris green and water in the proportion of four gallons of emulsion and one pound of paris green to fifty gallons of water. After the heads are two-thirds grown, powdered hellebore, one ounce to two gallons of water, should be substituted for the poisonous paris green mixture.

Root-knot (*Nematodes*).—Although seldom very destructive north of Philadelphia, this is often the unsuspected cause of failure in the South, particularly of fall crops in light lands. The only practical remedy is the avoidance of affected fields or sterilizing the soil by freezing or live steam.

Seed-breeding and -growing. Figs. 710, 711.

It is only through careful study of the practical value and correlation of varietal differences, the exercise of great care in selection and growing of the plants, and in the saving of the seed, that this or any vegetable can be improved or even its present good qualities maintained. Under favorable conditions the plant is capable of producing abundant seed, a single plant having been known to yield thirty-five ounces, enough to plant 25 to 40 acres, but such yields are very exceptional, and one-half to four ounces a plant is much more common. Although botanically the plant is self-fertile, when isolated it seldom yields much and often no viable seed. It transmits very persistently through many generations any distinct variation, but often without expression, although such hitherto unexpressed variations are apt to appear in the seed of self-fertilized plants, so that such seed is frequently less uniform than that from a field of plants of the same ancestry. At least one of our popular varieties is made up of the descendents of a single isolated plant, but it is a curious fact that in the second and subsequent generations 90 per cent of the plants, although quite uniform, were very different in character from that of the selected individual from which they were descended. The originator of one of our best varieties maintains that it is essential to the production of the best seed of that sort that seed-plants of very different types should be set together, and by crossing they will produce seed giving plants of the desired type. In spite of these facts, it is thought that the practice which will give the best results with other plants is equally desirable for the cabbage, and that first a distinct and well-defined conception of the varietal form desired must be formed and the stock started from the plant or plants whose seed most uniformly developed into plants of the desired



710. Wild cabbage plant in seed. Chalk cliffs of England.

character, rather than from those in which it was exceptionally well developed. Often even professional seed-growers have but a very vague and constantly changing conception of what a given variety should be.

The greatest profit is not from the field that produces even a good many of the most perfect specimens, but from that in which the largest proportion of the plants are most uniformly of the desired character. In order to produce seed which will give such results, one must first form a very clear conception of just what one wants in plant and head, and learn the relation between easily noted but economically unimportant qualities, and others not so easily seen but more important in determining value. Having selected a number of ideal plants, one should grow these either singly, or in groups of three or four that are nearest alike. Save and number the seed of each plant separately and plant a small sample of each number, carefully noting the numbers in which the product was most uniformly of the desired character. From the reserved seed of the numbers which most uniformly developed the desired form, one can start a stock for field planting. It is not safe, however, to rest there; one must start a new selection of the desired character so as to continually renew one's stock. In raising seed, plantings should be made a little later than one would for fall market cabbage. As the plants develop, each lot should be repeatedly looked over and not only those which show no disposition to form a head, or one in which the inclosing leaves do not pass over the center, but also those which show any departure (even if it be of itself a desirable one) from the desired form, should be removed. The plants should be left in place until there is danger of the ground being closed by frost and should then be pulled, a few of the larger leaves removed and then packed into narrow trenches in sheltered and well-drained localities, taking pains to pack the earth closely about the roots and stems. Gradually, as necessary to prevent hard freezing, they should be covered with earth and with coarse litter, the aim being to keep them as cold as possible without actually freezing, and to prevent them starting into growth. As early in the spring as possible, they should be set for seeding, giving each plant about twice the space needed for market cabbage. In setting, the plants, should be more or less inclined, so that while the top of the head is but little above the surface, the roots are not buried in hard and cold subsoil. As they are set, the heads should be scarred across the top, not deep enough to injure the sprouting center, but so as to facilitate its pushing its way through the head. The seedstalks should not be cut until they begin to shed the seed, which turns black and seems ripe before it is fully mature.



711. Cultivated cabbage in seed.

The entire plant should be cut and stored until quite dry, when the seed can be easily threshed, cleaned, and spread not over ½ inch deep in full sunlight for a few days and then stored.

Commercial seed-growing.—Although one occasionally sees heavily seeded plants in all parts of the United States, cabbage seed rarely proves a profitable crop, except in very limited areas along Long Island Sound, the eastern shores of New Jersey, Maryland and Virginia, and in the Puget Sound region, where the yield commonly secured varies from 300 to 700 pounds to the acre, although exceptional crops sometimes reach 1,500 to 2,000 pounds. The common method of growing does not vary materially from that described, except that very often too little care is exercised in securing stock seed, and it is sowed or the plants set so late that they fail to develop sufficiently to enable one to do very effective rogueing out of inferior stock. In Holland, seed is often raised from much better matured heads than are commonly used in America and which are cut from the root, but leaving more stem than for market use, and planted so that the top is level with or slightly below the surface. Treated in this way, they root like a great cutting and form loose, well-branched plants which are not so liable to injury from wind, and are said to yield more seed than would be produced if the entire plant was used. It is possible that this method might give good results in the Puget Sound region, but it would not in the East.

W. W. Tracy.

CABÓMBA (aboriginal name). *Nymphæàceæ.* Fanwort. Submersed aquatics of the western hemisphere, used in ponds and aquaria.

Flowers small; sepals and petals 3, persistent; stamens 3–6; carpels 3–18, separate: submerged lvs. finely dissected, mostly opposite.—Six species.

caroliniàna, Gray (*C. aquática*, DC., not Aubl. *C. viridifòlia*, Hort.). Washington Plant. Fish-Grass. Floating lvs. green, oblong-linear: fls. axillary, ½in. broad, white, with 2 yellow spots at base of each petal; stamens 6. Ponds and slow streams, S. Ill. to N. C., Fla. and Texas. A.G. 15:157.—Hardy as far north as Phila. if not frozen. The commonest plant for fish-globes and aquaria; roots easily in earth, grows well, is dense and bushy, and a good oxygenator; prefers water free from lime. Prop. by cuttings set in earth in 1–2 ft. of water at 55–70° F. Commonly sold for aquaria in bunches of 6–12 shoots 8 in. long, wrapped with lead at base; without earth the bunch lasts 4–8 weeks, when it drops most of its lvs. and must be replaced. Var. **rosæfòlia**, Hort., is a form with reddish lvs., less durable, and more difficult to prop. A. G. 15:157. Var. **pulchérrima**, Harper, has sts. reddish purple, lvs. darker with narrower segms. and petals bright purple. Ga. The true *C. aquática*, Aubl., of Trop. Amer., with yellow fls. and nearly orbicular floating lvs., is shown in B.M. 7090.

H. S. Conard.

CACÀLIA (ancient Greek name). *Compósitæ.* Perennial herbs of wide distribution, some of which are planted in the open for ornament.

Flowers paniculate or corymbose, the florets all hermaphrodite, with white, flesh-colored, or orange, exclusively tubular corollas, each of the 5 lobes with a midnerve: achenes glabrous: lvs. petioled, alternate. The genus is by some considered as a section of Senecio, differing in never having ray-fls.—Species about 40, about one-fourth Asian and the remainder mostly American. They need protection in the North.

lùtea, Mill. A slender rather attractive perennial, with alternate, widely separated lvs. half clasping the st.: fls. orange-yellow, in heads about ½in. diam., corymbose. St. Helena; perhaps not a true cacalia.

C. aùrea and *C. lùtea* of gardens may be Emilia.—*C. coccínea*, Sims=Emilia.

N. Taylor.†

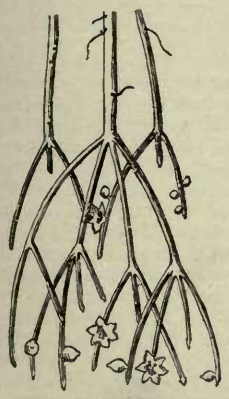
CACALIÓPSIS (*Cacalia-like*). *Compósitæ.* Perennial, for garden planting.

Heads discoid, very many-fld. of perfect yellow florets; corolla rather deeply 5-cleft, the lobes lanceolate: lvs. palmate.—One species, little known in cult.

Nardósmia, Gray. Stout, 1–2 ft. high, loose, woolly, but becoming nearly glabrous: lvs. nearly all radical, not unlike those of *Petasites palmata*, long-stalked, 5–9-cleft or very rarely parted, the lobes dentate or cut: heads an inch high, in a loose cluster at the summit of the nearly naked st., fragrant. Pine woods, Calif. to Wash.—Intro. by Gillett in 1881 as a border plant.

CACAO, COCOA: *Theobroma.*

CACTUS, CACTI. The plants correctly designated by this name constitute the family *Cactàceæ*. Scarcely any group in the whole vegetable kingdom is more remarkable for its strange and varied forms, the beauty of its flowers, and wonderful adaptation to desert life. It is not, however, confined to desert regions; for in the moist forests of the tropics of the New World it is represented by a number of interesting forms often epiphytal or scrambling in their habit of growth, with beautiful flowers and sometimes with delicious edible fruit.



712. Tips of Rhipsalis cassytha.



713. Skeleton of Opuntia stem.



714. Pereskia aculeata.



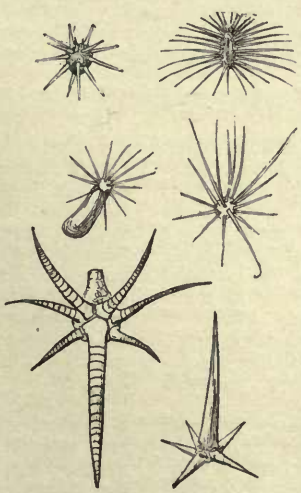
715. Opuntia joint with leaves.

The Cactaceæ are confined to America, the only apparent exception being the genus Rhipsalis, composed of plants with the habits of the mistletoe, growing on the trunks and branches of trees, and bearing small pellucid glutinous berries (Fig. 712). This genus, endemic in tropical America, has found its way to Africa, the island of Mauritius and even to Ceylon; and several opuntias, or prickly pears, occur on the shores of the Mediterranean, in South Africa, and Australia, where they have made themselves so thoroughly at home as to be regarded by many writers as indigenous. The Cactaceæ are not confined to tropical or even semi-tropical regions. At least two species of Opuntia extend northward into British Columbia, and species of Echinocereus, Echinocactus, and Mamillaria are found in the state of Colorado. The xerophytic forms flourish especially in the southwestern United States, the Mexican plateau, the peninsula of Lower California, where there are great cactus forests, and the vicinity of Tehuacan, in the southern part of the Mexican state of Puebla, a region celebrated for its remarkable and gigantic tree-like forms related to the genus Cereus. For an account of the vegetation of the deserts of the southwestern states and of Mexico, the reader is referred to Frederick V. Coville's "Botany of the Death Valley Expedition," published as Vol. IV of the "Contributions from the United States National Herbarium, 1893;" Coville and MacDougal's "Desert Botanical Laboratory of the Carnegie Institution —1903"; and to D. T. MacDougal's "Botanical Features of North American Deserts," publication No. 99 of the Carnegie Institution of Washington, 1908.

To the southward, the family extends to Chile and Argentina. Giant torch thistles and echinocacti are scattered over the pampas of Uruguay, and melon-shaped echinopses amid the snows of the lofty plateau of Bolivia.

The genus Mamillaria, so well represented in the southwestern United States and Mexico, is almost absent from Central America, the representative genera of that region as well as of the warm Huasteca region of eastern Mexico being Cereus, Pereskia, Pereskiopsis, Nopalea, and Opuntia; while the "turk's-head" or "melon cacti" are chiefly West Indian.

The peculiar structure of columnar, opuntioid, and melon-shaped cacti is undoubtedly the result of excessive dryness of the climates in which they occur, to protect themselves from which they have been obliged to store up water and to reduce their transpiration as low as possible. They have a more or less pronounced woody axis surrounded by pulpy cellular tissue (parenchyma) in which the water-supply is stored. The stomata are usually situated in depressions or grooves in the leathery cuticle; and as an additional means for checking transpiration, the cell-sap is nearly always mucilaginous, while in some forms latex cells are present, filled with milky or gummy fluid which hardens on exposure to the air and effectively heals wounds in the soft fleshy plant. Certain species of Echinocactus (viznagas) are like great barrels studded with spines and filled with pulp of the consistency of watermelon rind, which is sometimes made into conserves like citron (dulces de viznaga). Other forms, like species of Pereskia, Pereskiopsis, and arboreous opuntias have hard, woody stems and branches. The reticulated skeletons of certain species of opuntia (Fig. 713) are manufactured into walking-sticks, legs of furniture, napkin rings, and even into veneering for woodwork. In Lower California and some parts of South America, where other vegetation is lacking, the stems of columnar cerei, or "cardones," are used for constructing habitations, inclosures, and for timbering mines. Columnar cacti are also planted for living fences, or hedges, especially the "organ cactus" (*Myrtillocactus geometrizans*) of tropical Mexico. Leaves are present in nearly all cacti, but in some species they are mere vestiges and can scarcely be seen with the naked eye. In other species they are large and perfectly developed, either with distinct petiole and feather



716. Cactus spines.



717. Opuntia leptocaulis, showing sheathed spines.

veins, as in *Pereskia aculeata* (Fig. 714), or sessile and fleshy with only the midrib and several parallel nerves apparent as in the genus Pereskiopsis. They are sometimes caducous, fleshy, cylindrical or awl-shaped, as in the genus Opuntia (Fig. 715). In the axils of the leaves are peculiar cushion-like areoles (corresponding in all probability to aborted branches) clothed with down or felt-like wool, from which spines, and, in some genera, also flowers, issue. In the genera Opuntia and Pereskiopsis, the areoles also bear minute short barbed bristles called glochidia, which will penetrate the skin and become detached at the slightest contact and are the source of annoying irritation which often persists for many hours.

The spines (Fig. 716) are not connected with the axis of the stem or branches, but emerge from the areoles. In some forms they are simple and straight, bristle-like, awl-shaped, or short and conical. In others they are bent like fishhooks or are curved and horn-like, with transverse ribs. Sometimes they are minutely downy or hairy and sometimes even plumose or feathery. They may be either naked or enveloped in a membranous barbed sheath (Fig. 717). They may be grouped in star-like clusters, with straight or curved rays spreading from a common center, or in comb-like fascicles, with the radial spines arranged in two rows on each side of a longitudinal axis (pectinate). In addition to the radial spines, there are usually erect central spines either straight and rigid, or more or less curved. One of the most striking forms is that of the organ cactus, *Myrtillocactus geometrizans*, in which the stout erect central spine resembles the blade of a dagger and the radials a guard for the hilt. In contrast with this may be mentioned the spines of *Pelecyphora aselliformis*, which resemble miniature sow-bugs, or aselli (Fig. 718).

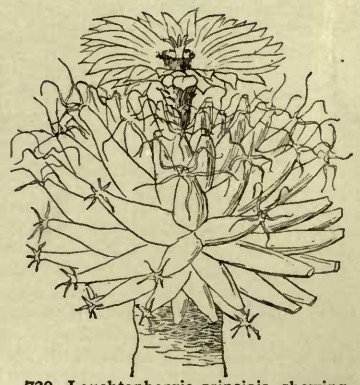


718. Extreme condensation of the plant body.—Pelecyphora aselliformis. (Nat. Size.)



719. Opuntia flower.

The flowers in most cases issue from the upper portion of the areoles, but in certain mamillarias and allied forms they come forth from between the tubercles or from their base at the end of a dorsal groove. Usually the flowers are solitary and sessile, but in the genus Pereskia (Fig. 714) they are peduncled and often clustered. They may be tinted with rose-color, crimson, purple, yellow or orange, or rarely with copper-color or scarlet, but they are never blue. Often they are pure white at first, gradually becoming suffused with rose-color in age. In a few species they are inconspicuous, as in the epiphytal Rhipsalis (Fig. 712). Some are diurnal, others nocturnal; some open at sunrise and close at night or when the sky becomes clouded; others open at a certain hour and close at another fixed hour of the day or night; some last for only a few hours, others for a day, and some persist for several days. Some, like the "night-blooming cereus" are delightfully fragrant, while others are ill-smelling or have no perceptible odor.

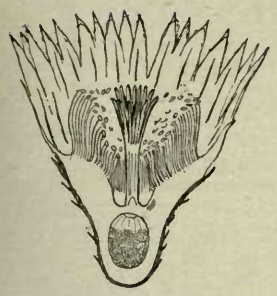


720. Leuchtenbergia principis, showing transformation from scales to petals.

The perianth is not divided sharply into calyx and corolla, although the outer floral leaves are usually sepal-like and the inner ones are true petals. In one great division of the family including Opuntia, which has been named *Rotatifloræ*, the perianth is more or less wheel-shaped or widely spreading (Fig. 719); in the other division, *Tubulifloræ*, to which Cereus belongs, the floral leaves form a tube, often remarkably long and slender, and crowned with a spreading limb. The floral leaves are not arranged in definite series but somewhat like those of a water-lily, the scale-like lower or outer leaves gradually becoming broad and petaloid as they approach the center (Fig 720). In all cases the perianth crowns the ovary, and sometimes persists after withering on the apex of the fruit (Fig. 721). The stamens are very numerous and are inserted on the petals or perianth-tube (Fig. 722). The single style is longer and stouter than the slender filaments, and usually terminates into a radially divided stigma (Fig. 723). Sometimes the stigma is conspicuously colored and issues star-like from the center of the



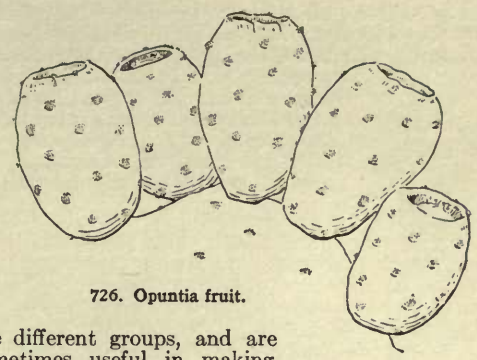
721. Cephalocereus fruit.



722. Echinocactus flower, showing insertion of stamens.



723. Opuntia flower, showing styles and ovary.



726. Opuntia fruit.

mass of stamens, as in the genus Echinocereus, in which the emerald-green star contrasts prettily with the golden-yellow or orange-colored stamens, rising from a rosette of rose-purple petals (Fig. 724). The ovary (Fig. 723), although formed of several carpels, is 1-celled. The placentæ are parietal, bearing an indefinite number of ovules, the stalks of which (funiculi) become fleshy as the seeds develop and form a sugary pulp around the seeds.

The fruits of the Cactaceæ are variable in form. That of the leafy Pereskia is apple-shaped and bears a number of leaf-like bracts on the skin (Fig. 725), on which account the fruit of *P. aculeata* is called blad-appel, or leaf-apple, in the Dutch colonies, while in the British West Indies it is known as Barbados gooseberry and is made into tarts and sauces like real gooseberries. In some of the pereskiopses, the fruit is elongated and shaped like a prickly pear, with watery rind and seeds covered with cottony hairs. In Opuntia and Nopalea the fruit is commonly called prickly pear, or tuna (by the ancient Aztecs, nochtli). These fruits bear small fleshy leaves at first, like the flattened pads of the plants, and when the leaves fall off the areoles persist armed with the irritating sharp-barbed glochidia described above (Figs. 717 and 726). Many species allied to the genus Cereus bear edible fruits, usually called pitahayas. Those of the tall columnar cardones (Lemaireocereus) are covered with easily detachable tufts of wool and spines but never bear glochidia. Those of Cephalocereus (Fig. 721) are spineless. The triangular climbing forms which are often trained over garden walls in tropical countries, sometimes bear enormous juicy fruits of fine flavor (Fig. 727). Those of Echinocactus (Fig. 728) are more or less scaly. The fruits of certain species of Echinocereus, called alicoches by the Mexicans, are known to Americans as strawberry cacti, on account of the fine flavor of their juicy pulp. Those of *Echinocactus longihamatus* are known in northern Mexican markets as limas de viznaga, or cactus limes, on account of their acid taste; and the small smooth crimson fruits of many mamillarias are called chilitos, on account of their resemblance to small chili peppers. Very much like them are the fruits of melon cacti (Fig. 729) which issue from the dense crown of bristles like scarlet radishes or firecrackers tipped with a fuse.



724. Echinocereus flower, showing radiate stigma.



725. Pereskia fruit.

The seeds of the Cactaceæ vary considerably in the different groups, and are sometimes useful in making generic determinations. Thus the woolly seeds of Pereskiopsis are sharply distinct from the black glossy seeds of the genus Pereskia, with which the first-named genus was at one time confused. In Opuntia and Nopalea they are flat, hard and bony, somewhat ear-shaped in the flat-jointed opuntias (Figs. 730, 733,) and usually discoid and marginless in cylindrical opuntias (Figs. 730, 735). In Cereus they are glossy black, with the testa either quite smooth or minutely pitted (Figs. 730, 732); in Echinocereus they are covered with minute tubercles or granules (Figs. 730, 734). In Echinocactus, which is not a very homogeneous group, the seeds are pitted in some species and tuberculate in others In one section of Mamillaria (Eumamillaria) they are glossy and marked with sunken rounded pits (Figs. 730, 731), while in another section, which should probably be made a distinct genus (Coryphantha) they are frequently smooth. In the closely allied Ariocarpus they are relatively large and tuberculate. In the genus Pelecyphora, they are sometimes kidney-shaped, as in *P. aselliformis*, and sometimes of a peculiar boat-like form with a very large umbilicus, as in *P. pectinata*. In the epiphytal *Rhipsalis cassytha* they are kidney-shaped and finely granular. The seeds of many of the species of Pachycereus ("cardones") are used by the Indians of Lower California and Mexico for food. In southern Puebla the fruit of *Pachycereus columna-trajani*, called tetezo figs (higos de tetetzo) are a regular food staple, offered for sale in the markets of Tehuacan during the month of May.

Other cactus fruits of great economic importance are those of the giant Cereus of our arid southwestern region, *Carnegiea gigantea*, locally known as pitahayas de sahuara, first brought to notice in the year 1540 by the members of Coronado's expedition. They are not spiny like the fruits of Pachycereus and they burst open when quite ripe. The fruit of *Lemaireocereus Thurberi*, known as pitahaya dulce, although much sweeter, bears clusters of stout spines issuing from tufts



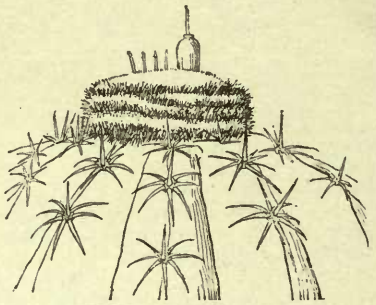
727. Fruit of Hylocereus.

of wool. Closely allied to it is *Lemaireocereus griseus* of central and southern Mexico, which yields much nutritious fruit. The fruit of the organ cactus, *Myrtillocactus geometrizans*, sold in the markets as garambullas, either fresh or dried, must also be mentioned as of economic importance.

Of medicinal importance is the narcotic peyote or "mezcal button" (*Lophophora Williamsii*), used as an intoxicant and febrifuge by certain tribes of Indians, and regarded by some of them with superstitious reverence. This little plant was regarded by some of the early Spanish writers as a fungus and was used by the Mexican Indians to produce marvelous visions.



728. Fruit of Echinocactus.



729. Melon cactus bearing fruits.

For an account of the methods of propagation and culture of cacti and their application to ornamental gardening the reader is referred to a paper by Charles Henry Thompson, on "Ornamental Cacti: Their Culture and Decorative Value," issued by the United States Department of Agriculture as Bulletin No. 262 of the Bureau of Plant Industry, December 17, 1912. See also *Succulents*, vol. VI. W. E. SAFFORD.

CÁCTUS (shortened from Melocactus by Linnæus). *Cactàceæ*. A single small species, sometimes grown in under-glass collections and in open succulent gardens South.

Stems globose or ovoid, with vertical ribs, crowned at maturity with a "cephalium"—a prolongation of the axis densely covered with small tubercles imbedded in wool and bearing in their axils small fls. and berries. The plant has the appearance of an Echinocactus, but the fls. and berries resemble those of Mamillaria.

Melocáctus, Linn. (*Melocáctus commùnis*, Link & Otto). Fig. 731. Ribs 10–20, acute; areoles nearly 1 in. apart; radial spines 8–11, straight or curved, subulate; centrals 1–4; cephalium at first low, hemispherical, becoming cylindrical in time, reaching a height of 8 in.; the dense wool of the cephalium is pierced by many red or brown bristles: fls. red, slender: fr. ⅔in. long, crowned by the persistent remains of the fl., red. W. Indies; called there "Turk's head." B.M. 3090. J. N. ROSE.



730. Seeds of Cacti.
1. Mamillaria; 2. Cereus; 3. Flat-jointed opuntias; 4. Echinocereus; 5. Cylindrical opuntias.

CADÁLVENA: *Kaempferia.*

CÀDIA (Arabic name, *Kadi*). *Leguminòsæ*, tribe *Sophòreæ*. Small evergeen shrubs of Arabia and Africa, remarkable for their regular mallow-like flowers.

Leaves pinnate: fls. axillary, mostly solitary, drooping; stamens 10, free, shorter than the petals: pod linear, acuminate, flattened, leathery.—Four species. Can be grown outdoors in Calif. or S. Fla.; in the N. in the temperate house. Prop. by seeds and cuttings.

purpùrea, Forsk. (*C. vària*, L'Her.). A small shrub, the branches woody: lfts. 20–40 pairs, very narrow, almost sessile: fls. bell-shaped, pedunculate, rose-red, the corolla about 1–1½ in. long and very veiny, not spiny. Arabia.

C. Ellisiàna, Baker, has few large lfts. and rose-colored fls. Madagascar. B.M. 6685.—*C. pubéscens*, Bojer. Lfts. 8–10 pairs, broad-oblong. Madagascar. N. TAYLOR.†

CÆSALPÌNIA (Andreas Cæsalpinus, 1519–1603, Italian botanist). *Leguminòsæ*. BRASILETTO. Including *Guilandina*, and *Poinciana* in part. Ornamental tropical or subtropical trees or shrubs chiefly grown for their showy flowers and also for their attractive finely divided foliage; some species yield tanning materials and dye-stuff.

Calyx with short tube and 5 imbricated lobes, the lowest concave and larger; petals 5, clawed, usually orbicular or obovate and nearly equal; stamens 10, curved; ovary sessile with few ovules and a slender elongated style: pod ovate to lanceolate, usually compressed, often indehiscent.—About 30 species in tropical and semi-tropical regions. The genus belongs to the subfamily Cæsalpinioideæ, in which the fls. are not papilionaceous, and is allied to Gleditsia.

Cæsalpinias are armed or unarmed trees or shrubs, rarely climbers, with finely divided bipinnate leaves and conspicuous yellow or sometimes partly red flowers in racemes, often forming terminal panicles. Many species are very showy in flower and are favorities in tropical and subtropical countries; in this country they can be grown only in Florida and southern California except *C. japonica*, which is the hardiest species and will probably stand the winter in sheltered locations as far north as Washington, D. C. They are also grown sometimes in warm glasshouses.

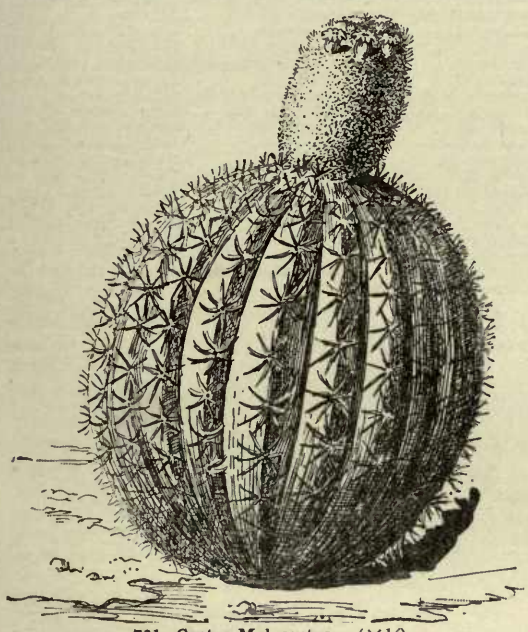
Propagation is readily effected by seeds, which should be well soaked in warm water for some hours before sowing. A sandy soil should be chosen for the seed-bed, and lightly shaded. After the plants show the first true leaf, they should be potted off into small pots of ordinary garden soil, not too rich, made light by the addition of sand, if of a clayey nature. The plants grow very rapidly, and must be shifted into larger pots as their size requires for greenhouse culture, but in tropical climates may be transplanted into permanent positions outdoors after they reach a fair size in pots. The dwarf species are elegant subjects for subtropical gardening during the summer months in temperate climates, provided a sunny location is given them, as they revel in rather dry very warm soil, and do not require artificial watering after being established. A rocky, sunny situation may be given *C. pulcherrima* and its variety *flava*, where they will bloom during many weeks of summer, until frost checks them, if strong plants about a foot high are selected in early summer. Care should be taken to harden off plants gradually in the house, so that they may not be chilled when transplanted outdoors. While they will do well in a poor soil, an application of manure or chemical fertilizer may be given them to advantage, causing them to make a more vigorous growth and give better and larger heads of flowers. In the tropics, and also in subtropical climates, these shrubs and trees are always admired and are commonly planted for ornament. The royal poinciana (*C. regia*, but properly *Poinciana regia*, which see), and also the dwarf poinciana, or flower-fence (*C. pulcherrima*), will thrive in close proximity to the sea, and are valuable for planting in exposed coast situations. (E. N. Reasoner.)

A. *Stamens long-exserted: fls. very showy: trees, unarmed or nearly so.*

Gílliesii, Wall. Shrub or small tree, with very many small lfts., scarcely ½in. long, oblong, obtuse, glabrous:

fls. light yellow, with brilliant red stamens protruding 3–5 in., in terminal racemes; sepals hairy-fringed. S. Amer. B.M. 4006 (as *Poinciana Gilliesii*, Hook.). F.S. 1:61. R.H. 1893:400. G.C. III. 15:73. Gn. 76, p. 4.—A very showy and worthy plant which bears in Calif. the popular name of "Bird of Paradise" like *Strelitzia Reginæ*. It will stand a temperature as low as 20° F.

pulchérrima, Swartz. Barbados Pride. Barbados Flower-Fence. Dwarf Poinciana. Shrub, with few scattered prickles, delicate, evergeen, mimosa-like lvs. with 12–18 pinnæ, each with 20–24 oblique-oblong lfts. less than 1 in. long, and very gaudy red-and-yellow crisped fls. on the ends of the new growth: stamens and style red, and long-exserted. Generally distributed in the tropics. B.M. 995. P.M. 3:3. Gn. 75, p. 594.—One of the most popular shrubs in warm climates, as S. Fla. There is a var. **flàva,** with yellow fls.



731. Cactus Melocactus. (×⅛)

aa. *Stamens not much exceeding the petals, or shorter.*

b. *Lfts. very obtuse.*

c. *Branches unarmed.*

pannòsa, Brandeg. Medium-sized tree with slender branches spreading horizontally and clothed with white, deciduous bark: lvs. decompound; pinnæ 2–4, each with 4–6 oblong and retuse lfts.: fls. yellow, showy: pod glandular, 1–2-seeded. Lower Calif.—A rapid-growing species which can be used for fences and is therefore called "palo estaca" in Lower Calif.

cc. *Branches prickly.*

d. *Pod smooth: shrubs.*

sepiària, Roxbg. Scrambling pubescent shrub: lvs. glaucous, slightly pubescent beneath; pinnæ 12–20, each with 16–24 oblong lfts., rounded at both ends, ½–1 in. long: fls. yellow in simple stalked racemes. India.—Furnishes dye-wood; also used as a hedge plant.

japónica, Sieb. & Zucc. Loose, spreading shrub, armed with stout, recurved prickles: lvs. with 6–16 pinnæ, each with 10–20 lfts., oblong, very obtuse: fls. in large, panicle-like clusters, canary-yellow, the stamens bright red. Japan. B.M. 8207. G.C. III. 42:43. R.H. 1912:60. Gn. 40:588; 61, p. 81; 76, p. 411. J.H. III. 34:531; 51:181.—Endures the winters in some parts of England. The hardiest species of the genus, probably hardy as far north as Washington, D. C.

Nùga, Ait. Vigorous climber: branches flexuose with copious hooked prickles: lvs. glabrous; pinnæ 4–6, each with 4–6 ovate-obtuse lfts. 1½–2 in. long: fls. bright yellow in large panicles; calyx glabrous: pods ovoid-oblong, 2 in. long, indehiscent, 1-seeded. Himalayas and Philippine Isls. to N. Austral. and Polynesia. Blanco, Fl. Filip. 150.

dd. *Pod prickly: tree.*

echinàta, Lam. Tree, with prickly rusty pubescent branches: lvs. unarmed, glabrous; pinnæ 5–9, each with 15–20 rhombic-oblong obtuse lfts. ½–¾in. long: fls. yellow in axillary and terminal racemes; calyx pubescent; stamens shorter than petals: pod oblong, 3 in. long. Brazil. Fl. Brasil. 15, 2:22.—Yields dye-wood.

bb. *Lfts. acute or mucronulate: pod prickly.*

mìnax, Hance. Diffuse shrub, thorny: pinnæ 10, with 12–20 ovate-lanceolate glabrous lfts. 1–1½ in. long: racemes panicled, many-fld., with very large bracts; fls. white and purple: pods 7-seeded (seeds large and black), prickly. China.

Bónduc, Roxbg. Climbing shrub, with prickly, pubescent bipinnate lvs., oblong-ovate mucronate lfts. 1½–3 in. long, yellow fls., and a few large yellow seeds in a short, prickly pod. Tropics; S. Fla.

C. bíjuga, Swartz (Acacia Bancroftiana, Bert.). Spiny shrub, with ultimate lfts. in 2 pairs: fls. paniculate. Jamaica.—*C. kauaiénsis*, Mann=Mezoneuron kauaiense.—*C. règia*, Dietr.=Poinciana regia.—*C. vernàlis*, Champ. Tall climbing prickly shrub: fls. in racemes. China. B.M. 8132.

L. H. B. and Alfred Rehder.

CAHOUN: *Attalea Cohune.*

CAILLÌEA: *Dichrostachys.*

CAJÀNUS (aboriginal name). *Leguminòsæ.* A tropical shrub, grown for the nutritious peas. One variable species, probably originally from Africa.

índicus, Spreng. (*Cỳtisus Càjan*, Linn.). Grandul. Congo Pea. Pigeon Pea. Dhal. Toor. Urhur. Erect, 3–10 ft., villous or often tomentose: lfts. elliptic-oblong, exstipellate, resinous-punctate beneath: fls. yellow and maroon, pea-like, continuing all through the year, in axillary racemes: pod pea-like, hairy, constricted between the many seeds. Much cult. in the tropics for the seeds or pulse, being treated usually as an annual. It varies greatly in stature and in character of seeds: *C. flàvus*, DC., has yellow fls. and 2–3-seeded pods which are not spotted; *C. bícolor*, DC., a smaller plant, has red-striped fls., and 4–5-seeded pods which are spotted. See B.M. 6440 and R.H. 1874:190. The pigeon pea is much grown in the W. Indies, some varieties being preferred for human food and some for live-stock; run wild.

L. H. B.

CAJÓPHORA: *Blumenbachia.*

CALABASH: *Crescentia.*

CALABASH GOURD: *Lagenaria.*

CALÀDIUM (origin of name obscure). *Aràceæ.* Warmhouse large-leaved plants, grown for the foliage; also employed in summer bedding.

Herbaceous perennials, arising from large rhizomes or tubers, acaulescent, with usually beautifully marked, long-petioled lvs.; the secondary nerves oblique to the few spreading primary nerves: peduncles usually solitary; spathe with the tube convolute, constricted at the throat, the blade boat-shaped; spadix erect, a little shorter than the spathe, the lower part naked, stipe-like, the staminate part longer than the pistillate; fls. unisexual: fr. a berry, white.—A dozen or less species in Trop. S. Amer. Two of the species are immensely variable, and many named horticultural varieties are in the trade. Engler in DC. Monog. Phan. 2:452 (1879); also F. S. 13.

As soon as Caladium plants begin to lose their leaves in the fall, water should gradually be withheld until the leaves are all gone. The pots should then be removed to a position under a bench, and laid on their sides, or taken from the soil and placed in sand. During the resting period they should not be subjected to a lower temperature than 60° F., and kept neither too wet nor too dry. About the beginning of March the tubers should be started for the earliest batch to be grown in pots. Arrange the tubers in their sizes, and keep each size by itself. The largest-sized tubers will start quickest, and it is desirable to begin with these for pot-plants. Start them in chopped moss in boxes. The tubers may be arranged rather close together in the box, and merely covered over with the moss to the depth of about an inch. The new roots are made from the top part of the tuber, so it is important that this part should be covered to encourage the roots. For starting, a heat varying between 70° and 85° will suffice. As soon as a healthy lot of roots makes its appearance, the plants should be potted, using as small-sized pots as possible. The soil for this potting should be principally leaf-mold, with a little sand. In a short



732. Caladium bicolor var. Chantinii. (No. 17).

time they will need another shift; the soil should on this occasion be a little stronger; give a position near the glass, and shade from strong sunshine.—New forms are raised from seed, this operation being an exceedingly easy one with the caladium, as they cross-fertilize very readily. The flowers, unlike those of the Anthurium, are monœcious, the females ripening first. To pollinate them, part of the spathe must be cut away. Seedlings at first have the foliage green, and it is not until the fifth or sixth leaf has been developed that they show their gaudy colorings. Propagation of the kinds is effected by dividing the old tubers, the cut surfaces of which should be well dusted with powdered charcoal to prevent decay.—As bedding plants, the fancy-leaved caladiums are gradually becoming more popular. To have them at their best for this purpose, the ground should be worked for some time previous to planting out, with a goodly quantity of bone meal incorporated with the soil. The tubers are best put out in a dormant state, as then they make very rapid progress, and eventually make finer plants than when they are first started in the greenhouse, as by this system they are too likely to sustain a check in the hardening-off process, and lose their leaves. The fine, highly colored kinds are not so well suited for outdoor work as those having green predominating in the foliage, but some of the kinds, such as Dr. Lindley and Rosini, do remarkably well. Frequent watering with manure-water is absolutely necessary to the development of the foliage, both outdoors and in. (G. W. Oliver.)

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Wallisi, 28.
Wightii, 44.

It will be seen that most of the cultivated caladiums are considered to be forms of *C. bicolor* and *C. picturatum*. Only five species are concerned in the following list: *Schomburgkii, 1; marmoratum, 7; bicolor, 8; picturatum, 48; Humboldtii, 57.*

A. *Blade not at all peltate, obliquely elliptical-ovate.*

1. **Schómburgkii,** Schott. Petiole slender, 4 times longer than the blade, sheathed one-third its length; blade obliquely elliptical-ovate; midrib and 4–5 acutely ascending primary nerves silvery, pale, or red; sparsely spotted above, paler beneath. French Guiana to Para. —Runs into the following forms:

(1) *Veins red.*

2. Var. **marmòreum,** Engl. Blade dull green, with brownish red nerves, bordered with yellow.

3. Var. **erythræum,** Engl. (*C. Schmítzii*, Lem. *C. cordàtum*, Hort.). Midribs and nerves red. I.H. 8:297.

4. Var. **píctum,** Engl. With white or red spots between the red veins. S. Amer.

(2) *Veins silvery or green.*

5. Var. **argyroneùrum,** Engl. (*C. argyroneùron*, C. Koch. *C. Schélleri*, Lem.). Midrib and veins silvery. I.H. 8:297.

6. Var. **subrotúndum,** Engl. (*C. subrotúndum*, Lem.). Lf.-blade rounded at the base, or shortly cordate, with white or red spots. Brazil.

AA. *Blade distinctly peltate.*

B. *Lf. sagittate-oblong-ovate; basal lobes united for two-thirds their length, or more.*

7. **marmoràtum,** Mathieu (*Alocàsia Roézlii*, Bull. *C. thripedéstum*, Lem.). Petiole cylindrical, 12–16 in. long, twice as long as the blade, variegated; blade 6–8 in. long, 4–6 in. wide, dark green, with irregular gray, yellowish green and snow-white spots, glaucous-green beneath, sagittate-oblong-ovate, the upper lobe semi-ovate, slightly cuspidate, the basal ones unequal, one-third or one-half as long as the upper, connate two-thirds to three-fourths their length: spathe-blade pale green, 2–3 in. long. Ecuador. I.H. 5, p. 59, desc.

BB. *Lf. not as above; basal lobes united one-third their length or less.*

C. *Shape of lf. ovate-triangular, or ovate-sagittate* (8–47).

8. **bícolor,** Vent. (*Árum bícolor,* Ait.). Petiole smooth, 3–7 times as long as the blade, pruinose toward the apex; blade ovate-sagittate, or ovate-triangular, variegated above, glaucous beneath; upper lobe semi-ovate, narrowing gradually to a cuspidate point, the basal ones one-half to but little shorter than the upper, oblong-ovate, obtuse, connate one-fifth to one-third their length. S. Amer. Intro. into cult. in 1773. B.M. 820.—Very common in cult., furnishing many of the fancy-leaved caladiums. The marked varieties are as follows (9–47):

(1) *Lf.-blade and veins of one color.*

9. Var. **Velloziànum,** Engl. (*C. Velloziànum,* Schott. *C. Purdieànum,* Schott. *C. pusíllum,* C. Koch. *C. Spruceànum,* Schott. *C. firmulum,* Schott.). Lf.-blade dark green above; basal lobes connate past the middle. Brazil, Peru. R.B. 10:169.

(2) *Lf.-blade more or less variegated.*

(a) *With a colored disk* (Nos. 10–18).

(b) *Disk transparent.*

10. Var. **transpárens,** Engl. (*C. transpárens,* Hort.). Blade with a pale green, nearly transparent disk; midrib and primary veins red-purple.

11. Var. **rubicúndum,** Engl. (*C. bícolor,* Kunth). Petiole green, or variegated green and violet; blade green, with a red, transparent, central disk, and a very narrow red line between the disk and the margin.

(bb) *Disk opaque.*

(c) *Purple disk.*

12. Var. **Baráquinii,** Engl. (*C. Baráquinii,* Hort.). Petiole violet; blade with a purple-red disk; beautiful green between the disk and margin; nerves and midrib red-violet. Para. I.H. 7:257. F.S. 13:1378.

13. Var. **Kétteleri,** Engl. (*C. Kétteleri,* Hort.). Petiole crimson, variegated toward the base; blade with purple disk, midrib and primary veins, sparsely marked between the veins with many small, rosy spots.

(cc) *Red disk.*

14. Var. **splèndens,** Engl. (*C. ròseum,* Hort. *C. splèndens,* Hort.). Petiole green below, red above; blade with a red disk at the middle; midvein and primary veins red-purple; green between the nerves and along the margin. Lowe, 4.

15. Var. **Lèopoldii,** Engl. (*C. Lèopoldii,* Hort. *C. Gærdtii,* C. Koch. *C. Rogièrii,* Chant. & Lem.). Petiole violet beneath, red-purple above; blade with a broad, reddish disk; margin green, red-spotted; midrib and primary veins dark red-purple. Para, 1864.

16. Var. **albomaculàtum,** Engl. (*C. Alfred Bleu*). Petiole green; blade green, with red disk, midrib and primary veins, and marked clear to the margin with many large, white spots between the nerves.

(cec) *Rose disk.*

17. Var. **Chântinii,** Engl. (*C. Chántinii,* Lem. *C. Connærtii,* Hort. *C. amœnum,* Hort. *C. Marter-steigiànum,* Hort. *C. punctatissimum,* Hort. *C. Haage-ànum,* Hort.). Fig. 732. Petiole more or less violet; blade broadly red-purple along the midrib and primary nerves, rosy at the center, and with very numerous, unequal spots between the nerves clear to the marginal vein. Para, 1858. I.H. 5:185. F.S. 13:1350–51. B.M. 5255. A.F. 8:129. G. 12:375.

(ccee) *Light green disk.*

18. Var. **Houllétii,** Engl. (*C. Houllétii,* Lem. *C. Mooreànum,* Hort.). Petiole green, the sheath and a little of the base violet-variegated; basal lobes of the blade somewhat introrse, rounded, connate one-third; blade obscurely green toward the margin, the midrib and primary veins slightly reddish, and with a pale disk marked with many irregular white spots.

(aa) *Without a colored disk.*

(b) *Margins colored throughout.*

(c) *Red margin.*

19. Var. **marginàtum,** Engl. (*C. marginàtum,* C. Koch). Blade dark green, with a red line on the outer margin.

(cc) *Yellow margin.*

20. Var. **Krameriànum,** Engl. (*C. Krameriànum,* Hort.). Veins purple; yellow margin.

21. Var. **Stangeànum,** Engl. (*C. Stangeànum,* C. Koch). Blade reddish; green along the narrow margin, yellowish toward the margin.

(ccc) *Solid white margin.*

22. Var. **Perriérii,** Engl. (*C. Perriéri,* Lem.). Petiole violet-black; blade dull green, with many red-purple spots, and white along the margin. Brazil, 1861.

(cccc) *Spotted margin.*

23. Var. **Éckhartii,** Engl. (*C. Éckhartii,* Hort.). Petiole violet-blotched at the base, green above the middle; blade green, with few rosy spots along the margin, and small white ones in the middle.

24. Var. **Héndersonii,** Engl. (*C. Héndersonii,* Hort.). Petiole variegated violet and green, reddish toward the apex; blade mostly green, reddish next the lower parts of the nerves; midrib and primary veins red-purple spotted; small red spots along the margin.

25. Var. **Sièboldii,** Engl. (*C. Sièboldii,* Hort.). Petiole violet and green, reddish toward the apex; basal lobes of the lf. somewhat introrse, connate one-third their length, dark green; midrib and primary veins beautifully red-purple spotted, and a very narrow white border, marked with small purple-red spots. A.F. 8:127.

(ecccc) *Purple margin.*

26. Var. **Houbyànum,** Engl. (*C. Houbyànum,* Hort.). Petiole dirty green on the lower surface, bright red above; blade bright green, with large pale spots, and small red-purple ones between the midrib and primary veins; a red-purple spot above the insertion of the petiole, and a pale purple line around the margin.

27. Var. **pellùcidum,** Engl. (*C. pellùcidum,* DC.). Petiole reddish, variegated with violet; blade broadly reddish purple spotted along the midrib and primary veins, and more or less marked with transparent, reddish purple spots between the primary veins; a continuous purple line along the outer margin.

(bb) *Margin colored only on basal sinus.*

28. Var. **Devosiànum,** Engl. (*C. Devosiànum,* Lem. *C. Wállisii,* Hort. *C. Óttònis,* Hort.). Petiole green; blade bright green, with small, irregular white spots between the midrib and primary veins, and a narrow crimson border at the sinus. Para. I.H. 9:322.

29. Var. **hæmatostígmatum,** Engl. (*C. hæmatostígmatum,* Kunth. *C. pellùcidum,* DC. *C. díscolor,* Hort.). Petiole violet; blade dark green, with a purple line on the basal sinus, and sparsely marked with blood-red spots. Para.

30. Var. **pœcìle,** Engl. (*C. pœcìle,* Schott. *C. pallidinérvium,* Hort.). Petiole reddish brown, or closely streaked-variegated; blade dark green; midrib and primary veins paler, often whitish; a red-purple spot where the petiole joins the blade, narrowly purple-margined in the sinus. Brazil.

31. Var. **regàle,** Engl. (*C. regàle,* Lem. *C. Wágneri,* Hort. *C. surinaménse,* Miq. *C. sagittæfòlium,* Sieb.). Blade bright green, purple-margined at the sinus, every-

where marked with small, confluent white spots. W. Indies, 1710. I.H. 9:316.

(bbb) *Margin and disk without color.*

(c) *Variegated green blade.*

32. Var. **Brongniártii,** Engl. (*C. Brongniártii,* Lem.). Very large; petiole variegated violet and green, reddish toward the apex; blade green, except along the nerves below, where it is colored reddish, paler green between the primary nerves, deep green toward the margin; veins and nerves red-purple. Brazil, 1858. F.S. 13:1348–9. I.H. 5, p. 58, desc.

33. Var. **mirâbile,** Engl. (*C. mirâbile,* Lem.). Petiole green; blade bright green, densely covered with large and small irregular pale green spots between the primary nerves and midvein. Para. I.H. 10:354.

(cc) *Blue-green blade.*

34. Var. **píctum,** Kunth (*C. píctum,* DC.). Petiole greenish, variegated beneath; basal lobes connate one-fifth their length; blade thin, blue-green, marked with large, irregular, usually confluent, pale yellowish semi-transparent spots. Lowe, 43.

(ccc) *Colorless blade.*

35. Var. **Duchártrei,** Engl. (*C. Duchártrei,* Hort.). The long petiole green above, variegated below the middle with violet-black; blade colorless, except the midrib and all the veins, or here and there pale rosy or red-spotted, or even more or less dirty green. A.F. 8:129.

(cccc) *Solid green blade.*

(d) *Dark green.*

36. Var. **argyróspilum,** Engl. (*C. argyróspilum,* Lem.). Petiole grayish red, sparsely and finely streaked; blade a most beautiful green, with a crimson spot at the middle, and with many small white spots between the primary veins. Para. F.S. 13:1346–7.



733. Caladium picturatum var. Belleymeii. (No. 49.)

37. Var. **Curwádlii,** Engl. (*C. Curwádlii,* Hort.). Petiole greenish, slightly violet-blotched toward the base; blade reddish purple along the midrib and primary veins, marked between the veins with large white spots; otherwise dark green.

38. Var. **Kòchii,** Engl. (*C. Kòchii,* Hort.). Lf.-blade more rounded, dark green, with small white spots midway between the midrib and margin. Para, 1862.

39. Var. **macrophýllum,** Engl. (*C. macrophýllum,* Lem. *C. gríseo-argénteum,* Hort.). Petiole green; blade dark green, marked everywhere with many small, scarcely confluent white or slightly rosy spots. Para, 1862. I.H. 9:316.

40. Var. **Neùmannii,** Engl. (*C. Neùmannii,* Lem.). Petiole green; blade very beautiful dark green, with scarcely paler veins, marked between the primary veins with large and small white-margined, reddish purple spots. F.S. 13:1352–3. B.M. 5199.

(dd) *Light green.*

(e) *Not spotted.*

41. Var. **rubéllum,** Engl. (*C. rubéllum,* Hort. *C. Reichenbachiànum,* Stange). Blade green, with reddish purple midrib and primary veins.

42. Var. **rubrovènium,** Engl. (*C. rubrovènium,* Hort. *C. rubronérvium,* Hort.). Petiole variegated green and violet; blade small, oblong-ovoid, the basal lobes somewhat introrse, obtuse, connate almost to the middle, pale caulescent or red-green along the midrib and primary veins; veins pale red or scarlet. Para, 1862.

(ee) *Spotted.*

(f) *With white spots.*

43. Var. **Laucheànum,** Engl. (*C. Laucheànum,* C. Koch). Blade bright green, with white spots at the middle.

(ff) *With purple and white spots.*

44. Var. **Wìghtii,** Engl. (*C. Wìghtii,* Hort.). Petiole pale green; blade very beautiful green, marked between the primary veins with large, red-purple and small white spots. French Guiana.

(fff) *With red or crimson spots.*

45. Var. **Enkeànum,** Engl. (*C. Enkeànum,* C. Koch). Blade bright green, marked with large and small red spots.

46. Var. **Líndenii,** Engl. (*C. Líndenii,* Hort.). Blade bright green, with confluent small red spots.

47. Var. **Verschafféltii,** Engl. (*C. Verschafféltii,* Lem.). Petiole pale green; blade very beautiful green, with few irregular crimson spots. I.H. 5:185. B.M. 5263. Lowe, 46.

cc. *Shape of blade lanceolate-sagittate.*

48. **picturàtum,** C. Koch. Petioles usually green, variegated below, elongated; blade lanceolate-sagittate, cuspidate and submucronate at the apex, the upper lobe nearly triangular, oblong or ovate-lanceolate, basal lobes over half as long, lanceolate subacute, connate one-sixth to one-fourth their length, separated by a triangular sinus; primary lateral veins 4–7, erect-spreading or spreading. Brazil.—Variable, furnishing many of the fancy-leaved caladiums.

(1) *Transparent white blade.*

49. Var. **Belleỳmei,** Engl. (*C. Belleỳmii,* Hort.). Fig. 733. Petiole greenish above, variegated violet beneath; blade slenderly hastate-sagittate, white, translucent except the green veins and nerves, with small green spots along the margin; basal lobes 1–5, or rarely one-fourth or one-third connate. Para. I.H. 7:252. A.F. 8:127. G. 2:89.

(2) *Pale green blade.*

(a) *With transparent blotches.*

50. Var. **hastàtum,** Engl. (*C. hastàtum,* Lem.). Petiole long, stout, white, violet-spotted; blade hastate-sagittate, slightly contracted above the lobes; dull, pale green, very irregularly marked with transparent blotches; basal lobe one-fourth connate, crimson margined in the sinus. Para.

(aa) *Opaque.*

51. Var. **albostriátulum,** Engl. Blade greenish white along the midrib and veins, white-striped and dotted between the nerves.

52. Var. **Osyànum,** C. Koch. Blade white along the midrib and primary veins, with purple spots between the veins.

53. Var. **porphyroneùron,** Engl. (*C. porphyroneùron,* C. Koch. *C. cùpreum,* Hort. *Alocàsia porphyroneùra,* Lem.). Petiole pale reddish, variegated with dull violet; blade broadly hastate-sagittate, dull, pale green, slightly reddish on the veins, opaque basal lobes one-sixth to one-third connate. Peru and Brazil. I.H. 8:297.

(3) *Dark green blade.*

54. Var. **élegans,** Engl. Petiole rosy, greenish below, variegated; blade narrowly hastate-sagittate, slightly contracted above the lobes, dark green above, broadly red or purple next the midrib and primary lateral veins; basal lobes one-fifth connate.

55. Var. **Lemaireànum,** Engl. (*C. Lemaireànum,* Barr. *C. picturàtum albinérvium,* C. Koch. *C. picturàtum viridíssimum,* C. Koch). Blade shaped like preceding, dark green; midrib and primary veins pale green or white. S. Amer., 1861. I.H. 9:311.

56. Var. **Troubétskoyi,** Engl. (*C. Troubétskoyi,* Chantin. *C. Appuniànum,* Hort.). Petiole red, variegated; blade very narrowly hastate-sagittate, slightly contracted above the lobes, dark green above, broadly marked with pale red along the midrib and primary veins, and with scattered, transparent, small white or rose spots. F.S. 13:1379.

ccc. *Shape of blade oblong-ovate, or oblong: plant small.*

57. **Húmboldtii,** Schott. (*C. argyrites,* Lem.). Fig. 734. Petiole slender, variegated, 2 to 3 times longer than the blade; sheath slender, narrow; blade oblong-ovate, or oblong, green along the margin, midrib and primary veins, with many large and small transparent spots between; shortly and very acutely acuminate, the apical lobe oblong-ovate, twice as long as the oblong or ovate-triangular, obtuse basal ones; basal lobes one-third connate, separated by an obtuse triangular sinus, the 3–4 primary veins of the apical lobe uniting in a collective nerve remote from the margin. Brazil. I.H. 5:185. F.S. 13:1345. Gng. 3:279. A.F. 10:197. Lowe, 22. C.L.A. 19:343. G. 14:501.

58. Var. **myriostígma,** Engl. (*C. myriostígma,* C. Koch). Blade marked everywhere with small white spots.

The following names are in the trade, or occur in the lists of dealers and fanciers, but are not identified botanically:—*albanense, Barrattii, candidum, Endlicherianum, Fenzlianum, Ortgiesii, Petschkanii, Rodeckii, speciosum, Thelemannii, venosum.*

C. esculéntum=Colocasia antiquorum esculenta.—*C. odoràtum,* Lodd.=Alocasia macrorrhiza.—*C. pubéscens,* N.E.Br. A new species, distinct from those already in cult. by being pubescent. Peru. B.M. 8402.

JARED G. SMITH.
GEO. V. NASH.†

CALAMAGRÓSTIS (Greek, *calamos,* a reed, and *agrostis,* a grass). Syn. *Deyeuxia. Gramíneæ.* Usually tall or reed-like perennials bearing rootstocks. Including hay grasses and a few more or less ornamental species.

Spikelets 1-fld., the rachilla prolonged behind the palea as a usually hairy pedicel; lemma hairy on the callus, awned from the back.—Species about 120, distributed throughout the world in temperate and arctic regions, usually in damp or swampy soil. The species are often valuable native forage grasses. One species, **C. canadénsis,** Beauv., is a source of an excellent quality of native hay in the northwestern states, where it is called blue-joint. Another species, **C. stricta,** Beauv., native of the northern states, is sometimes cult. in a variegated form as an ornamental.

C. brevípilis=Calamovilfa brevipilis. A. S. HITCHCOCK.

CALAMINT, CALAMINTHA: *Satureia.*

CALAMOVÍLFA (Greek, *calamos,* a reed, and *vilfa,* a kind of grass). *Gramíneæ.* PURPLE BENT-GRASS. A group differing from Calamagrostis in having awnless spikelets and no prolongation of the rachilla. Species 3, in S. E. U. S. **C. brevípilis,** Hack., is cult. as an ornamental grass. This is a stout, tufted grass, 2–4 ft., with short, horizontal rootstocks, pyramidal purplish panicle 4–8 in. Sandy swamps in pine-barrens, N. J. to N. C. Dept. Agric., Div. Agros. 7:156; 20:84.

A. S. HITCHCOCK.



734. Caladium Humboldtii. (No. 57.)

CALÁMPELIS: *Eccremocarpus.*

CÁLAMUS (Greek for *reed*). *Palmàceæ,* tribe *Lepidocárpæ.* A group of interesting, usually climbing pinnate palms of the Old World tropics, not much known to the trade although over thirty species are in the European catalogues.

Stems very slender, always more or less prickly, usually climbing and never bearing a terminal infl.: lvs. alternate, pinnate, often ending in a terminal sometimes elongated cirrus, by which they are attached to their support; lfts. narrow, with 1–5 nerves; lf.-sheaths at first completely inclosing the internodes, sometimes split and open: spadix laterally attached at the summit of the lf.-sheaths, often elongate and slender and frequently ending in a tail-like appendage (flagellum) which is thorny; spathes long and narrow, hardly if at all split, differing from Dæmonorops which has a readily opening spathe; fls. diœcious, paniculate or branched 2 or 3 times; corolla coriaceous, longer than the calyx in male fls., as long as the calyx in the female: fr. globose, ovoid or ellipsoid, topped by a short permanent style.—There are more than 200 species, most of which inhabit India. See Beccari's excellent monograph Ann. Royal. Bot. Gard. Calcutta 11, 1908.

Calamus is an easily grown group of palms, very ornamental, even in a young state. Some of the species have stems several hundred feet long, which enable them to unfold their leaves at the tops of the tallest trees. The leaves are peculiarly well adapted to assist the plant in climbing, having numerous hook-like processes arranged on a long continuation of the midrib of the leaf. When accommodations can be given, these plants should be selected, as their growth is rapid, and they are capable of furnishing a large conservatory quickly. Numerous suckers are produced, so that when the main stem ascends the lower part is clothed in foliage. *Calamus tenuis* (or *C. Royleanus*) and *C. Rotang* furnish the rattan canes. Malacca canes are furnished by *C. Scipionum.*—Young plants thrive best in a rooting medium containing a considerable quantity of leaf-mold. Older plants need soil of a more lasting nature; a quantity of ground bone and charcoal in the soil may

be used to advantage. Old well-furnished plants need enormous quantities of water. All of them require stove temperature. (G. W. Oliver.)

ciliàris, Blume. St. slender, climbing by means of long axillary leafless branches, covered with short hooked spines: lvs. 1½–2½ ft. long, 6 in. wide; lfts. 40–50 on each side, hairy; petiole 2 in. long with few hooked spines: spadix of female and male fls. finely hairy-hispid on the spathes: fr. globose, about ½in. diam. Java and Sumatra. F.R. 1:607. G.C. III. 21:86.—Intro. into cult. in 1869. To be grown in tropical house.

aspérrimus, Blume. St. slender, climbing by the prickly cirrus of the lvs. and the prickly branches: lvs. without stalks, about 18 in. long, bearing not more than 8–10 thin, papery, irregularly placed lfts. on each side of the rachis: spadix simply decompound, about 7 ft. long, terminating in a slender prickly appendage. Mts. of Java.—Can be grown in a cooler house than the preceding.

C. Andreànum, Hort., Pill & Mitterb=(?).—*C. calicárpus,* Griff. =Dæmonorops calicarpus, Mart.—*C. dealbàtus.* Hort,=Acanthophœnix rubra, Wendl.—*C. Lewisiànus,* Griff.=Dæmonorops Lewisianus, Mart.

N. Taylor.

CÁLAMUS or SWEET FLAG: *Acorus Calamus.*

CALÁNCHOË: *Kalanchoë.*

CALANDRÌNIA (J. L. Calandrini, Genevan botanist, who wrote an important thesis in 1734). *Portulacàceæ.* Fleshy, spreading or nearly trailing plants, sometimes cult. in borders and rockeries, or used for edgings in sunny places.

Flowers red or pink or rose-color, of short duration; petals 3–7; sepals 2; stamens 5 (or 3) to 12; style with 3 branches: lvs. alternate, narrow.—About 60 species, Brit. Col. to S. Amer. and in Austral. Annuals and perennials, but the latter mostly treated as annuals; not much grown in gardens.

A. *Fls. in a short umbel-like cluster.*

umbellàta, DC. Perennial, 4–6 in.: lvs. linear and hairy: fls. in a corymb, or umbel-like terminal cluster, bright crimson. Peru. R.H. 1853:5.—The *C. umbellata* of gardens is hardy in many parts of the U. S.; in New York it should be planted in a well-sheltered position, or provided with ample protection in winter; sometimes it acts like the biennials, but, as seeds are produced very freely, young seedlings spring up constantly between the old plants, and one does not miss the few which may decay during the second year; the plant forms a very neat, slightly spreading tuft; fls. are produced in many-fld. umbels, terminal, numerous, and large, glowing crimson-magenta, saucer-shaped, very showy. June to Nov. Full exposure to sun, and light sandy soil, are needed to bring out the rare beauty of these plants. The fls. close up when evening comes, like the annual portulacas, but they reopen on the following day. In the sunny sloping part of a rockery, even when quite dry, or among other low plants in a bed or border, they are highly satisfactory. Although perennial, it may also be treated like the annuals, as it flowers the first summer as freely as afterwards. Can be prop. by cuttings.

AA. *Fls. in longer clusters, pedicels often more or less drooping.*

díscolor, Schrad. (*C. élegans,* Hort.). Perennial, 1–2½ ft.: lvs. fleshy, spatulate to obovate, purple beneath, gray-green above, blunt: fls. bright light purple, 2 in. across, with yellow stamens. Chile. B.M. 3357.

Ménziesii, Torr. & Gray (*C. speciòsa,* Lindl.). Red Maids. Annual: 3–12 in. high, with green herbage, glabrous, or nearly so: lvs. linear, or spatulate-oblanceolate: fls. rose-red or purple, rather large and long-peduncled (petals ½in. long). Calif., N. B.R. 1598.—Variable. There is a white-fld. variety advertised.

grandiflòra, Lindl. Perennial, 1–3 ft.: much like *C. discolor,* but lvs. oval and pointed, narrowed to petiole, green, 4–8 in. long: fls. somewhat smaller, light purple. Chile.

spectábilis, Otto. & Dietr. Perennial, 2 ft.: lvs. lance-spatulate or rhomboid, 1½ in. long, somewhat pointed: fls. bright purple, 2 in. across. Chile.—Said to produce seed seldom; prop. by cuttings.

Bùridgii, Hort. Annual, 1 ft.: lvs. linear-lanceolate, smooth: fls. many, small, copper-rose or brick-red, in leafy clusters. S. Amer.

chromántha, Griseb. One ft., loosely branched: lvs. rather large: fls. and buds rose-colored: fr. orange-yellow, persisting. Argentina.

C. oppositifòlia, Wats.=Lewisia oppositifolia.

J. B. Keller.
L. H. B.

CALÁNTHE (Greek for *beautiful flower*). *Orchidàceæ.* Sub-epiphytal or terrestrial hothouse orchids found in the eastern hemisphere, and sparingly in the western hemisphere.

Scapes erect, many-fld.: lvs. broad, plaited: fls. white or rose-colored, rarely yellow: pseudobulbs angulate, with grayish green sheaths in the Vestitæ section, but absent in the Veratrifoliæ section.—Forty to 50 species in tropics of both hemispheres.

Most of the species and the numerous varieties grown are deciduous, losing the foliage about the time of flowering, and, at this season, water is given sparingly until the flowers are cut; then the bulbs are kept in a dry warm place until signs of growth in spring. All calanthes are terrestrial and should be potted each year in fibrous loam, with a small portion of old manure and sand mixed in. Use plenty of drainage as for other orchids, and about 2 inches of soil; secure the bulbs firmly by means of part of the old wiry roots; water very sparingly until active root-action takes place; but, when in full growth, weak manure-water may be given at each watering. The young foliage is very sensitive to sun, and must be shaded as soon as it develops; keep the plants near the glass and give all light possible, and the warmest treatment permitted in orchid culture. They enjoy a little heat, even in summertime, from the pipes at night. The best place to grow calanthes is a sunken, well-heated pit facing south, lowering the plant as the foliage nears the glass. *Calanthe veratrifolia* is an evergreen species and may be treated similarly to the Phaius. Calanthes are easily increased by separation of the bulbs at the time of repotting. Young bulbs are often produced from the apex of old ones; old ones will start again the second year and make increase. (E. O. Orpet.)

vestîta, Lindl. (*C. oculàta,* Hort.). Lvs. broadly lanceolate, nearly 2 ft. long, from grayish green pseudobulbs: fls. nearly 3 in. across, numerous, in racemes; petals and sepals whitish, all more or less overlapping, the former oval-oblong, the latter obovate-oblong; labellum flat, large, 3-lobed, the mid-lobe cleft; a yellow or crimson blotch in front of the short column; scapes from 2–3 ft. high, hairy. Blooms in winter. Malaya. B.M. 4671. F.E. 9:325. A.F. 6:655. F.S. 8:816.—A most popular orchid. There are many forms, of which the following are the most important: Var. **gigantèa,** Hort. Larger in all parts: fls. white, with red eye. Var. **nivàlis,** Hort. Fls. pure white. Var. **Túrneri,** Hort. (*C. Túrneri,* Reichb. f.). Fls. more numerous, labellum with a crimson blotch; blooms later in the season than the next. Var. **rùbro-oculàta,** Hort. Labellum with a crimson-purple blotch. Oct.–Feb. G. 10:629. Var. **lùteo-oculàta,** Hort. Yellow-blotched. Var. **Regnièri,** Hort. (*C. Regnièri,* Reichb. f. *C. Stevensiàna,* Regnier). Pseudobulbs more elongated, with a depression above the middle: labellum rose-colored, with a purple blotch in front of column, less deeply

lobed than in the type. A.F. 6:655. Var. **Regnièri Williamsii**, Hort. (*C. Williamsii*, Hort.). Sepals white, sometimes shaded pink; petals white, rose-bordered; lip deep rose.

veratrifòlia, R. Br. Lvs. oblong-lanceolate, about 2 ft. long, from a creeping rhizome: fls. white, in dense corymbose racemes; petals obovate-spatulate; sepals obovate-oblong; labellum 4-parted, the anterior lobes usually broader than the posterior or basal lobes. Blooms May–July. Malaya. B.M. 2615.

Veìtchii, Lindl. Fig. 735. A hybrid between *C. rosea* and *C. vestita:* fls. rose-colored; labellum with white spot near the base. Winter-flowering. There is also a white variety. This hybrid was raised by Veitch, in 1856. B.M. 5375. Gng. 14:134. A.F. 25:1093. Forms of this are var. **bélla**, Hort., with pink fls.; var. **nìgro-oculàta gigantèa**, Hort., with stout sts., the fls. white with an eye of reddish crimson; var. **Sandhurstiàna**, Hort., with crimson fls.; var. **Sèdenii**, Hort., with deep rose fls.; var. **supérba**, Hort., has richer color.

Masùca, Lindl. Scape 2 ft. long, with large, many-ribbed, dark lvs.: fls. 1 in. across, the segms. overlapping, deep violet, fading to lilac, the lip deep violet-purple. Summer and autumn. N. India. B.M. 4541. Var. **grandiflòra**, Hort., is of greater size throughout.

C. burmánica, Rolfe. Fls. mauve-purple, with yellow crest. Burma.—*C. Clive*, Hort. (C. Veitchii × ?).—*C. Cookxonii*, Hort. (C. Veitchii × C. vestita luteo-oculata). Fls. pure white, except a blotch of yellow in the throat and a few lemon-yellow lines on lip. —*C. Cornelius Vanderbilt*, Hort. (C. vestita rubro-oculata × C. Veitchii).—*C. discolor*, Lindl. Sts. leafy: fls. with claret sepals and petals and a 3-lobed white lip flushed rose. Japan. G.C. III. 35: 389. B.R. 26:55.—*C. Eÿermannii*, Hort. (C. vestita rubro-oculata × C. Veitchii). Racemes shorter than in C. Veitchii, with larger, more spreading white fls. with a reddish blotch at the base of the lip. G.F. 4:17.—*C. gigas*, Hort. (C. grandiflora × C. Regnieri). Fls. nearly 3 in. across, borne on a st. over 5 ft. tall; sepals and petals milk-white. the latter tinged rose at base and apex; lip 4-lobed, bright rose, striated with pale rose or white, a reddish crimson blotch at the base.—*C. Hénnisii*, Loher. Similar to C. vestita. Philippines. G.C. III. 46:34, desc.—*C. madagascariénsis*, Rolfe. Sepals and petals rosy mauve; lip dull magenta with white spot at base. G.C. III. 28: 335, desc.—*C. McWilliamsii*, Hort.=(?).—*C. Orpetiàna*, Hort.—*C summiténse*, Hort.—*C. Wárpuri*, Rolfe. Sepals white; petals much narrower, white; lobed lip dull purple, changing finally to orange. Madagascar.

GEO. V. NASH.†



735.
Calanthe Veitchii.
(×⅓)

CALATHÈA (Greek for *basket*, the application not apparent). *Marantàceæ*. Perennial foliage plants of warmhouses, with maranta-like leaves arising in a tuft from the crown.

Sepals 3, free and equal; corolla tubular, with 3 spreading lobes; stamens 3, petal-like, 2 sterile, and 1 bearing an anther on its side (compare *Canna*). From Maranta the genus differs chiefly in technical characters. In Maranta the fr. is 1-seeded, in Calathea usually 3-seeded; in the former the fl.-clusters are branched and few-fld., in Calathea usually capitate or cone-like.—Of calatheas there are more than 100 species, mostly of Trop. Amer., but a few of trop. Afr. The lvs., for which the plant is grown, are variously marked with shades of green, red, brown, yellow, and white. They spring from the very base of the short st., just above the rhizome, the rhizomes themselves more or less tuberiferous (Fig. 736). Monogr. by Schumann in Engler's Pflanzenreich, hft. 11 (1902).

All the calatheas thrive in a moist tropical house in a temperature that does not go below 65° F., with a rise during the day to 90° or 95° F. For general purposes, the best compost in which to grow them is made of equal parts of good turfy loam, leaf-mold and sand. Some of the more delicate species are best grown in leaf-mold and sand only. Stagnation of the soil must be particularly avoided by abundance of drainage, as they require to be kept rather moister at the roots than most stove plants. The close moist atmospherical conditions that these plants require can be secured only by constant syringing and damping down amongst the plants; therefore the need for abundance of drainage is apparent, whether they are grown in pots or planted out in a border. It is only by planting them out with a free root-run that calatheas may be had in their full beauty; and when so grown a collection of these plants forms one of the most beautiful examples of tropical foliage. Particular attention should be given to protecting them from all strong sunshine, the thin texture of their leaves rendering them specially liable to damage from this cause. Most of the species are of easy culture providing the above conditions are followed. Many of them spread rapidly and make quick growth; therefore they require to be potted or overhauled every spring, but when once well established, they may be fed with liquid manure once a week.—Propagation is by dividing the crowns, or by cuttings in those kinds that make secondary growths, these cuttings being taken just below the nodes. In spring, just before growth begins, is a good time for this work. Tubers may be used, if produced.

In Florida, calatheas grow exceedingly well in shady lath plant-houses. The soil should be leaf-mold and very old cow-manure added to the original natural soil. Commercial fertilizer should never be used. In very cold weather they should be covered with pine branches and leaves or pine-needles. All the kinds soon form very beautiful clumps. All of them need much water while they are growing, but not in the winter if they are planted out in beds. Each spring they must be replanted in fresh soil. Then the clumps may be divided, or if large specimen plants are desired, they may be left intact. (Nehrling.)

The calatheas are a confusing group to the horticulturist, because the differences that he knows lie mostly in characters of leaf and habit and these are variable. The size of leaf and plant depends much on the treatment, and in some species the juvenile leaves are different from the mature ones. The coloration of the foliage depends much on the age, and the way in which the plants are grown. However, we may roughly throw the species into two groups,—the small-

leaved and the large-leaved, although it is a question where to place such intermediate kinds as *C. Veitchiana*, *C. insignis*, *C. leopardina*, *C. Sanderiana*, *C. nigricans*, and some others; or we may arrange them in two groups by the red-marked kinds (of foliage), and by the green-, gray- and white-marked kinds, but this would not account for the juvenile and adult stages of *C. leopardina*, *C. imperialis*, *C. Chantrieri*, *C. ornata*, and others. The botanical classification by floral characters would be of little use to the general horticulturist. Some plants known in collections as calatheas are likely to be marantas, phryniums, monotagmas, ctenanthe, or others. The radical tufted leaves and capitate inflorescence of Calathea, and the zigzag stems and branched inflorescence and small flowers of Maranta are general characters of separation between these two genera. In the present account, the attempt has been made to draw the characters as much as possible from cultivated specimens apparently authentically named.

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A. *Markings of lf. (upper surface) in red or brown, at least in part.*

1. **ròseo-pícta,** Regel (*C. ròseo-lineàta*, Hort.? *Maránta ròseo-pícta*, Lind. *M. Wágneri*, Hort.). Dwarf: lvs. nearly orbicular, purple beneath, the upper side dark green, the midrib red, and an irregular red zone (sometimes two zones) two-thirds of the distance from the midrib toward the margin. Amazon. F.S. 16:1675–6. Gn. 2, p. 3.

2. **Pavònii,** Kœrn. (*C. tubíspatha*, Hook. f.). Two feet or less high: lvs. obovate-elliptic, short-acuminate or cuspidate, thin, greenish beneath, lively green above, and marked midway between the rib and the margin with lighter green and squarish patches of brown. Peru. B.M. 5542.

3. **angustifòlia,** Kœrn. (*Maránta discolor*, Hort.). Habit loose, erect, only slightly spreading at apex: growths bearing 1–4 lvs. from 1–5 ft. high; blade lanceolate, unequilateral, ¾–2 ft. long, rich light green with fine lines of purple-red above, rich shining red beneath; petiole erect, stout, 1–3 ft. high, rich dark red, heavily marked with light green tuberculate spots; sheath extending from one-third to one-half its length: in the juvenile form the whole of the plant is densely covered with reddish brown hairs, but in the adult plant, the blade is almost entirely glabrous. Cent. Amer. B.M. 8149.

AA. *Markings of lf. mostly on the order of green or white (exceptions in juvenile stages of Nos. 35, 36, 37 and others).*

B. *Lf.-blades small or short, usually less than 12 in. long.*

C. *Under side of lvs. green, grayish, or yellowish (violet in forms of No. 14).*

4. **mìcans,** Kœrn. (*Maránta mìcans*, Math. *Phrỳnium pùmilum*, Klotzsch). Very small: lvs. 2–3 in. long, and 1 in. wide, oblong-lanceolate, somewhat acuminate, green and shining above, the rib in a feathered white stripe, paler beneath. Brazil.—Probably the smallest cult. Calathea.

5. **chimboracénsis,** Lind. Dwarf: lvs. oblong-ovate, 8–12 in. long, acuminate, green above and below, with a very dark green white-margined band running lengthwise the blade midway between the rib and each margin. Neighborhood of Mt. Chimborazo. I.H. 17:6.

6. **Wiotiàna,** Makoy (*Maránta Wiòtii*, Morr.). Habit dwarf, spreading: rhizomes branching freely: growths bearing only a single lf. each; blade linear-lanceolate, slightly oblique, 4–12 in. long, undulate, acute, upper side silvery gray with a narrow band of light green around the margin; midrib green, with a row arranged pinnately, along either side of the midrib, of dark olive-green blotches or stripes; under side dull grayish green finely striated all over between the principal veins with patches of light yellowish green; petiole 3–15 in. long, erect or spreading, light green, terete sheath entirely absent. Probably Brazil.—A most beautiful species; thrives best in leaf-mold and sand.



736. Tuber of calathea. (×½)

7. **trifasciàta,** Kœrn. (*Phrỳnium propínquum*, Poepp. & Endl.). Habit dwarf, spreading, with short free-branching rhizomes: growths bearing 1 lf. only; blade cordate-ovate, unequilateral, 3–12 in. long, apex acute, and half twisted around, upper side silvery gray shading to green at the margins and with a row on either side of the midrib of dark green stripes arranged pinnately, under side light green, prominently striated on both upper and lower sides with a network of fine veins connecting all the principal lateral veins; midrib pale yellowish brown on the under side and covered with dark brown hairs in the lower half and extending for an inch or more on the apex of the petiole; petiole 3–12 in. long, light green, glabrous except in the upper inch or so; scale lvs. reddish brown. Guiana.—A companion plant to *C. Wiotiana*, to which it is closely allied, but differs in the broader and paler color of the lvs. Of easy cult.

8. **fasciàta,** Regel & Kœrn. Habit dwarf, compact: lvs. 10–18 in. long, reflexed; growths bearing 1–3 lvs.; blade broadly ovate or orbicular, acute or obtuse, glabrous 5–10 in. long, slightly undulate; upper side rich dark olive-green alternately marked by transverse bars of silvery white; under side dull grayish green; petiole 4–8 in. long, spreading, dull green, covered with short and minute brownish hairs; sheath extending up to one-half the length of the petiole, upper part terete. Brazil. Gn. 2, p. 3.—Considered by some to be a variety of *C. rotundifolia*, Kœrn. *C. farinosa* and *C. ovalifolia* are probably stages in the development of this plant or perhaps slight varieties.

9. **Luciàna,** Hort. Habit medium to strong, compact, more or less tufted: growths with 2–5 lvs., usually with 3, arching over at the tips and ½–3 ft. high; blade elliptic, oblique, glabrous, acute, slightly undulate, 3–12 in. long, upper side light pea-green feathered along the midrib with pale greenish white and with a concentric zone of the same shade near the margin of the lf., under side dull grayish green; petiole erect, slender, rigid, pale green, glabrous or nearly so; sheath extending from one-half to nearly the entire length of the petiole, upper part oval, slightly flattened on each side: infl. a short few-fld. spike; peduncle 1–3 in. long; bracts spreading or erect, ovate, light reddish brown, 1½ in. long; fls. in pairs, yellow; sepals thin, linear, one-third the length of the tube; corolla yellow; petals elliptic, ⅔in. long, spreading, acute; the 2 petaloid aborted stamens obovate, ⅓in. long, bright yellow,

and striped or blotched with bright red; style curved, ½in. long, yellow. Trop. Amer.

10. **flavéscens,** Lindl. Habit tufted, glabrous in all parts: growths with 3–5 lvs., 1–2½ ft. high; blade elliptic, slightly oblique, 6–12 in. long, acute, light green above, soft grayish green below; petiole 12–18 in. long, pale yellowish green finely spotted with darker green; sheath one-third to one-half the length of the petiole, upper part oval: infl. a dense globose short raceme; peduncle less than an inch; bracts large, elliptic, outer ones 2 in. long, bracteoles smaller, linear or lanceolate; fls. in pairs, sessile or nearly so, an inch diam.; sepal primrose, equal, lanceolate; petals large, bilobed, obovate, bright yellow. Brazil. B.R. 932.—Perhaps to be referred to *C. grandiflora,* Schum.

11. **Sagoreàna,** Hort. (*Maránta Sagoreàna,* Hort.). Habit dwarf and compact: growth bearing 2–4 lvs., usually with 3, and from 6–18 in. high, erect at first, arching towards the apex; blade lanceolate, unequilateral, 4–9 in. long, pale yellowish green with a row on either side of the midrib of arrowhead-shaped blotches of dark green which give this plant a distinct and pretty appearance, the under side in plain yellowish green; petiole slender, erect, 6–12 in. long; sheath extending only to about a quarter of its length, upper part terete.

12. **vittàta,** Kœrn. (*C. álbo-lineàta,* Hort. *C. ornàta* var. *álbo-lineàta* and *Maránta álbo-lineàta,* Hort.). Habit dwarf, compact, ½–2 ft. high: growths with 2–5 lvs.; blade elliptic-lanceolate, slightly oblique, 3–12 in. long, glabrous, acute, upper side light green, pinnately striped with white from apex to base, underside pale dull green shaded between the veins with slightly lighter yellowish green; petiole slender, erect or spreading, 3–15 in. high, light green, glabrous; sheath extending from one-third to one-half its length, upper part terete. Probably Colombia.

13. **Wállisii,** Regel (*Maránta Wállisii,* Lind.). Habit strong, but neat and graceful, branching and forming numerous growths: growths bearing from 2–7 lvs., and 1–4 ft. high; blade broadly ovate, acute or obtuse, 6–12 in. long, rich light velvety green along the margin and midrib and with a row on either side of the midrib of dark irregular blotches of olive-green, under side soft grayish green; petiole erect, slender; sheath, extending to half the length of the petiole, and covered with soft hairs, upper part terete: with the exception of the sheathing lower half of the lf.-stalks, the whole plant is glabrous. Peru.—One of the commonest species in cult. and of very easy culture. A useful and decorative pot-plant.

14. **virginàlis,** Lind. Lvs. soft-hairy below, broad-oval, rather blunt, 7–9 in. long, 4–6 in. broad, upper surface light green, and below, in the common form, whitish green and lighter zones shown, as on the upper surface,—or in another form, which has been distributed in gardens as *C.* (*Maranta*) *Marcellii,* under side shaded a light violet and without zones. Brazil. A.F. 7:611.—Allied to *C. Veitchiana,* but has bracts with indurated tips rather than membranaceous.

cc. *Under side of lvs. violet, purple, or suffused with red.*

15. **Álbertii,** Hort. (*Maránta Álbertii,* Pynaert & Van Geert). Habit dwarf, spreading, less than a foot high: growths bearing 2–5 lvs., erect or spreading; blade oblique, elliptic, undulate, acute, 4–9 in. long, glabrous, upper side dark green feathered on either side of the midrib with a band of pale yellowish green, under side dull green suffused with light purple-red: infl. a few-fld. terminal spike; peduncle 3–4 in. long, pale green; floral bracts half reflexed outwards, orbicular or broadly ovate, ¾in. long; bracteoles 4–6, white, scarious; fls. in pairs, pure white; sepals half the length of the tube; petals lanceolate, ½in. long, tube ⅔in. long; 2 petaloid stamens slightly longer than the petals, obovate, fertile stamen hooded and curved over the stigma; style and stigma short curved, white.

16. **Makoyàna,** Nichols. (*Maránta Makoyàna,* Morr. *M. olivàris,* Hort.). One to 4 ft.: lvs. broad-oblong, obtuse or somewhat short-pointed, the stalks red, the lf. olive-green or cream-colored above but marked against the midrib with outspreading, dark green blotches of oblong, oval or pyriform shape, the under surface similarly marked, but in red. Brazil. F.S. 20:2048–9. G.C. 1872:1589. Gn. 4, p. 87.

17. **nìtens,** Bull. Habit dwarf; blade elliptic, acute, glabrous, upper side bright green, with oblong acute bars of dark olive-green, alternate long and short, on either side of the midrib, under side dull green tinted with dull red. Brazil.—Distinct and pretty.

18. **crocàta,** Morr. & Joris. Whole plant 12 in. high: lvs. sub-distichous; petiole 2–3 in. long, sheathing most of its length; blade 4–5 in. long, erect, ovate-lanceolate, acuminate, somewhat undulate, dark green and veined above, rose-purple beneath: spike short, the bracts bright saffron-yellow. Brazil. B.M. 7820. G.C. III. 28:113. G.M. 53:265. J.H. III. 60:329. G. 32:263. F.W. 1876:161.—A free bloomer and showy when in flower.

19. **Veitchiàna,** Hook. f. Fig. 737. Habit strong, loose, and spreading, 1–4 ft. high: growths with 2–8 lvs., usually with 3; blade ovate or elliptic-ovate, oblique, acute, undulate, glabrous, 4–12 in. long, upper side rich dark glossy green, feathered along either side of the midrib with an irregular band of pale green and with an inner zone of dark olive-green blotches and an outer one of pale yellowish green (often shading to white) between the midrib and margin; under side similarly blotched, but in shades of purple-red and rosy red; petiole ½–3 ft. long, stout, green and glabrous above, tinted with reddish brown and hairy in lower part; sheath extending from one-third to one-half the length of the petiole, upper part terete: infl.



737. Calathea Veitchiana.

on erect densely fld. spike on peduncle 4–6 in. long; spike 2–3 in. long, with a rosette 2 in. diam., of large green foliolose erect or capped spreading bracts; floral bracts erect, spreading at the tips, ovate, an inch long, outer ones covered in lower part with brown hairs; fls. in pairs, primrose-white, tube ¾in. long, slender; sepals erect, ½in. long, lanceolate; petals elliptic ½in. long, reflexed; fertile stamen hooded, small, 2 aborted petaloid ones longer than the petals, obovate, bilobed, with a bright violet blotch on the front; style and stigma small, curved. Peru. B.M. 5535. G.C. 1870:924. Gn. 2, p. 545. F.S. 16:1655–8.—A dwarf var. **Fóxii,** Raffill, has recently been intro. into cult. from Venezuela. It differs from the type in its dwarf habit, rarely exceeding 10–12 in. high: lvs. broader, more reflexed, and with a bright rose or red midrib; the color of the markings of the lf. are darker and of a slightly different shape, the dark inner zone of green being more broken in outline, and running into the midrib: infl. smaller, but the fls. in size and color are the same as in the type.

20. **illústris,** Nichols. (*Maránta illústris,* Lindl.). Habit dwarf and compact, 6–9 in. high; lvs. spreading, growths bearing 2–5 lvs. 6–9 in. long; blade oblique, ovate, acute, undulate, 4–6 in. long, 2–5 in. broad, upper side rich dark shining olive-green, with a bluish metallic luster over the whole, the midrib being feathered on either side with dull silvery white and an irregular zone of the same color running the complete circle of the blade, under side dull purplish red; petiole 2–3 in. long, spreading, dull greenish brown; sheath extending to one-half the length of the petiole, upper part terete; petioles, lf.-scales and under side of the midrib covered with minute brown hairs: infl. an erect, capitate, few-fld. spike, on slender peduncle 4–6 in. long; bracts of two kinds, the upper 3 or 4 green, foliolose ovate, spreading over the floral bracts, and curving upward at the tips; lower bracts scarious, orbicular, light brown and shading to bright red at the point of attachment to the rachis, bracteoles 2–4, lanceolate, shorter than the bract: fls. in pairs; sepals white, two-thirds length of the tube, tube ⅔in. long; petals lanceolate, white, spreading, ½in. long; 2 aborted petaloid stamens larger than the petals, obovate, lower one heavily blotched with purple; stamen hooded; style and stigma white, curved, ⅓in. long; ovary minute, white. Ecuador. F.S. 16:1691-2.—By some regarded as derived from *C. roseo-picta.*

21. **Louìsæ,** Chantrier (*Maránta Louìsæ,* Hort.). Habit tufted, 2–3 ft. high: growths with 2–5 lvs.; blade elliptic, only slightly oblique, glabrous, acute margins plain or slightly undulate, 6–12 in. long, upper side light pea-green, feathered along the midrib with white, changing with age to a soft greenish white; under side light green tinted with pale purple-red; petiole ½–2½ ft. long, slender, erect, green, covered with soft minute brown hairs; sheath extending from one-third to one-half the length of the petiole, upper part terete: infl. an erect spike, elliptic in outline, on a leafy peduncle 4–12 in. long; bracts creamy white, reniform, obtuse or acute, bracteoles numerous, white, scarious; fls. in pairs; sepals linear, cream, half the length of the tube, tube ¾in. long; petals lanceolate, reflexed; lip elliptic, with bright yellow disk reflexed with scarious margins; column white or cream, linear curved towards the lip.

22. **Vándenheckei,** Regel (*Maránta* and *C. Goulétii,* Hort.). Habit dense and tufted, 1–2½ ft. high: growths with 1–3 lvs., usually 2; blade oblique, elliptic or elliptic-ovate, 3–9 in. long, acute, upper side glabrous, rich dark green, marbled with silvery white along the midrib and an irregular undulating line of the same color running the complete circle of the blade, the intervening tissue in some cases will be also entirely composed of this silvery white colored tissue and the green part reduced to a marginal ring ½in. diam.; these two strikingly distinct forms of lvs. will often be found on a single plant in adjoining growths; in this case it is not that either of them represent the adult stage, as both are of frequent occurrence on the same plant and both produce infls.; under side, dull purple-red; petiole erect or spreading, dull reddish brown; sheath reaching from one-third to one-half its length, upper part terete or oval: infl. an erect narrow spike, sometimes sessile but more commonly on a peduncle 3–15 in. high; bracts erect, ovate, green tinted with brown, closely adpressed and forming a narrow cone-like mass some 3–5 in. long, the upper pair of bracts always being enlarged and spreading outwards like 2 small elliptic lvs.: fls. in pairs, white; sepals half the length of the tube; tube ¾in. long; petals elliptic spreading; column curved, white with brown stripe.—A fine stove plant for large or small pots, and on account of its tufted habit is of great use for decoration. Of very easy cult.

23. **Liètzei,** E. Morr. (*Maránta conspícua,* Bull. *M. Neùbertii,* Hort.). Habit dwarf, spreading by means of runners: growths bearing from 1–7 lvs. ½–2 ft. high; blade obliquely elliptic, acute, undulate, glabrous, 3–9 in. long, upper side soft velvety green, striped along the principal veins with dark olive-green and feathered between the veins with splashes of yellowish green, lower side dull purple-red, midrib brown; petiole 3–15 in. long, softly tomentose in lower part; sheath extending from one-half to nearly the entire length of the petiole: infl. borne upon long slender leafy sts., which later become swollen and root at the nodes and change to runners, thus forming an easy means of prop: few-fld., bracts green, ovate; fls. in pairs in axil of each bract, pure white, ½in. diam.; sepals linear; petals obovate. Brazil. B.H. 25:273.

24. **pícta,** Hook. f. (*Maránta pícta,* Hort.). Habit dense and compact, covered in all parts with soft velvety hairs: growths with 4–10 lvs. and ½–3 ft. high; blade elliptic, undulate, acute, 6–15 in. long, upper side rich velvety olive-green, feathered on either side of the midrib, pale yellowish green; under side rich purple-red; petiole 3–18 in. long, dull red; sheath extending nearly the entire length of the petiole, the upper inch or two being terete, and rather brighter in color than the lower part: infl. a dense cone-like spike, borne on long slender terete sts. 1–3 ft. long and bearing 1 or more lvs. which change into runners after the fls. are over, becoming fleshy and rooting at the nodes, forming a ready means of prop.; bracts 1–2 in. long, erect, elliptic or ovate, pale primrose tinted with rose or violet; fls. in pairs, 1 in. diam., primrose tinted with violet. Brazil. B.M. 7674. G.C. III. 22:293.

25. **noctiflòra,** Hort. (*Maránta noctiflòra,* Regel & Kœrn. *M. grácilis,* Hort.). Habit loose and spreading, 1–2½ ft. high: growths with 2 or 3 lvs.; blade elliptic or elliptic-ovate, 6–12 in. long, pendulous or horizontal, upper side pale yellowish green, pinnately striped with rich dark green bars along the principal veins, lower side light green faintly suffused with dull red, the principal veins being more strongly marked with a deeper shade of red; petiole erect, rigid, 6–18 in. long; sheath, extending to half its length, upper part terete, green. Probably Brazil.—Perhaps a true Maranta.

26. **exímia,** Kœrn. (*Phrỳnium eximium,* Koch). Habit loose and spreading: growths bearing 1–3 lvs., usually 2, and from 1–3 ft. long; blade elliptic or elliptic-ovate, acute, 6–15 in. long, upper surface alternately striped with rich olive-green and light silver tissue, and arranged in the form of a feather, midrib channeled pale yellowish green, under side rich dark wine-red, glabrous above, softly tomentose with brown hairs beneath; petiole spreading, stout, 1–2 ft. long, lower part light green, reddish brown above, beneath extending from one-third to nearly the entire length of

the petiole, upper part oval or terete. Cent. Amer. Gt. 686.—One of the finest and most beautiful members of the genus.

27. **rufibárba,** Fenzl. Habit erect, densely tufted: growths with 3–7 lvs. 1½–4 ft. long; blades linear-lanceolate, 6–12 in. long, rich shining green, suffused with purplish red below, undulate, acute; petiole ¾–2½ ft. long, terete above the sheath; sheath extending from 2–10 in. of the base of the lf., dull red heavily spotted with green. Probably Brazil. B.M. 7560.—Densely hairy in all its parts.

28. **Lindeniàna,** Wallis (*C. Líndenii,* Wallis & André). Lvs. elliptic-oblong, short-acuminate (12 in. or less long), deep green above with an olive-green zone either side of the midrib, and beyond which is a darker zone of green, the under side counterfeiting the upper side, but with purplish zones. Brazil. I.H. 18:82.—By some considered to be a form of *C. roseo-picta.*

29. **prínceps,** Regel (*Maránta prínceps,* Lind.). Lf. elongated or elliptical-lanceolate, 7–10 in. long, 3–3½ in. broad, light green above, with broad black-green, flaming, broken band along the middle nerve, violet-purple below. Amazon.

30. **Legrelliàna,** Regel. Lf. elliptical, pointed, 5–6 in. long, 2–3½ in. broad, above shining green, with broad, white, flaming, broken middle band along the middle nerve and numerous broken white linear small bands between the side nerves; lower surface whitish green and marked with red and green. Colombia, Ecuador.—A neat species.



738. Calathea zebrina.

BB. *Lf.-blades larger, mostly upwards of 12 in. long.*

C. *Under side of lvs. green (red in juvenile states of Nos. 34 and others and in No. 37 and perhaps No. 45).*

31. **crotalífera,** Wats. Rattlesnake Plant. Lvs. oval, abruptly acute at each end, 1½–2 ft. long, and 10–12 in. broad, yellowish green, with a white-margined midrib, paler underneath; petiole 2–3 ft. long, curved, sheathing: peduncles 1 or 2, 8–10 in. high, bearing distichous yellow-fld. spikes. Guatemala.—Offered in Fla. The spikes suggest the rattle of a rattlesnake (Crotalus) whence the specific name.

32. **Allùia,** Lindl. Habit erect: growths bearing 4–10 lvs. 2–4 ft. long; blade 1–2 ft. long, elliptic, arching in upper half, light green above, pale silvery gray below, margins slightly undulate; petiole erect, often as much as 2 ft. long, green, striped with dull red on each side, the sheath extending up to within 2–3 in. of the apex, where it becomes terete. W. Indies.—Alluia is a native Carib name.

33. **leopardìna,** Regel (*Maránta leopardìna,* Bull). Habit strong and vigorous, quickly forming a large and fine specimen: growths bearing 3–7 erect or spreading lvs., often as much as 5 ft. high, and arching over at the tip; blade to 20 in. long, elliptic, slightly oblique, acute, slightly undulate, and glabrous in all parts, upper side rich green in the adult stage; in the juvenile stage the lvs. are dark olive-green in the center, with an irregular outer band of paler green, forming a complete zone between the dark green center and margin; under side light green; petiole 1–4 ft. high, rigid, erect; sheath extending from one-third to one-half the length of the petiole, upper part terete, glabrous, shining light green. Brazil.—A near ally of *C. Chantrieri,* but not so brightly colored in the markings of the lf.

34. **Chantrìeri,** Hort. (*Maránta Chantrièri,* André). Habit strong and vigorous, erect, spreading and arching above: growths bearing 3–4 lvs. and reaching as much as 6 or 7 ft. high in the adult stage; blade elliptic, glabrous; in the juvenile stage the larger part of the upper side of the lf. is a pale yellowish green with a dark green irregular band running around the margins and along the midrib, the under side is rich purplish red, in the adult stage the color on both sides of the lf. is all lost and becomes a rich dark green, the intermediate stages of development are marked by a gradual loss of the light yellowish green on the upper side and purple-red of the lower and the gradual encroachment of the dark green color which predominates in the adult stage; petiole 1½–5 ft. long, downy when young, glabrous when old, spreading outward; sheath extending from one-half to three-fourths of its length, upper part terete. Brazil.—A near ally, if not a variety of the older *C. leopardina,* Regel.

CC. *Under side of lvs. in shades of purple or red (or perhaps green in No. 45).*

35. **ornàta,** Kœrn. (*Maránta ornàta,* Lind. *M. regàlis,* Hort.). Habit vigorous, erect, spreading with age: growths bearing 1–4 lvs.; blade elliptic or elliptic-cordate, acute, 1–3 ft. long, rich shining green above (in the adult stage), dull purple-red below, the lvs. in the juvenile stage all beautifully striped between the principal veins with rose or pink, which in the intermediate stage changes to white and disappears entirely in the adult; petiole erect spreading with age, often as much as 4 ft. long and thick in proportion; sheath extending from one-third to one-half its length, upper part terete, slightly downy, especially in the lower part. Guiana to Ecuador. F.S. 4:413–14.—The forms this plant assumes during the different stages of its development have been distinguished by some nurserymen who have distributed them under separate names, *C. regalis, C. majestica,* and *C. roseo-striata* all being stages of the one plant. To add to the confusion they are also known in the trade under the generic name of Maranta. The plant known as *C. albo-lineata* or *Maranta albo-lineata,* has been referred by some authors to this species, but it has no near affinity and is a different plant from *C. ornata, C. imperialis* or *C. Sanderiana.*

36. **imperiàlis,** Hort. (*Maránta imperiàlis,* Hort.). Habit vigorous, erect, spreading in the adult stage: growths with 2–7 lvs. 6 in. to 5 ft. long; blade as much as 2 ft. long when adult, elliptic-ovate, acute, entire, shiny green above, rich purple-red below; petiole stout, erect or spreading, dull green; sheath developed about half its length, upper part terete.—One of the best species for decorative effect. This species presents a striking dissimilarity between the juvenile and adult stages of growth. The juvenile stage is much the better for horticultural purposes as the lvs. are then striped with bright rose or pink between the principal lateral veins. This color gradually changes as the plant grows stronger and becomes vigorous, the stripes on the lower lvs. first becoming white and gradually disappearing on the lvs. that are developed after the plant reaches the adult stage, until a stage is reached when all the color and stripes on the upper side of the lvs. are lost and the lvs. are a rich shining green color. The high color is again developed as soon as the plant is disturbed at the roots either for prop. or by injury.

37. **Sanderiàna,** Hort. (*Maránta Sanderiàna*). A species closely allied to *C. imperialis* but differing in the broader and shorter lf.-blades, darker color of the under sides of the lvs , transverse striation between the veins, the hairy character of the petioles and under side of the lvs. Habit erect, spreading with age: growths bearing 1–4 lvs.; blades ovate, or elliptic-ovate, up to as much as 2 ft. long when adult, acute, green above (in the adult stage), rich plum-red below; lvs. in the juvenile stage are striped with bright rose which become white in the intermediate stage and entirely disappear in the adult; petiole erect, stout; sheath extending from one-third to one-half its length, upper part terete; lf.-scales, petioles and under sides of the lvs. slightly pubescent. Brazil.—*C. ornata, C. imperialis* and *C. Sanderiana* are probably all forms of one very variable species.

38. **insígnis,** Bull. Habit tufted, dwarf and compact: growths bearing 2–3 lvs. and from ½–3 ft. high; blade linear-lanceolate, 3–18 in. long, undulate, acute, glabrous, upper side highly glabrous, pale yellowish green shading to rich olive green at the edges, and with a row on either side of the midrib arranged pinnately of alternate long and short blotches of dark olive-green, giving the plant a most distinct and striking effect; under side a rich dark maroon-red; petiole 3–20 in. long, rigid, slender; sheath only developed near the base, upper part terete, green. Brazil. J.H. III. 45:218.—One of the most beautiful foliage plants in cult. and one which thrives well in a hot moist stove in a mixture of leaf-mold and sand.

39. **argyrophýlla,** Hort. A garden hybrid. Habit spreading: growths with 2–5 lvs. 1–3½ ft. long, 12–20 in. long, elliptic, silvery white, feathered with pale green above and rich reddish brown below; petiole 12–20 in. long, pale green, striped along the back with red; sheath extending up to within 4–8 in. of the lf.-blade, upper part terete and slightly channeled on upper side, glabrous in all parts.

40. **nígricans,** Gagnep. Habit loose, light and elegant, erect at first, spreading with age: growths bearing 2–3 lvs., 2–5 ft. high; blade elliptic, occasionally lanceolate, acute, undulate, 12–20 in. long, rich dark velvety green above, dull red below; petiole 1–4 ft. long, erect; sheath extending to one-third the length of the petiole, upper two-thirds terete, dull green in color: infl. arising from center of the growth of the lvs., an erect globose spike with large foliose; bracts: fls. 2–3 in the axil of each bract, 1 in. diam., primrose in color, petals shaded with purple; tube 1 in. long; bracts green, reflexed, upper ones forming an umbrella-like mass under which the fls. are developed in the axils of the lower bracts. Trop. Amer. R.H. 1904, p. 576.

41. **Sòphiæ,** Hort. Habit medium to strong: growths with 3–7 lvs. and 1–3 ft. high; blade elliptic, acute, undulate, 12–18 in. long, rich bright velvety green with a bright yellowish green channeled midrib above, light red below; petiole erect, rigid, covered with soft tomentum; sheath extending from one-third to one-half the length of the petiole, upper part terete.—Closely allied to *C. nigricans.*

42. **zebrìna,** Lindl. (*Maránta zebrìna,* Sims). Zebra Plant. Fig. 738. Habit compact, 1–3 ft. high: growths bearing from 6–20 spreading lvs.; blade elliptic, obtuse or acute, slightly undulate, ¾–2 ft. long, upper side rich velvety green, with alternating bars of pale yellowish green and dark olive-green, under side light purple-red in the adult stage, and pale grayish green in the young stage; petiole ½–2 ft. long, pale green; sheath large, canaliculate, and extending nearly the whole length of the petiole; scape short. Variable. Brazil. B.M. 1926. L.B.C. 5:494. R.H. 1865, p. 90. S.H. 1:164. Lowe, 1.—The commonest species, occurring in nearly all collections of warm greenhouse plants.

Var. **Binòtii,** Hort., is a stronger-growing variety with darker colored foliage, with lvs. as much as 4½ ft. long.—One of the finest and best stove foliage plants in cult., of easy culture and one that should be in all collections.

43. **pulchélla,** Kœrn. (*Maránta tigrìna,* Bull). Weaker grower than *C. zebrìna,* the lvs. lighter colored, with two series (large and small) of broad green bars. Brazil.—By some considered to be a form of *C. zebrina.*

44. **Warscewíczii,** Kœrn. Rather large: lvs. 2 ft. long, oblong-lanceolate, acuminate, purple beneath, dark, velvety green above, but the midrib broadly feathered with yellow-green. Costa Rica. F.S. 9:939–40. Gn. 17:560. Lowe, 17.—One of the best.

45. **Bachemiàna,** Morr. Lvs. unequilateral, cordate at the base, ovate-lanceolate or rarely oblong, attenuate-acuminate, smooth, silvery green above, finely striate, with parallel greenish or whitish markings along the primary nerves, purplish or greenish beneath. Brazil.

C. argyræa, Kœrn. Lvs. very short, unequal, oblong-lanceolate, short-acuminate, above deep green and ash-colored, beneath purple. Country unknown.—*C. arrécta,* Lind. & André. Tall: lvs. oblong, red beneath, green above, with the nerves all prominent. Ecuador. I.H. 18:77.—*C. bambusàcea,* Poepp. & Endl.=Ischnosiphon.—*C. Baraquínii,* Regel. Lvs. oval-lanceolate, green, with bands of white. Brazil.—*C. fascinàtor,* Hort. Dwarf: lvs broad-ovate-oblong, purplish beneath, green above and with blotches of lighter color and transverse narrow bars of red. Brazil. I.H. 41:104 (as Maranta Fascinator).—*C. gigas,* Gagnep. Eight ft.: lf.-blade lanceolate, 2 ft. long, 8–10 in. broad, violet-purple when young but becoming green; petioles 5 ft. long: spike cylindric, about 4 in. long, bearing 8 pairs of yellow-and-white fls. Trop. Amer.—*C. hieroglýphica,* Lind. & André. Dwarf: lvs. short-ovate, short-pointed, purplish beneath, green above and marked by many oblique bands or bars of silvery white. Colombia. I.H. 20:122–3.—*C. Kerchoveàna,* Hort.=Maranta bicolor var.—*C. Lageriàna,* Hort. Lvs. large, dark red beneath, the prominent veins rich bronze.—*C. májor,* Hort.=Ischnosiphon.—*C. Massangeàna,* Hort.=Maranta bicolor var Massangeana.—*C. mèdio-pícta,* Makoy (Maranta prasina, Bull). Lvs. oval-lanceolate and tapering to both ends, dark green, with the rib feathered with white from base to summit. Brazil.—*C. musàica,* Hort. (Maranta musiaca, Bull). A dwarf-growing species with obliquely cordate ovate lvs. 4–6 in. long, glabrous, acute, upper side pale shining green marked with numerous close set transverse veins of a lighter shade; petiole 3–6 in. long. Brazil.—*C. Oppenheimiàna,* Morr.= Ctenanthe.—*C. pardìna,* Planch. & Lind.=C. villosa.—*C. smaragdìna,* Lind. & André=Monotagma.—*C. splèndens* and *splèndida,* Hort.=Maranta splendida.—*C. villòsa,* Lindl. Large: lvs. 10:20 in. long, oblong-ovate, pale green, with dark brown angular blotches: fls. yellow. S. Amer. F.S. 11:1101–2 (as C. pardina); also, Lowe, 32.

L. H. B.
C. P. Raffill.

CALCEOLÀRIA (Latin *calceolus,* a slipper, alluding to the saccate flower; these plants are sometimes called lady-slippers, but the name is best used for Cypripedium). *Scrophulariàceæ.* Showy-flowered herbs and shrubs, grown both in the greenhouse and in the open.

Leaves mostly opposite, usually hairy and rugose, entire or incised or pinnatifid: corolla 2-parted nearly to the base, the lower part or lip deflexed and inflated slipper-like, the upper lip smaller and ascending, but usually saccate; stamens 2 or rarely 3, and no rudiments (A, Fig. 739): fr. a many-seeded caps.—About 200 species, mostly from the Andes of Peru and Chile, but extending north to Mex.; also 2 in New Zealand. Monogr. by Kränzlin, Engler's Pflanzenreich, hft. 28 (1907).

Many species of Calceolaria have been cultivated at one time or another, but the number now grown is few, most of the garden kinds apparently being hybrids or marked variations from specific types. The genus falls into two horticultural sections, the herbaceous kinds, and the shrubby kinds. The former are the only ones generally known in this country, being treated more or less as annuals. The herbaceous garden forms Rodigas considers to be offshoots chiefly of *C. arachnoidea* and *C. crenatiflora,* and he has called this race *C. arachnoideo-crenatiflora* (see I.H. 31:528, 536; 35:54). In this work, however, the more inclusive terms *C. herbeohybrida* of Voss is employed (Fig. 739); and also the corresponding *C. fruticoybrida* for the shrubby

derivatives. *C. crenatiflora* seems to have left its impress most distinctly on the greenhouse forms. The calceolarias are grown for the variously colored and often spotted slipper-like flowers. The shrubby forms, grown much in England, do not thrive in the heat of the American summer.

The cultivation of the herbaceous and the shrubby kinds of calceolarias is about the same, with the difference that the herbaceous kinds are nearly always grown from seeds, while the shrubby varieties are oftener grown from cuttings.—Seeds may be sown from the end of March until the first of September, according to the size of the plant required. Those sown early are more easily carried through the hot months than any that are propagated in the end of May or in the month of June. Sow the seeds in shallow pans with good drainage in a compost of equal parts of sand and of



739. Calceolaria herbeohybrida.

the peat which is shaken out of fern-root that is to be used for potting orchids, adding about one-fourth of charcoal. All this should be sifted through a fine sieve. This material should be well mixed and placed an inch in depth in the receptacle that the seeds are to be sown in. The surface should be made as level as possible, and the seeds, after being thinly scattered over the same, may be pressed gently into the compost, covering them very lightly with sphagnum moss sifted through a very fine sieve. Water by dipping the pan in a tank of water, allowing it to soak through the holes in the bottom of the pan. This mode of watering is not so liable to disturb the small seeds, as an overhead watering with a fine rose on the watering-pot. A temperature of 60° will cause calceolaria seeds to germinate, but the sun should not strike them until the cool of autumn comes. A greenhouse with a northern aspect is best for them until the end of September, giving all the air possible day and night. From the first of October until the end of March, the plants will stand the full sun, and should then be grown in a night temperature of 40°, allowing 10° or 15° of rise during the day. For a first potting (which may be to 2-inch pots) the same mixture in which the seeds were sown is the best, and the seedlings should be big enough to be easily held between the finger and thumb; and as the plants are moved along into larger pots, equal parts of fibrous loam, fern-root, leaf-mold, sand and dried cow-manure may be used, always having this compost in as lumpy a state as can be equally and conveniently packed around the plant. When the plants are well rooted in their flowering pots, they may be watered with manure water. An ordinary handful of green cow-manure to about three gallons of water may be used, and if any of the commonly used fertilizers are to be employed for a change, the same amount of fertilizer to an equal amount of water is about right; but always water with clean water twice between these applications.—If cuttings are to be used for the propagation of calceolarias, they should be rooted in a temperature of 45° to 50°, kept shaded from the sun. Cuttings may be procured from the plants that are trimmed into shape during their growing period (in August or September) and should have two leaves attached and another joint to go in the sand. When rooted, treat them as described above for the seedlings. The varieties of the rugosa section are largely used for bedding plants in Europe.—Calceolarias are very subject to attacks of green- and white-fly; the best means of keeping these pests in check is by fumigation with hydrocyanic gas. In the evening is the best time to fumigate, and the foliage of the plants should be perfectly dry; in fact, it is better if possible to use no water at all in the greenhouse the day they are to be treated. In the hot months of summer, a cool evening should be selected and one-quarter of an ounce of cyanide of potassium, one ounce of sulfuric acid and two ounces of water to every 1,000 cubic feet contained in the greenhouse may be used. (See *Fumigation*.) The house at this season of the year should be opened up in forty-five minutes after the cyanide has been dropped into the liquid. Repeat at intervals of about three weeks. In winter the quantity may be doubled to the same cubic feet of space, and the house may be kept closed until morning. When opening the ventilators after fumigating in this manner, do not breathe in the greenhouse until the air has changed, say about half an hour after, as the gas is deadly to human beings. Fumigating with tobacco will kill the green-fly, but it has no effect on the white-fly. (Geo. F. Stewart.)

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A. *Herbaceous calceolarias, some of them parents of the florists' varieties of this country.*

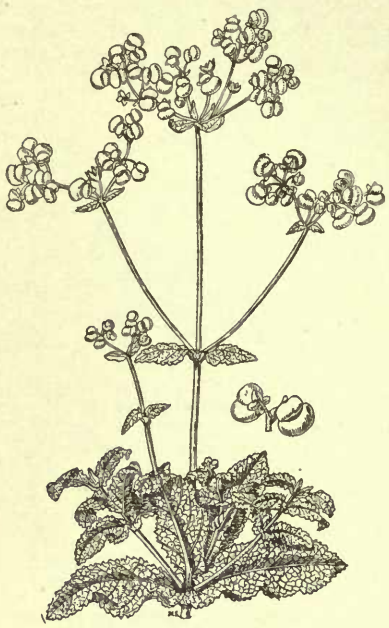
B. *Lvs. simple.*

C. *Fls. essentially yellow.*

1. crenatiflòra, Cav. (*C. péndula*, Sweet. *C. mirábilis*, Knowl. & Wesc.). One to 2 ft., the st. soft-hairy, terete: radical lvs ovate and long-petioled (the petioles winged at top), undulate and dentate, sometimes obscurely lobed, rugose and pubescent, paler beneath, often purplish toward the tip; st.-lvs. shorter-petioled and becoming sessile above: fls. in a forking corymb, the slipper large, oblong or oblong-obovate, furrowed or crenate, hanging, yellow, with orange-brown dots. Chile. B.M. 3255.—From this species we appear to have derived the spots of calceolaria fls.

2. **corymbòsa,** Ruiz & Pav. (*C. Whèleri,* Sweet). One to 3 ft. high, the st. 4-angled: radical lvs. ovate and sometimes cordate, obtuse or nearly so, doubly crenate, rugose and hairy, whitish beneath; st.-lvs. smaller and narrower, somewhat clasping, opposite: fls. small (about half as large as in *C. crenatiflora*), in a broad, somewhat loose corymb, the slipper somewhat short-oblong, clear yellow outside and marked with red lines inside. Chile. B.M. 2418.

3. **biflòra,** Lam. (*C. plantagínea,* Smith. *C. suberécta,* Hort. *C. Mórrisonii,* Don). Herbaceous, stemless: lvs. ovate-spatulate, toothed at top: scapes many, few-fld.; fls. large, yellow, lower lip large and the upper one small and notched, the under side of the slipper dotted with red. Chile, Argentina. B.M. 2805. L. B. C. 15:1402. F.S.R. 2:312.



740. Calceolaria integrifolia var. viscosissima. (×⅓)

4. **Pavònii,** Benth. An erect, strong-growing, herbaceous, or half shrubby species: st. terete, green, stout: lvs. perfoliate, on short winged petioles, ovate or elliptic, coarsely serrate, 5–9 in. long (in a vigorous plant), and a rich light green in color: sts. and lvs. densely hairy; infl. paniculate, terminal, large and handsome; fls. rich golden-yellow and marked in throat with brown, and about 1 in. diam. Peru. B.M. 4525. G. 27:663. J.H. III. 50:489. J.F. 1, pl. 32.—One of the parents of several handsome hybrids.

5. **Búrbidgei,** Hort. (*C. hýbrida* var. *Búrbidgei,* Gumbl.). A garden hybrid raised at Trinity College, Dublin, by Burbidge between *C. Pavonii* on the one side and *C. deflexa* (*C. fuchsiæfolia*) or possibly *C. amplexicaulis* on the other: plant erect: sts. hairy, terete: lvs. light green, lanceolate, 5–9 in. long, serrate, winged along the petiole: infl. large, in terminal free-branching panicles; fls. 1 in. diam., rich golden yellow. G. 25:547. Gn. 47:306.—One of the finest of cool greenhouse kinds and valuable also as a bedding plant as it grows into a fine large specimen as much as 6 ft. high and branches freely from the base. Readily prop. by cuttings.

cc. *Fls. purple.*

6. **purpùrea,** Graham (*C. Herbertiàna,* Lindl.). Sts. erect, pubescent, 1–2 ft.: radical lvs. spatulate and acutish, with a strong midrib, sparsely hairy, rugose, dentate; st.-lvs. broad-cordate and clasping, less toothed: fls. in loose corymbs, small, purplish or reddish violet, the slipper somewhat furrowed. Chile. B.M. 2775. B.R. 1313.—Supposed to have entered largely into purple-fld. varieties.

7. **arachnoídea,** Graham. St. a foot or two high, terete, branchy, woolly, with appressed hairs: lvs. oblong or lingulate, narrowing into long-winged petioles, clasping, obscurely toothed, rugose, woolly on both sides: peduncles in pairs, forking: fls. small, dull purple, the slipper nearly globular and furrowed. Chile. B.M. 2874. L.B.C. 16:1557.

bb. *Lvs. compound, or essentially so.*

8. **scabiosæfòlia,** Sims (*C. pinnàta,* Ruiz & Pav. *C. heterophýlla,* Willd.). Often 2 ft., the st. terete, hairy, and leafy: lvs. opposite, with clasping petioles, cut nearly or completely to the midrib; lfts. varying from lanceolate to broad-oval, acuminate, ciliate, dentate: fls. very small, in small hairy corymbs, pale yellow, the slipper nearly orbicular in outline. Chile, Peru, Ecuador. B.M. 2405.—This is sold by seedsmen as an annual bedding plant.

9. **pinnàta,** Linn. Often reaches 3 ft. or more: lvs. pinnatifid or completely compound, the divisions short and nearly entire, obtuse or nearly so: fls. small, sulfur-yellow. Chile, Peru, Bolivia. B.M. 41.—The first known garden species, still sold as an annual.

10. **herbeohýbrida,** Voss (*C. hýbrida, C. herbàcea, C. Yoùngii,* Hort., and others). Derivatives of the herbaceous calceolarias: mostly dwarf or small (2 ft. or less), in many colors, usually with well-inflated slippers.

aa. *Shrubby calceolarias.*

b. *Fls. yellow.*

11. **integrifòlia,** Murr. (*C. rugòsa,* Ruiz & Pav. *C. salviæfòlia,* Pers.). Two to 6 ft. high, branchy and bushy: lvs. glabrous, oval-lanceolate, crisped and dentate, the short petioles winged: fls. in terminal clusters, small, yellow. Chile. L.B.C. 10:942. B.R. 744, 1083.—Variable. Probably the chief source of shrubby calceolarias. Var. **viscosíssima,** Hort. (Fig. 740), is a sticky-hairy form with sessile lvs. and showy fls.

12. **thyrsiflòra,** Graham. More shrubby: lvs. linear and clustered, toothed, sessile, not hairy: fls. small, yellow, in a close, terminal cluster. Chile. B.M. 2915.

13. **amplexicaùlis,** HBK. A foot or two high: lvs. cordate-ovate to ovate-lanceolate, long-acuminate, pubescent, woolly beneath and deep-rugose above, clasping: fls. small, in an upright corymb, pale yellow and spotless, the slipper hoof-shaped. Ecuador, Peru.

bb. *Fls. white.*

14. **álba,** Ruiz & Pav. Shrubby, erect, branched, the branches opposite: lvs. linear, toothed above, with fascicles of fls. in axils: fls. small, white, of 2 very unequal lips, the upper one being very small, the throat closed. Chile. B.M. 4157. G.C. III. 22:141. Gn. 51:60; 75, p. 6. J.H. III. 61:419.—A most beautiful species in England when planted out in a soil rich in humus, but should be shaded from hot sun. The plant dislikes pot culture. This species has recently been used by the hybridist in order to secure a race with white fls. The new hybrid *C. Veitchii* is likely to prove a great aquisition to gardens, and is partly derived from this species.

15. **fruticohýbrida,** Voss (*C. ascéndens,* Hort., not Lindl. *C. dentàta,* and *C. integrifòlia,* Hort., for the most part). Here may be grouped the shrubby garden calceolarias that are derivatives of most other species. They are marked by the prevailing under-color of yellow, orange or orange-red; sometimes they are yellowish white or dull red.

C. andìna, Benth. (C. Herbertiana var. pallidiflora, Lindl.). Shrubby, glandular-pubescent: lvs. orbicular-ovate, thick, rugose, hairy: fls. small, yellow, the slipper crenate. Chile. B.M. 7326. B.R. 1576.—*C. bícolor,* Ruiz & Pav. Shrubby: lvs. ovate, dentate: fls. small, the slipper sulfur-yellow above and white below. Peru. B.M. 3036. L.B.C. 18:1783.—*C. càna,* Cav. Herbaceous, tufted, scapose, 1–1½ ft.: lvs. radical, oblong-lanceolate, spatulate or obovate: fls. white with small purple or rose-colored lines and blotches. Chile. B.M. 8416.—*C. Clibrànii.* Hort.=C. profusa. F.E. 28:143.—*C. deflèxa,* Ruiz & Pav. (C. fuchsiæfolia, Hemsl.). Shrubby: lvs. lanceolate: fls. yellow, panicled, the upper lip very large. Peru. B.M. 6431. G.C. II. 15:269. Gn. 15:258.—*C. flexuòsa,* Ruiz & Pav Shrubby at base: lvs. large-ovate, coarsely crenate-dentate: fls. rather large, clear yellow, with very large

green calices. Peru. B.M. 5154. F.S. 22:2331.—*C. Forgétii*, Skan. Undershrub, 1–1½ ft., slender: lvs. ovate, obtuse or somewhat acute, serrate: fls. small, pale yellow with a large reddish brown blotch inside the lower lip. Peru. B.M. 8436.—*C. fuchsiæfòlia*, Hemsl.=C. deflexa.—*C. Hénrici*, Hook. f. Shrubby, evergreen: lvs. willow-like, small-toothed: fls. panicled, clear yellow, the upper lip large. Peru. B.M. 5772.—*C. hyssopifòlia*, HBK. Shrubby: lvs. crowded, small, lanceolate and toothed, or at top of st. linear and entire, margins revolute: fls. rather large, in many-fld. corymbs, pale sulfur-yellow, the slipper obovate-orbicular and crenate. Ecuador.—*C. Jéffreyi*, Hort., is a hybrid group between herbaceous greenhouse kinds and C. integrifolia, produced about 10 years ago in England: 2–6 ft., with branching panicles bearing fls. about 1 in. across of few colors.—*C. kewénsis*, Hort. Cross of C. Jeffreyi with herbaceous varieties: more compact and larger-fld. than C. Jeffreyi; colors of wide range: plant 1–2½ ft. high and about as broad when in good bloom. G.C. III. 39:390.—*C. lobàta*, Cav. Herbaceous: lvs. triangular-ovate, palmately 5–7-lobed, dentate: fls. in terminal clusters, clear, pale yellow, and spotted on the up-curved slipper. Peru, Bolivia. B.M. 4525, 6330.—*C. mexicàna*, Benth., is a small-fld., pale yellow species hardy in England: annual: lower lvs. 3-parted or -lobed, the upper ones pinnatisect. Mts., Mex., Costa Rica.—*C. petiolàris*, Cav. (C. floribunda, Lindl.). Herbaceous: lvs. ovate, the lower ones wing-petioled, toothed, rugose: fls. yellow in loose panicles, the lips connivent. Chile.—*C. pisacomènsis*, Meyen. Shrubby: lvs. ovate-cordate, nearly or quite obtuse nearly sessile, irregularly crenate, margins reflexed: fls. large, orange varying to red, the slipper up-curved. Peru. B.M. 5677.—*C. polyrrhìza*, Cav. A dwarf and tufted species from Patagonia, with dark yellow purple-spotted fls.: herbaceous, cespitose: lvs. crowded, lanceolate. S. Chile, Patagonia. For rockwork.—*C. profùsa*, Hort. (C. Clibranii, Hort.). On the order of C. Burbidgei. A garden form of free-flowering habit.—*C. Sinclairii*, Hook. Herbaceous, half-hardy: lvs. oblong-ovate, stalked, crenate-dentate, hairy: fls. small, lilac or flesh-colored, spotted within, the 2 lips nearly equal, not saccate. New Zeal. B.M. 6597. Now referred to Jovellana (J. Sineclairii, Kränzl.)—*C. tenélla*, Poepp. & Endl. Herbaceous, half-hardy, 6 in. high: lvs. ovate or orbicular, small (⅓in. long), nearly or quite sessile: fls. yellow, spotted within. Chile. B.M. 6231.—*C. Veitchii*, Hort. Hybrid of C. alba and a garden variety: 3–5 ft., erect and branched: fls. many, rather small, pale lemon-yellow. G.C. III. 51, Suppl. June 1. Gn. 76, p. 271. (See No. 14.)—*C. violàcea*, Cav. (Jovellana violacea, Don). Shrubby: lvs. small, ovate-cordate, deep-toothed, stalked: fls. yellow-salmon, spotted within and without, the two lips not saccate. Chile. B.M. 4929.—*C. virgàta*, Ruiz & Pav. Bushy, 1–1½ ft.: lvs. ovate, short-stalked: fls. rather small, numerous, white. Peru, Bolivia. G.C. III. 51:50.

L. H. B.

CALÉNDULA (Latin, *calendæ* or *calends:* throughout the months). *Compósitæ*. Flower-garden plants.

Small herbs, the common cult. species annual, others perennial, with alternate simple lvs., mostly large heads with yellow or orange rays, glabrous incurved achenes, plane naked receptacle, pappus none, and involucre broad, with scales in one or two series, their margin usually scarious.—Some 15 species from Canary Isls. to Persia.

officinàlis, Linn. POT MARIGOLD. Fig. 741. Annual: 1–2 ft. high, more or less hairy: lvs. oblong and more or less clasping, entire, thickish: heads solitary, on stout stalks, large with flat spreading rays, showy, closing at night. S. Eu. B.M. 3204. V. 5:44; 16:165.—One of the most universal garden fls., running into many vars., distinguished by size, color, and degree of doubling. The color varies from white-yellow to deep orange. This is the marygold of Shakespeare's time. The fl.-heads are sometimes used in cookery, to flavor soups and stews. The calendula is of the easiest culture in any warm, loose soil. The seeds are usually sown where the plants are to stand, but they may be sown indoors or in a frame and the plants transplanted. The achenes are large and germinate quickly. The plant blooms the whole season, particularly if the fls. are picked. It is a hardy annual, and in the southern states will bloom most of the year. In the N. it blooms up to the first frosts, sometimes beyond. Sown in summer or autumn, it makes a good winter bloomer. Florets are used in medicine as a vulnerary and anti-emetic. The flowering plant was formerly used for removing warts.



741. Calendula officinalis, double-flowered. (×⅔)

suffruticòsa, Vahl (*C. Noëàna*, Boiss.). More diffuse, annual: lvs. sessile, lanceolate, somewhat dentate: heads bright yellow, not doubled, very numerous, on long peduncles. W. Medit. region.—Seeds are sold by American dealers.

C. Póngei, Hort., and *C. pluviàlis*, Linn., will be found under Dimorphotheca.

L. H. B.

CALICO BUSH: *Kalmia.*

CALIFORNIA POPPY: *Eschscholtzia.*

CALIFORNIA YELLOW BELLS: *Emmenanthe penduliflora.*

CALÍMERIS (Greek, *beautiful arrangement*). *Compósitæ*. Good daisy-like border plants.

Calimeris comprises about 10 Asian herbs, now mostly united with Aster, but horticulturally distinct, and differing from that genus in the hemispherical involucre of few nearly equal scarious-margined bracts, and broad convex receptacle: achene flat and hairy. Hardy perennials of low growth, suited to the border in front of stronger plants. *C. tatarica* is described in the genus Heteropappus.

incìsa, DC. (*C. incisæfòlia*, Hort.? *Aster incìsus*, Fisch.). One to 2 ft., erect, corymbose at the summit: lvs. lanceolate, remotely incise-dentate; scales of involucre red-margined: fls. large, purple-rayed or almost white, and yellow-centered.—Of easy cult. in any good soil, making a display throughout July and Aug. The commonest species in cult.

altàica, Nees (*Aster altàicus*, Willd.). Lower, pubescent or hispid: lvs. linear-lanceolate and entire: scales of involucre pubescent and white-margined; rays narrow, blue.

L. H. B.

CALIPHRÙRIA: *Calliphruria.*

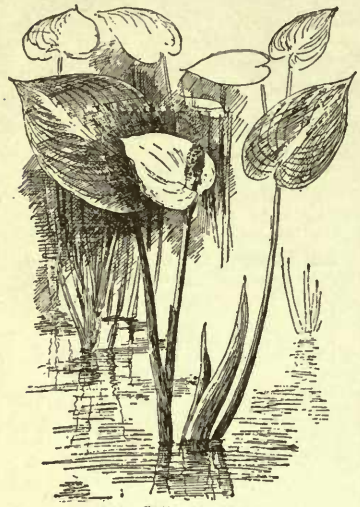
CÁLLA (ancient name, of obscure meaning). *Aràceæ*. A monotypic genus, containing a native bog-plant with a white spathe.

Herb, with creeping rhizomes and 2-ranked lvs. Differs from Orontium in the parallel secondary and tertiary veins of the lf.-blade, as well as in having a prominent more or less fleshy persistent spathe enveloping the spadix, and in the absence of perianth; lower fls. perfect, upper staminate; fr. a red berry. See *Zantedeschia* for *C. æthiopica*, *C. albo-maculata*, and others. The calla of florists, or calla lily, is Richardia of recent books, but is properly Zantedeschia, where it is described and the culture given in this work.

palústris, Linn. WATER ARUM. Fig. 742. Rhizome bearing many distichous lvs. one year, the next only 2 lvs. and the peduncle: petioles cylindrical, long-sheathed; blade cordate: spathe elliptical, or ovate-lanceolate, white. Eu., N.

Asia, and E. N. Amer. V. 2:197; 14:244. B.M. 1831. —An interesting little perennial plant, useful for outdoor ponds. JARED G. SMITH.

CALLIÁNDRA (Greek, *beautiful stamens*). *Leguminòsæ*. Evergreen shrubs and trees of greenhouse culture, planted in the open far south.



742. Calla palustris.

Leaves bipinnate; lfts. numerous: fls. usually in globose heads or clusters; corolla small, obscured by the numerous, long, silky, purple or white stamens.—About 120 species, widely distributed in tropics. Distinguished from Acacia by the presence of a thickened margin on the pod.

Propagation is by cuttings placed in sand over bottom heat. Keep in warmhouse, with the exception of those from Mexico.

Lambertiàna, Benth. (*Acàcia Lambertiàna*, D. Don.) Unarmed; branches terete: lvs. puberulous-villous; pinnæ 2–3-yoked; lfts. 9–12-yoked, oval-oblong, obtuse at both ends; peduncles 3–5, racemose, heads roundish; stamens 20–25, pink. Mex. B.R. 721.

tetragòna, Benth (*Acàcia tetragòna*, Willd.). Unarmed; branches tetragonal: pinnæ 5–6-yoked: lfts. 16–29-yoked, linear, acute, the outer larger: heads pedunculate, axillary; fls. white. Trop. Amer.

portoricénsis, Benth. (*Acàcia portoricénsis*, Willd.). Unarmed shrub or small tree: pinnæ 2–4-yoked; lfts. 15–25-yoked, linear, obtuse, closing at evening; branchlets pubescent: heads globose, pedunculate, axillary, the white fls. opening as lvs. close; calyx ciliate on the margin; stamens 20–25; filaments long, white: pod straight, linear, tapering at base. W. Indies.—Endures temperatures as low as 24° F. in Calif. Var. **màjor,** a splendid form, is known abroad. B.M. 8129.

Tweèdyi, Benth. Unarmed shrub, lightly pubescent: pinnæ 3–4-yoked; lfts. 20–30-yoked, linear, obtuse, shining: peduncles axillary, 1–2 in. long, from large scaly buds; calyx and corolla silky, lobes erect; stamens long, numerous, purple. Brazil. B.M. 4188.

C. californica, Benth. A stiff, hairy, much-branched shrub cult. in Calif. It is native near Magdalena Bay and is the most northerly known representative of the genus.—*C. caracasàna*, Benth. (Mimosa caracasana, Jacq.) differs from C. portoricensis in having purple stamens, but is probably not distinct.—*C. grandiflòra*, Benth. Not over 10 ft.: foliage glaucous: fls. scarlet. Intro. by Franceschi.=Mimosa grandiflora, L'Her.(?).—*C. Samán*, Griseb., =Pithecolobium Saman. HARVEY MONROE HALL.†

CALLIÁNTHEMUM (Greek, *beautiful flower*). *Ranunculàceæ*. Two or 3 little herbs of the mountains of Eu. and Cent. Asia, allied to Anemone, sometimes mentioned for outdoor planting. Lvs. radical (very small or none on the st.), decompound: fls. terminal, white or rose-color; sepals 5, deciduous; petals 5–15, showy, with nectaries at the base. The species apparently intergrade. **C. anemonoìdes,** Endl. Three to 10 in. high, blooming in spring: lvs. as broad as long, triangular in outline, bipinnatifid: fls. 1½ in. or less across; sepals broad; petals narrow: rhizome somewhat fleshy. Tyrol. Useful in rockwork.

CALLICÁRPA (Greek, *beauty* and *fruit*). *Verbenàceæ*. Ornamental woody plants cultivated chiefly for their brightly colored berry-like fruit appearing late in autumn; also for the attractive flowers which appear in summer.

Flowers perfect; calyx short-campanulate, truncate or slightly 4-toothed, rarely 4-parted; corolla with short tube, 4-lobed; stamens 4, of equal length; ovary 4-celled, cells 1-ovuled: fr. a subglobose berry-like drupe with 2–4 stones.—More than 30 species in tropical and subtropical regions of Asia, Austral., N. and Cent. Amer.

Callicarpas are shrubs or trees, often with stellate hairs, with opposite, usually serrate, deciduous leaves and small pink, bluish or whitish flowers in axillary clusters, followed in autumn by small berry-like lilac, violet or red, rarely white fruits. The hardiest are *C. dichotoma*, *C. japonica* and *C. Giraldii*, which may be grown even North in sheltered positions, if somewhat protected during the winter. If killed to the ground, young shoots spring up vigorously, and will produce flowers and fruit in the same season. If grown in the greenhouse, they require a sandy compost of loam and peat, and plenty of light and air. Propagation is readily effected by greenwood cuttings in spring or summer under glass; also by hardwood cuttings, layers and seeds.

A. *Lvs. tomentose beneath.*

americàna, Linn. Shrub, 3–6 ft., with scurfy, downy tomentum: lvs. cuneate, elliptic-ovate, acuminate, obtusely serrate, 3–6 in. long: cymes short-stalked; corolla bluish, glabrous: fr. violet. July, Aug. Woods and rich soil, Va. to Texas and W. Indies.—One of the handsomest in fr., but more tender than the Japanese species. Var. **álba,** Hort., has white fr.; very conspicuous in fall and early winter.

AA. *Lvs. not or slightly pubescent below and glandular: corolla glandular outside.*

B. *Peduncles longer than petioles: lvs. glabrous or nearly so below.*

japónica, Thunb. (*C. Mimurazàki*, Sieb.). Fig. 743. Shrub, 2–5 ft.: lvs. cuneate, elliptic or ovate-lanceolate, long-acuminate, serrulate, 2½–5 in. long: cymes peduncled, many-fld.; fls. pink or whitish: fr. violet. Aug. Japan. S.I.F. 1:70. G.C. 1871:173. P. F.G. 2, p. 165. H.F. 1861:12. Var. **leucocárpa,** Sieb. With white fr.

dichótoma, Koch (*C. grácilis*, Sieb. & Zucc. *C. purpùrea*, Juss.). Shrub, 1–4 ft.: lvs. cuneate, elliptic or obovate, crenately serrate above the middle, entire toward the base, 1½–3 in. long:



743. Callicarpa japonica. (×⅓)

cymes peduncled, few- or many-fld.; fls. pink: fr. lilac-violet. Aug. Japan, China. Gn. 23:540.—Closely allied to the former, but smaller in every part.

BB. *Peduncles shorter than petioles.*

Giráldii, Hesse. Shrub: lvs. broadly elliptic or elliptic-ovate to elliptic-lanceolate, 2–4 in. long, dentate, glandular beneath, and sparingly stellate-pubescent; petioles slender, ⅓–½in. long: fls. pink in dense cymes on pubescent stalks shorter than the petioles: fr. violet. W. China.

C. cána, Linn. Shrub: lvs. broadly elliptic, shining above and whitish-tomentose beneath: fr. deep purple. E. India, China, Philippine Isls. B.M. 2107.—*C. longifólia,* Lam. Shrub: lvs. oblong-lanceolate or lanceolate, narrowed at both ends, 3–5 in. long, stellate pubescent and glandular beneath: cymes short-peduncled; fls. pink or purple: fr. white. Himalayas, China. B. R. 10:864. H.E.. 2:133.—*C. móllis,* Sieb. & Zucc. Shrub, to 4 ft.: lvs. oblong-lanceolate, rounded at the base, tomentose beneath: fls. and fr. pink. Japan. S.I.F. 1:70.—*C. pedunculàta,* R.Br. (C. lanata, Schau., not Linn.) Shrub: lvs. oblong-ovate, nearly sessile, and rounded at the base, green and slightly tomentose beneath: cymes slender-peduncled. E. Indies. Austral. Sieb. Flor. d. Jard. 4:97.—*C. rubélla,* Lindl. (C. dichotoma, Hort., not Juss.). Shrub or small tree, to 20 ft.: lvs. cordate-oblong, tomentose beneath: fr. purple. Himalayas, China. B.R. 11:883. F.S. 13:1359. I.H. 6:202. G.C. 1859:96. R.H. 1859, p. 106, 107.

ALFRED REHDER.

CALLICHRÒA: *Layia.*

CALLIÓPSIS: *Coreopsis.*

CALLIPHRÙRIA (Greek, *beautiful prison;* referring to the spathe inclosing the flowers). Written also *Caliphuria. Amaryllidàceæ.* Tender bulbs.

Distinguished from Eucharis by the stamens, the filaments being petaloid, with 3 large linear teeth on top, the middle one bearing the anther. The fls. appear with the lvs.; perianth funnel-shaped, spreading upward; stamens inserted at the throat of the tube: caps. tardily splitting.—Three species from Colombia.

Calliphrurias are warmhouse plants and should be grown in a rich soil of loam, peat or leaf-mold and sand. Propagated by offsets.

Hartwegiàna, Herb. Bulb ovoid, 1 in. thick, stoloniferous, with brown membranous tunics: lvs. bright green, firmer and more closely veined than in Eucharis, with an oblong-acute blade 4–5 in. long, 2 in. broad, narrowed into a petiole, which is flat above and round beneath: scape slender, 1 ft. long; fls. 6–8, in an umbel, white; perianth 1 in. long and wide. Andes of Bogota.—B.M. 6259. B.R. 30, p. 87, desc. Intro. in 1889 by Reasoner.

C. subedentàta, Baker=Eucharis subedentata.

N. TAYLOR.†

CALLIPRÒRA: *Brodiæa.*

CALLIPSŸCHE (Greek, *beautiful* and *butterfly*). *Amaryllidàceæ.* Three bulbous plants from Ecuador and Peru, the lvs. produced after the yellow or greenish yellow fls., probably not in the horticultural trade. Leaves thin, oblong and stalked: fls. many in an umbel on a hollow peduncle or scape; perianth funnelform with short tube, the segms. all equal and oblanceolate to oblong; stamens 6, much exserted, attached at the throat: fr. a deeply 3-lobed caps., with many seeds. They require the general treatment given amaryllis. **C. mirábilis,** Baker, has an oblong bulb 2 in. diam.: lvs. 1 or 2, blade 5 or 6 in. broad: peduncle 2–3 ft.; fls. greenish yellow, about 30 in a dense umbel; stamens three times as long as perianth and widely spreading. July, Aug. **C. aurantîaca,** Baker, has an ovoid bulb 1 in. diam.: lvs. few: peduncle 1½–2 ft.; fls. bright yellow, 6–8 in the umbel; stamens green, twice the length of perianth. Autumn and winter. B.M. 6841.

L. H. B.

CALLÍPTERIS (Greek, *beautiful fern*). *Polypodiàceæ.* Ferns allied to Asplenium and Diplazium, with elongate sori formed on both sides of the veins, and the veins uniting to form meshes or areoles.—Some 15 species are known from the warmer parts of both hemispheres. The following is the only one in cult. Culture the same as for tropical aspleniums.

prolífera, Bory (*Asplènium decussàtum,* Swartz). Lvs. 3–6 ft. long, the stalks 1–2 ft. long, the pinnæ numerous, 6–12 in. long, 1–2 in. wide, with deeply crenate margins and frequently with bulblets in the axils; veins pinnate, with the branches of contiguous veins uniting. Polynesia and Malaya.

L. M. UNDERWOOD.

CALLÍRHOË (Greek mythological name). Written also *Callirrhoë. Malvàceæ.* Hardy showy herbs, for outdoor planting.

Perennials or annuals: lvs. alternate, with lobed or cleft blades or more finely dissected: fls. showy, axillary or sometimes in terminal racemes, the petals irregularly cut at the apex or truncate, differing in this from the notched petals of Malva; involucel of 1–3 bracts, or wanting.—Nine species, native.

The callirhoës are of the easiest culture, and deserving of a much greater popularity. They are chiefly propagated by seeds, but the perennial species may also be propagated by cuttings.



744. Callirhoe pedata.

A. *Annual: involucel absent.*

pedàta, Gray. Fig. 744. Height 1–3 ft.: st. erect, leafy: radical and lower lvs. round-cordate, palmately or pedately 5–7-lobed or -parted, the lobes coarsely toothed or incised, upper 3–5-cleft or -parted, usually into narrow divisions: fls. red-purple, cherry-red, varying to lilac. On plains and in sand, S. U. S., spring and summer. R.H. 1857, p. 430.

AA. *Perennial: involucel present.*

involucràta, Gray. Height 9–12 in., plant hirsute or even hispid: root large, napiform: sts. procumbent: lvs. of rounded outline, palmately or pedately 5–7-parted or -cleft, the divisions mostly wedge-shaped, incised, the lobes oblong to lanceolate: fls. crimson-purple, cherry-red or paler. All summer. Minn. to Texas. R.H. 1862:171 (as *C. verticillata*).

Var. **linearíloba,** Gray (*C. linearíloba,* Gray). Less hirsute than the type: sts. ascending: lvs. smaller, 1–2 in. across, the upper or all dissected into linear lobes: fls. lilac or pinkish. Texas and adjacent Mex.—An excellent trailer, especially for rockeries. Thrives even in very dry soils, the root penetrating to a great depth. A sunny position is preferable.

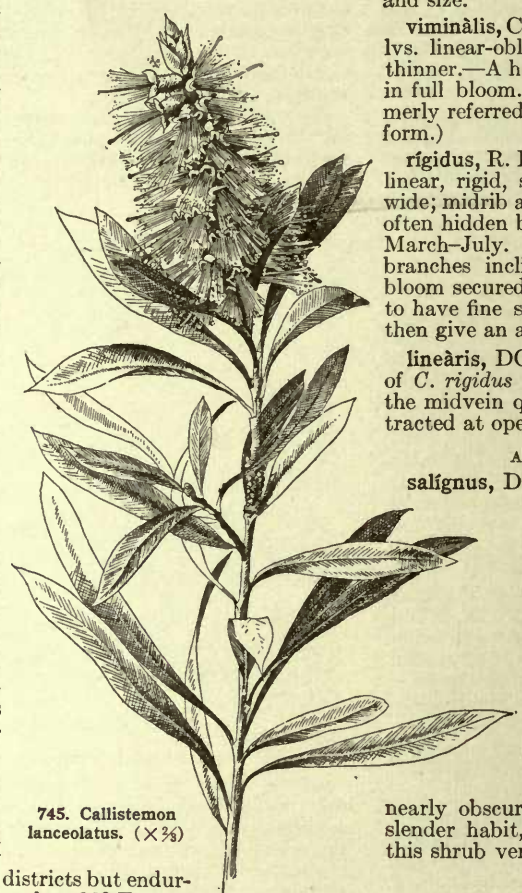
C. Papàver, Gray. A perennial decumbent or ascending plant with 3–5-lobed or -parted lvs. and involucrate purple-red fls. S.U.S. —Useful for very dry sandy places.

N. TAYLOR.†

CALLÍSTA: *Dendrobium.*

CALLISTÈMON (Greek, *kallos*, beauty; *stemon*, a stamen; in most of the species the stamens are of a beautiful scarlet or crimson color). *Myrtàceæ.* BOTTLE-BRUSH. Ornamental shrubs, thriving without irrigation in California, where they are hardy and much used; also planted to some extent elsewhere in warm climates and occasionally seen under glass. Page 3566.

Leaves alternate, entire, lanceolate or linear, mostly with oil- or resin-dots and fragrant when crushed: fls. in dense cylindric spikes, at first terminal but the axis growing out as a leafy shoot; calyx-teeth 5; petals 5, deciduous; stamens indefinite in number, not united; anthers versatile, the cells parallel and bursting longitudinally; ovary inferior, maturing into a caps. which persists for several years.—About 25 species, natives of Austral., where they inhabit arid districts. Distinguished from Melaleuca only by the stamens, which in that genus are united into bundles. Hall, Univ. Calif. Pub. Bot. 4:22.



745. Callistemon lanceolatus. (×⅔)

The showy flower-clusters, resembling bottle-brushes in shape, and so giving the common name to the genus, are highly colored and render these shrubs very ornamental. The quantity of bloom may be much increased by judicious autumn pruning. The various species are recommended for parks, depot-grounds, school-yards, and also for smaller yards if kept well pruned. Hardy only in warm-temperate districts but enduring temperatures less than 20° F.

Propagation from seeds is satisfactory: these are gathered during the summer months by allowing the capsules to open in boxes or on sheets of paper kept in a warm place; sow in early spring in finely sifted mixture of sand, leaf-mold, and loam, and cover very lightly; the ordinary cool greenhouse is warm enough. Some nurserymen state that plants from cuttings of ripened wood or of wood which is getting firm at the base will blossom earlier than seedlings; others find no advantage in this method. Although adapted to nearly every variety of soil, these plants make but slow growth in heavy clay.

A. *Stamens ¾–1 in. long.*

lanceolàtus, DC. (*Metrosidèros semperflòrens,* Lodd.). Fig. 745. Height 6–12 ft.: lvs. lanceolate, 1¼–2½ in. long, about ¼in. wide, acute, reddish when young; midrib and lateral veins prominent: spikes 2–4 in. long, bright red, less dense than in the following species: fr. ovoid, contracted at summit. Jan.–June. B.M. 260 (as *M. citrina*). Maiden, Fl. Pl. and Ferns of New S. Wales, 8.—Attains 30 ft. in Austral. where the hard and heavy wood is used for wheelwrights' work and for mallets. Garden hybrids between this and other species have been developed, especially in Eu.

speciòsus, DC. Large shrub: lvs. narrowly lanceolate, obtuse or acute, 1½–4 in. long, about ¼in. broad; midrib prominent but lateral veins obscure: spikes 2–6 in. long, bright red, very dense: fr. nearly globose, the summit scarcely contracted. March–June. B.M. 1761.—The most highly colored callistemon, the golden anthers contrasting well with the dark red filaments. There are many garden forms varying in color, habit, and size.

viminàlis, Cheel. Tall slender tree of pendulous habit: lvs. linear-oblong: stamens slightly shorter: rim of fr. thinner.—A handsome, graceful tree, very showy when in full bloom. Grown at Santa Barbara, Calif. (Formerly referred to *C. speciòsus*, of which this may be a form.)

rígidus, R. Br. (*C. linearifòlius,* DC.). Lvs. narrowly linear, rigid, sharp-pointed, 2–5 in. long, about ⅛in. wide; midrib and marginal ribs prominent; cross-nerves often hidden by oil-dots: spikes deep red, large, dense. March–July. B.R. 393.—Stiffly branched shrub, the branches inclined to become rangy; best form and bloom secured by means of autumn pruning. In order to have fine specimen plants, cult. well and now and then give an application of commercial fertilizer.

lineàris, DC. Scarcely more than an extreme form of *C. rigidus* with very narrow lvs. channeled above, the midvein quite obscure: fr. more globular and contracted at opening.

AA. *Stamens ½in. or less long.*

salígnus, DC. Tall shrub or small tree: lvs. lanceolate, acute, 1½–3 in. long, ¼–¾in. wide (much narrower in one variety), very distinctly penniveined: spikes yellow or light pink, 1–2 in. long: fr. nearly globular, with rather large opening. Apr., May. B.M. 1821. Var. **viridiflòrus,** F. v. M. Lvs. only 1–2 in. long, thicker, rigid; veins obscure: fls. greenish yellow. B.M. 2602.

brachyándrus, Lindl. Slender shrub, young shoots soft-hairy or whole plant gray with a soft pubescence: lvs. rigid, nearly terete, ¾–1½ in. long: spike 2–3 in. long, the filaments dark red but nearly obscured by the golden yellow anthers.—The slender habit, gray foliage, and golden bloom render this shrub very desirable for ornamental planting.

HARVEY MONROE HALL.

CALLÍSTEPHUS (Greek words for *beautiful crown*, said to be in allusion to character of fruit). *Compósitæ.* CHINA ASTER. (See page 419, Vol. 1.) One species in China and Japan. The genus Callistemma, also erected by Cassini, is older than Callistephus, but the latter is one of the "nomina conservanda" of the Vienna code, retained because accepted and in general use for fifty years following its publication. Under both these generic names, Cassini described the China aster as *C. hortensis.* It was first named by Linnæus, however, as *Aster chinensis*, and Nees subsequently transferred this name to Callistephus, so that the plant now would better bear the name *Callistephus chinensis*, Nees.

Callistephus is closely allied to Aster, from which it differs, among other things, in its pappus, which is minute and forming a crown in the outer series, and of slender longer barbellate and caducous bristles in the inner series: annual, erect, hispid-hairy branching herbs, with showy terminal fl.-heads: lvs. alternate,

Univ. of California



XXII. Carnations.—Types of the American winter-flowering varieties. (Half size.)

broadly ovate or triangular-ovate and deeply and irregularly toothed; blade decurrent into a petiole, those on the upper parts becoming spatulate or narrower: heads in wild plant heterogamous and radiate, the ray-florets in 1–2 series and pistillate, the disk-florets perfect and fertile; involucre hemispherical, the bracts imbricated in many series and the outer ones large and green: fr. a compressed achene. The rays become much multiplied under cult., and they are also variable in size, shape and color. The colors are violet, purple, blue and white, the rays never being true yellow. Widely variable under cult., and one of the best of the garden annuals, growing from 6 in. to 2½ ft. high. It is the Reine-marguerite of the French and the Sommeraster of the Germans. L. H. B.

CALLÍTRIS (from the Greek for *beautiful*). Including *Frenéla* and *Widdringtònia*. *Pinàceæ*. Evergreen trees or shrubs, not quite hardy in the open in England, but thriving well in the southernmost parts of the United States; allied to Thuja.

Leaves scale-like or awl-like, in whorls of 3 or 4 on jointed branches, or sometimes alternate: monœcious; sterile catkins cylindrical or ovoid, the stamens in whorls of 3 or 4, the scales broad and sometimes peltate; fertile cones of 4–8 scales, and borne on short and thick peduncles, either solitary or clustered, usually ripening the second year and often persisting after the seeds have fallen.—About 15 species in Austral., New Caledonia and Afr. Little known in cult. here.

A. *Cone 6-valved.*

robústa, R. Br. (*Frenéla robústa,* Cunn.). Cypress Pine. Ranging from a shrub to a tree 90 ft. high: branchlets crowded, short and erect: sterile catkins ¼in. or less long, solitary or in 3's: cones solitary or few-clustered, nearly globular, about 1 in. diam.; seeds usually 2-winged. Austral.—Trees about 30 years old are said to be growing at Santa Barbara. In S. Fla. it makes good specimens, in 5 years becoming 10–12 ft. high. The tree somewhat resembles red cedar, and is reported as useful for tall hedges and windbreaks. This is one of the "pines" of Austral., the wood being used in building and for the making of furniture.

rhomboídea, R. Br. (*Frenéla rhomboídea,* Endl.). Smaller, reaching 25–50 ft.: branches somewhat slender and often drooping, angled when young: cones usually only one-half the diam. of those of *C. robusta*, globular, the 6 valves alternately larger and smaller, the larger valves having a broadly rhomboidal apex with a protuberance at the center. Austral. and Tasmania.—Timber used for telegráph poles and in construction.

AA. *Cone 4-valved.*

quadriválvis, Vent. (*Thùja articulàta,* Vahl). Arar-Tree. Sandarach. Gum Tree. Small tree, with fragrant hard durable wood: branches jointed and spreading: lvs. very small, flattened, distichous, reduced to scales at the nodes: cone 4-sided, small, the valves oval and with a protuberance near the tip. N. Afr., in the mts. L.B.C. 9:844.—Furnishes varnish resin (gum sandarach).

Whỳtei, Engler (*Widdringtònia Whỳtei,* M. Wood). The wood is dull reddish white, strongly aromatic, and locally used for furniture and for doors and windows. Tree attaining a maximum height of 140 ft., with a diam. of 5½ ft. at a point 6 ft. above the ground, the trunk being clear for 90 ft.: lvs. on ultimate branchlets, deltoid and closely appressed opposite; on other branchlets usually linear-lanceolate, spreading at the tips, alternate: in seedling stage linear, spreading and about 1 in. long: cones 4–6 together, about ¾in. long and ¾–1 in. wide when open. S. E. Afr.—It grows at an altitude of 5,000–7,000 ft. on Mt. Milanji in Nyassaland and is known as the Milanji cypress or cedar. Apparently hardy in parts of Cent. Calif. L. H. B.

CALLÓPSIS (*Calla-like*). *Aràceæ*. A single species from German E. Afr.: **C. Vólkensii,** Engler. Spathe like that of a little calla, snow-white, 1¼ in. long by 1 in. broad, the spadix partly united to it (and yellow): lvs. crowded, cordate-ovate, 5 in. long, shining, the petiole about 2 in. long; semi-epiphytic, with creeping rhizome. Probably cult. only in botanic gardens or other collections.

CALLÙNA (Greek, *to sweep;* the branches are sometimes used for making brooms). *Ericàceæ*. Heather. Low evergreen shrubs cultivated chiefly for their bright rosy pink, rarely white flowers appearing in great profusion late in summer.

Leaves scale-like, opposite, in 4 rows, the branchlets therefore quadrangular: fls. in terminal, 1-sided spikes; corolla campanulate, 4-parted, shorter than the 4-parted colored calyx; stamens 8, with 2 reflexed appendages: fr. a septicide, 4-celled, few-seeded caps.—One species in W. and N. Eu., also in Asia Minor; in E. N. Amer. in some localities naturalized. The genus differs from the closely related Erica in its deeply 4-parted colored calyx, longer than the 4-parted corolla. For culture, see *Erica*.



746. Calluna vulgaris. (Plant ×⅓)

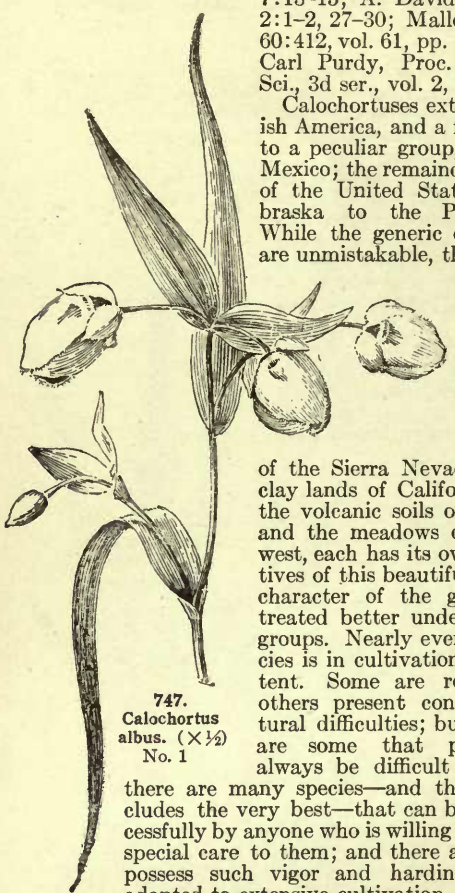
vulgàris, Salisb. (*Erìca vulgàris,* Linn.). Fig. 746. From ½–3 ft.: lvs. oblong-linear, obtuse, sagittate at the base, glabrous or pubescent: fls. small, in long, erect, rather dense racemes, rosy pink, sometimes white. Aug., Sept.—Some of the most distinct of the numerous named varieties are the following: Var. **álba,** Don (and var. *álba Hámmondii*), with white fls.; var. **Alpòrtii,** Kirchn., of more vigorous growth, with rosy carmine fls.; var. **cárnea,** Hort., with flesh-colored fls.; var. **plèna,** Regel, with double rose-colored fls.; var. **hirsùta,** Gray (var. *tomentòsa,* Don), the branchlets and lvs. with grayish tomentum; var. **nàna,** Kirchn. (var. *pýgmæa,* Hort.), forming low moss-like tufts; var. **rùbra,** Kirchn., with deep rosy carmine fls.; var. **prostràta,** Kirchn., with the branches spreading and partly prostrate, fls. pink; var. **Sèarlei,** Hort. (var. *álba Sèrlei,* Hort.), fls. white, appearing late in autumn.—The heather is a very handsome small shrub, well adapted for borders of evergreen shrubberies, or for dry slopes and sandy banks and preferring sunny positions; it is also found growing well in swamps and in partly shaded situations. Cut branches keep their life-like appearance for many months.

Alfred Rehder.

CALOCHÓRTUS (Greek for *beautiful* and *grass*). *Liliàceæ*. Incl. *Cyclobòthra*. Mariposa Lily. Star Tulip. Globe Tulip. West American cormous plants, the occidental representatives of Tulipa, useful as border plants and to some extent for indoor culture.

Stem usually branched, and from a coated corm, more or less leafy: perianth of unequal segms., the outer ones the smaller and more or less sepal-like, the 3 inner ones large and showy and bearing glands and hairs; stigmas 3, sessile and recurved; stamens 6; fls. showy, shallow-cupped on the inner segms., arching.—From 40–50 species, mostly on the Pacific side of the con-

tinent from Wash. to Mex., and some of them in the interior country. Nearly all the species are in cult. Monogr. by J. G. Baker, Journ. Linn. Soc. 14:302–10 (1875); and by S. Watson, Proc. Amer. Acad. Arts and Sci. 14:262–8 (1879). See also Colochorti in the Sierra Nevada, by George Hansen, Erythea, 7:13–15; A. Davidson, Erythea, 2:1–2, 27–30; Mallett. Gn. 1901, 60:412, vol. 61, pp. 185, 203, 220; Carl Purdy, Proc. Calif. Acad. Sci., 3d ser., vol. 2, No. 4 (1901).



747. Calochortus albus. (×½) No. 1

Calochortuses extend into British America, and a few, belonging to a peculiar group, are found in Mexico; the remainder are natives of the United States, from Nebraska to the Pacific Ocean. While the generic characteristics are unmistakable, the species and even varieties have the most variable inclinations as to soil, exposure and climate. The Colorado Desert and the summits of the Sierra Nevada, the heavy clay lands of Californian valleys, the volcanic soils of the foothills and the meadows of the Northwest, each has its own representatives of this beautiful tribe. The character of the genus can be treated better under the various groups. Nearly every known species is in cultivation to some extent. Some are readily grown, others present considerable cultural difficulties; but while there are some that probably will always be difficult to cultivate, there are many species—and the number includes the very best—that can be grown successfully by anyone who is willing to give a little special care to them; and there are a few that possess such vigor and hardiness as to be adapted to extensive cultivation.

All calochortuses are hardy in the sense of withstanding extreme cold, but they will not endure alternate thawing and freezing nearly so well; and thus there is the paradox of their going safely through severe eastern or European winters and suffering the loss of foliage in mild ones. They should be planted in the fall, and it is better to plant late, so that leaf-growth is delayed until spring. Diverse as are their natural habitats, one soil will answer the needs of all. A light loam, made lighter with sand or sawdust, powdered charcoal, or spent tan-bark, is best. Excellent results have been secured with a mixture of equal parts of a good light loam and spent tan-bark, with a little broken charcoal. Wallace, one of the most successful English growers, recommends making a bed sloping to the south, composed of leaf-mold and road grit in equal parts, with a smaller proportion of sharp sand. The idea is to have a light and porous, not too stimulating soil, with perfect drainage. Wallace recommends covering the beds with reeds to throw off the heavy rains. The same end may be attained by such thorough drainage that the rains pass through quickly. In New York, they have been carried through the winter safely under a covering put on before the ground freezes hard. It is well to keep a few leaves about the shoots for a time and to have extra leaves at hand to be used when frost threatens. It is better to lift the bulbs as soon as they ripen, and replant in the fall. Water sparingly at all times. Under suitable conditions they are hardy and tenacious of life, but excessive moisture, either in air or ground, is not to their liking after the flowering season arrives. Theoretically, all calochortuses of Section A (star and globe tulips) should have shade, and all mariposas (AA) sunshine; but the light shade of a lath-house suits all alike, giving much finer bloom in the mariposas. The flowering season extends over three months, according to species.

They take well to pot culture with similar soils and treatment. While not to be forced rapidly, they considerably anticipate their out-of-door season. The same treatment can be used in coldframe culture, but they must not be coddled too much.

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A. *Blossoms or fr. more or less nodding (unless No. 4): inner perianth-segms. strongly arched: lvs. long and glossy, not channeled. (Eucalochortus.)*

B. *Fls. subglobose, nodding: st. usually tall and branching.* GLOBE TULIPS.—These have a single long and narrow shining lf. from the base, and slender, flexuous, leafy sts., the perfection of grace in outline. The fls. are exquisite in delicacy of tints. Woodland plants.

1. **álbus,** Douglas (*Cyclobóthra álba*, Benth.). Fig. 747. Strong, 1–2 ft. high, glaucous: fls. globular, pendent, 1 in. across, of a satiny texture, delicately fringed with hairs, very strongly inarched or practically closed. Calif. B.R. 1661. F.S. 11:1171.—Chaste and delicate. The form from the Coast Range is the Pearl calochortus of gardens; the form from the Sierras with fls. less strongly inarched and at length opening slightly is the *C. albus* of horticulture.

Var. **amœnus,** Hort. (*C. amœnus*, Greene). Like *C. albus*, but rose-colored, lower and more slender: fls. opening in full bloom. Fresno and Tulare Co., Calif.

2. **pulchéllus,** Douglas (*Cyclobóthra pulchélla*, Benth.). Stout, glaucous, 8–16 in., usually branching: fls. yellow, strongly inarched but parts not overlapping; sepals shorter than petals, ovate-acuminate, yellow tinged with brown on the back; petals ovate, obtuse, 1 in. or less long, canary-yellow, with long silky hairs above the gland. Cent. Calif. B.R. 1662.

3. **amábilis,** Purdy. Habit like *C. albus:* sts. stout, usually branching in pairs: petals clear yellow, very strongly inarched so that the tips overlap each other much like a child's pin-wheel; gland lined with stiff hairs that cross each other; petals margined with a line of stiff hairs. Cent. and N. Calif.

4. **Góldyi,** Watkins. Possibly *C Benthamii* × *C. amabilis*. Sts. several, freely branched, bearing 15–20 fls.: lvs. narrow-lanceolate: fls. erect, 1 in. across, straw-yellow, inner surfaces covered with long silky sulfur-tinted hairs and a few shorter crimson hairs deep down in the cup; petals rounded and very hooded. Apparently of garden origin.

BB. *Fls. bell-shaped, erect when open, mostly lined with hairs, the pedicels becoming recurved: st. mostly low, and fls. often more or less umbellate.* STAR TULIPS proper.—Like the globe tulip, but smaller as a rule, and the fls. dainty open cups. All of the species resemble each other, and were first included under the name *C. elegans*.

5. **Maweânus,** Leichtl. Plant low (3–10 in.), very slender, usually branched: fls. white, purplish at the base, filled with silky hairs, the gland covered by a broad semi-circular scale: caps. long-elliptic. Calif., north. B.M. 5976 (as *C. elegans*).—Variable. Var. **mâjor,** Hort. Twice as large in all its parts: fls. lighter colored. Var. **rôseus,** Hort. Fls. tinged rose.

6. **Bénthamii,** Baker. Sts. 7 in. high, very flexuose, dividing into pairs: lvs. linear-lanceolate: fls. nearly erect, yellow, the segms. ½in. long and brown at the base. Sierra Nevadas, in Calif. B.M. 6475. J.H. III. 30:549. Var. **Wállacei** (*C. Wállacei*, Hort.). Claw of the petal dark red or nearly black.

7. **cærûleus,** Wats. Similar to small plants of *C. Maweanus*, but lined and dotted with blue: low, 2–5-fld., the pedicels very slender; perianth ciliate inside: caps. nearly or quite orbicular. Calif., in the Sierras. Not variable.

8. **élegans,** Pursh. Similar to the last: petals greenish white and purplish at base, bearded, little or not at all ciliate: gland covered by a deeply fringed scale. Ore., Idaho.

Var. **nânus,** Wood (*C. Lŷallii*, Baker). Subalpine, dwarf and very slender: petals delicate cream-color, narrow and usually more acute, more hairy and ciliate. Mts. Calif., N.

9. **Lôbbii,** Purdy (*C. élegans* var. *Lóbbii*, Baker). St. 3–5 in. high: petals white tinged green, broadly rhombic-ovate, very deeply pitted and with the pit showing as a prominent knob on back of petal. Mt. Jefferson, Ore.

10. **umbellâtus,** Wood (*C. collînus*, Lemm.). Low and branching, 3–15 in., flexuose: fls. 5–10, white; petals broadly fan-shaped, nude excepting for many white hairs just above the scale. In open grassy places around San Francisco Bay.

BBB. *Fls. bell-shaped: like* BB, *but tall (1 ft. or more), and stoutly erect, with several fine, erect cups, similar to C. Maweanus.* GIANT STAR TULIPS.—In this splendid group the very dainty silky fls. and handsome glossy lvs. of the star tulip are shown with a stout st. a foot or two high, and large fls. Unlike the others, they grow naturally in open places, and have a vigor and health which are a high recommendation.

11. **Tôlmiei,** Hook. & Arn. Stout, a foot high, generally branched: petals often more than an inch long, tinged lilac, with purple and white hairs: gland without a scale: caps. broad-elliptic, acutish. Mt. Shasta, N.—Remains a long time in bloom.

12. **apiculâtus,** Baker. Taller and stouter, 12–18 in., with umbellate straw-colored fls. N. Idaho.

13. **Pûrdyi,** East. Glabrous and glaucous, 8–16 in., rather stout, branching, 2- to many-fld.: fls. creamy white or purple-tinged, filled with blue hairs, gland absent. S. Ore. G.C. III. 23:395.—Very handsome.

BBBB. *Fls. bell-shaped, the petals naked or hairy only at the base: low: lf. solitary.* MEADOW TULIPS.—These calochortuses are natives of wet meadows. *C. uniflorus* and *C. Vesta* grow well in all soils so long as well drained, and, as garden plants, thrive everywhere. In habit they are low, flexuous and leafy. The cups are open, erect and numerous, an inch or so in diam.

14. **nûdus,** Wats. Low, 2–4 in., delicate: lf. solitary: fls. 1–6, umbellate, small, greenish white or pale lilac, nude except for a tuft of 2 or 3 short hairs at each extremity of scale, denticulate. Calif., in the Sierras.

15. **uniflôrus,** Hook. & Arn. (*C. lilacînus*, Kell.). Handsome species, 4–8 in. high: fls. 4–10, on long pedicels, clear lilac, hairy only at base: caps. elliptic, obtuse. B.M. 5804.—Grows naturally in wet meadows, and makes offsets very freely. Often seen in a depauperate starved form, but responds at once to good treatment.

AA. *Blossoms on stout, erect pedicels, the sts. stout and strict: fls. open-bell-shaped.* MARIPOSA TULIPS.—Excepting in B, the mariposa or butterfly tulips have slender, grassy, radical lvs., stiff, erect sts. bearing cup-shaped fls., and sparingly leafy and with an erect caps. Bulbs small.

B. *Caps. oblong, acute-angled or winged: fls. lilac or white.* These are hardy species, growing in the meadows from Ore. to Mont., where they endure much cold. They form a connecting link between the giant star tulips and the true mariposas. Their lvs. are like those of the star tulips—long, broad and glossy. Like the star tulips, also, the seed-pod is handsome, 3-cornered and winged. The sts. are stiffly erect: the fls. cup-shaped, not so brilliant as the true mariposas, but very delicate: the plants are hardy, healthy and vigorous, and are to be highly recommended for cold climates.

16. **nîtidus,** Douglas. Scape erect, but not stiff: lf. solitary, glossy, narrow: fls. 1–3, large and showy, lilac, yellowish, or white, with a deep indigo blotch in the center, lined with yellow hairs. Meadows, E. Ore. to Mont. and N. E. Nev. Specimens from Yellowstone Lake are yellow.—Very beautiful and showy.

17. **Greênei,** Wats. St. stout and branching, 1 ft., 2–5-fld.: sepals with a yellowish hairy spot; petals lilac barred with yellow below, and somewhat purplish, loose-hairy, not ciliate: caps. beaked. Calif. and Ore.

18. **longebarbâtus,** Wats. Slender, about 1 ft. high, bulb-bearing near the base, with 1 or 2 narrow radical lvs., 2-branched and usually 2-fld.: fls. erect or nearly so, lilac with yellow at base, scarcely hairy except the long-bearded gland. Wash.

19. **Hôwellii,** Wats. St. erect, 1 ft. or more, 1–2-fld.: lvs. very narrow: sepals ovate, short-acuminate; petals yellowish white, 1 in. long, denticulate, slightly ciliate near the base, brown-hairy inside, the gland yellow-hairy. Ore.

BB. *Caps. oblong, obtuse-angled.*

C. *Color yellow or orange or orange-red, more or less marked with brown and purple (except in forms of C. luteus): in cult. forms running into other colors.*

20. **Weèdii,** Wood. Radical lf. single, glossy, broad: st. tall, leafy, bearing large orange-colored fls. dotted with purple: petals triangular, square-topped: gland small, hairy: bulb heavily coated with fiber. S. Calif. B.M. 6200 (as *C. citrinus*). G.C. III. 16:183.—Varies to white.

Var. **purpurâscens,** Wats. (*C. Plúmmeræ*, Greene). Similar, but lilac or purple and very showy. Calif. G.C. III. 16:133. J.H. III. 29:289. Gn. 47:80.—A fine form with fl. of large size and full outline, lined with long, silky yellow hairs.

Var. **vêstus,** Purdy. Petals much more truncated and curiously fringed with brown hairs; reddish brown. Santa Barbara.

Var. **obispoénsis,** Purdy (*C. obispoénsis*, Lemm.). Fig. 748. Tall and slender, branching, very floriferous: petals yellow, verging to red at the tip and less than half the length of the orange-brown sepals. Calif. G.F. 2:161 (adapted in Fig. 748).—Odd and bizarre.

21. **Kénnedyi,** Porter. Bulb small and ovoid: st. very low, 1–4 in.: lvs. linear, tufted from the branching of the st.: fls. 2–4, in an umbel; sepals broad with a purple spot; petals red-orange to vermilion, not ciliate nor prominently hairy, purple-spotted at the center. Desert species of S. Calif. B.M. 7264. Gn. 43:108. —Brilliant and desirable, but difficult to grow.

22. **aùreus,** Wats. Low, 4–6 in., with a single carinate radical lf.: petals yellow, not hairy, the hairy gland purple-bordered. S. Utah.



748. Calochortus obispoensis. No. 20 var. (×½)

23. **clavàtus,** Wats. Petals yellow lined with brown, the lower part bearing club-shaped (clavate) hairs, the gland deep and circular; anthers purple. Calif.— In this excellent sort we have the largest-fld. and stoutest-stemmed of all mariposas. The bulb is very large, the single bare lf. 1 or 2 ft. long: the st. is heavy, stout and zigzag. The fls. are shaped like a broad-based bowl, sometimes 5 or 6 in. across. The color is a deep, rich yellow, and the lower half is covered thickly with stiff yellow hairs, each tipped with a round translucent knob, and in the light look like tiny icicles. There are various strains: Eldorado, the largest, not so deep yellow; Ventura, very stout, deep yellow; Obispo, like the last, but the upper half of the back of each petal is olive-brown, which shows through the deep yellow of the inside, giving changeable shades.

24. **cóncolor,** Purdy (*C. lùteus* var. *cóncolor,* Baker). Bulb large reddish: lvs. narrow, glaucous: st. 1–2 ft., umbellate, if more than 1-fld.; not zigzag; petals a rich deep yellow, tending toward orange, lower third densely hairy with long yellow hairs above an oblong gland. A desert species of S. Calif. Much like *C. clavatus* in general aspect.

25. **lùteus,** Douglas. Butterfly Tulip. St. 1–10-fld., bulb-bearing near the base: lvs. very narrow: sepals narrow-lanceolate, with a brown spot; petals 2 in. or less long, yellow or orange, brown-lined, slightly hairy below the middle, the gland densely hairy. Calif. B.R. 1567.—Variable. Some of the forms are sold as *C. venustus.*

Var. **citrìnus,** Wats. (*C. venùstus* var. *citrìnus,* Baker). Petals lemon-yellow, with a central brown spot.

Var. **oculàtus,** Wats. (*C. venùstus* var. *oculàtus,* Hort.). Petals pale or white, lilac or yellowish, with a dark spot.

Var. **robústus,** Purdy (*C. venùstus* var. *robústus,* Hort.). A very bulbiferous form having white fls. luridly tinged in browns and purples. Very beautiful and also one of the hardiest.

26. **Vésta,** Purdy. Butterfly Tulip. Tall and large-fld. with petals more narrowly cuneate than in *C. luteus* var. *oculatus,* and the gland narrow and doubly lunate, color from white tinged through lilac to pink and lilac-purple; fl. often laciniately gashed, above the gland bearing rich maroon pencilings and markings. N. W. Calif. in adobe soil.—One of the largest-fld., showiest and most easily grown of mariposa tulips. Named by its author in compliment to his wife.

cc. *Color prevailingly white or lilac, but sometimes running into yellows.*

27. **venùstus,** Benth. Butterfly Tulip. Stout, 6–36 in.: petals white or pale lilac, with a reddish spot at top, a brown-yellow center, and brown base: gland large and oblong, usually densely hairy: caps. 1–2½ in. long. Calif. B.R. 1669. F.S. 2:104. Gn. 46, p. 395.—Very variable. The yellow forms (as var. *sulphùreus,* Hort.) are often treated as forms of *C. luteus.* To this group of calochortuses is properly applied the Spanish name mariposa (butterfly), for their brilliantly colored fls., with eye-like spots on each petal and sepal, and other delicate markings with dots, lines and hairs, which are strongly suggestive of the wings of a brilliantly colored butterfly. Botanists have variously divided this great group of allied forms between *C. luteus* and *C. venustus.* Botanically all may be considered as either strains of one variable species or as a number of closely allied species.

Var. **Eldoràdo,** Purdy. The finest strain of *C. venustus* in cult. It occurs naturally in a wonderfully varied mixture, in color from pure white through pink, to deep glowing reds and through lilac to deep purples. In one locality a few may vary to light yellow. Some of these forms have been named var. *pictus* for the white form, var. *sanguineus* for the blood-red. The purple forms are entirely distinct from *C. venustus* var. *purpurascens.* Sierran foothills from Eldorado County to the far South. Altogether these plants comprise the loveliest group of the mariposa tulips.

Var. **purpuràscens,** Wats. Petals deep lilac or purplish, darker at center, the fl. fully 3 in. across. Coast Range. Strong grower. Gn. 46:394.

Var. **ròseus,** Hort. (*C. ròseus,* Hort.). Creamy white or lilac, with an eye midway and a rose-colored blotch at apex. Gn. 46:394.

Var. **sulphùreus,** Purdy. Taller than the type: petals light warm yellow with eye, and with a rose-colored blotch at top. Lower part of San Joaquin Valley, Calif.

28. **spléndens,** Douglas. Tall and slender, 1–2 ft.: fls. 1–1½ in. across, deep purple with a dark spot on the claw and with or without a gland covered with matted hairs. San Diego Co., Calif. Known in horticulture as *C. splendens* var. *atroviolaceus.*

Var. **màjor,** Purdy. Strong and tall, 1–2 ft.: fls. 2–3 in. across; petals large, clear lilac, paler below, with a

darker claw and scattered long white hairs below the middle. Coast Ranges, Monterey Co., Calif.

Var. **montànus,** Purdy. More slender than the type, often bulbiferous: lilac to salmon-pink, densely hairy with short yellow hairs about the gland. High mts., S. Calif.

Var. **rùbra,** Purdy. Large, with deep-seated reddish bulb, 1–3 ft.: fls. reddish lilac, pink or purple; petals quite hairy, with short hairs on the lower third. Lake Co., Calif.



749. Calochortus Gunnisonii. (×½)

29. **flexuòsus,** Wats. Related to *C. splendens,* but with sts. so weak as almost to be said to creep. The fls. are large and very brilliant, a dazzling purple, with a darker purple eye, and yellow hairs below. S. Utah.—Intro. by Purdy in 1897.

30. **Pálmeri,** Wats. St. 1–2 ft., very slender and flexuous, 1–7-fld., bulb-bearing near the base: sepals with long, narrow, recurved tips, spotted; petals 1 in. or less long, white (or yellowish below), with a brownish claw and bearing scattered hairs about the gland: caps. very narrow. S. Calif.—The *C. Palmeri* of dealers is sometimes *C. splendens* var. *montanus.*

31. **catalìnæ,** Wats. (*C. Lỳonii,* Wats.). Habit of *C. splendens:* st. 1–2 ft., branching: fls. white to lilac, or deep lilac, very large and handsome, a large round black spot at base of each petal.—A lovely species between *C. splendens* and *C. venustus.* Remarkable for blooming with the star tulip section, fully a month before other mariposas. Native to Santa Catalina Isl., off S. Calif.; also to Calif. coast.

32. **Núttallii,** Torr. & Gray. SEGO LILY. St. erect and stiff, 1–2 ft., bulb-bearing at base, usually with only 1 cauline lf., 1–5-fld.: sepals ovate-lanceolate, often dark-spotted; petals 1–2 in. long, white tinged with greenish yellow or lilac, with a purplish spot or band above the yellow base and hairy about the gland; anthers obtuse. Dak. and Neb. to Calif. and New Mex., having the widest range of any calochortus.—There are no more exquisitely beautiful fls. than these sego lilies (the Mormon name) of the Great Basin. Most of them are plants of the sage-brush deserts. The lvs. are an ashy green, the foliage scant, but the great fls. are wonderful in tintings. There are shades in blue, pink, lilac, and yellowish; also white. The sego lily is the State flower of Utah.

33. **Leìchtlinii,** Hook. f. Slender alpine species (5–6 in. high), by some regarded as a form of *C. Nuttallii:* fls. smoky white, banded with green and marked with dark brown. Sierra Nevadas. B.M. 5862. F.S. 20:2116.

34. **Gúnnisonii,** Wats. Fig. 749. Much like *C. Nuttallii:* anthers acuminate: fls. light blue or almost white, delicate yellowish green below the middle, purple-banded at the base, and bearing a band of green hairs across each petal. Rocky Mts., Wyo. to New Mex.

35. **macrocârpus,** Douglas. GREEN-BANDED MARIPOSA LILY. St. stiff, the cauline lvs. 3–5: fls. 1 or 2; sepals acuminate, sometimes spotted; petals 2 in. or less, acute, lilac with a greenish midvein, somewhat hairy. B.R. 1152. N. Calif. to Wash. and Idaho.—This fine species forms a group by itself. It has a very large bulb, a stout almost leafless st.; and a large fl. of an exquisite pale lavender, banded down the back with green. Petals long, narrow and pointed.

BBB. *Caps. linear, not winged or prominently angled.*

36. **flàvus,** Schult. f. (*Cyclobóthra flàva,* Lindl.). St. slender, 1–2 ft., forked: lvs. 2 or 3 below the fork, linear, long-acuminate: fls. yellow, upright; petals and sepals acute, rhombic-oblong, with a darker somewhat hairy gland, the petals hairy and usually denticulate. Mex.

37. **Bonplandiànus,** Schult. f. (*C. purpùreus,* Baker. *Cyclobóthra purpùrea,* Sweet). Rather stout, 3 ft.: st.-lvs. short, acuminate-lanceolate: fls. yellow and purple: the sepals with a purple pit and the petals purple outside: gland naked. Mex.

CARL PURDY.
L. H. B.

CALODÉNDRUM (Greek, *beautiful tree*). *Pallásia,* Houtt, which is the older name. *Rutàceæ.* One of the handsomest deciduous trees at the Cape of Good Hope; cultivated in northern greenhouses, and outdoors in southern California and southern Florida.

The great panicles of white or flesh-colored fls. are sometimes 7 in. across and 6 in. deep. It is a symmetrical tree, with attractive evergreen foliage and many interesting features. Called "wild chestnut" in Afr. Prop. by cuttings of half-ripened wood under glass in heat. A monotypic genus.

capénsis, Thunb. CAPE CHESTNUT. Height in Afr. 70 ft.: branches opposite, or in 3's: lvs. simple, decussate, ovate, obtuse retuse or acute, parallel-nerved, 4–5 in. long, studded with oil-cysts, which look like translucent spots when held to the light: panicles terminal; peduncles usually trichotomous; calyx deciduous; petals 5, linear-oblong, 1½ in. long, 2 lines wide, sprinkled with purple glands; stamens 10, 5 alternate, sterile, and petaloid: seeds 2 in each cell, larger than a hazelnut, black and shining. G.C. II. 19:217. Also written *Calodendron capense.*

CALONÝCTION (Greek, referring to the beauty of the flower, and the night-blooming habit). *Convolvulàceæ.* MOONFLOWER. Twining perennial herbs with large night-blooming flowers.

Flowers white or purple, fragrant, showy; sepals 5, the outer ones with horn-like tips; corolla salverform, the limb more or less flat, the tube very long and not dilated at the throat; stamens 5, exserted; style capitate and obscurely 2-lobed; ovules 4: lvs. broad, alternate.—Three species in Trop. Amer., two of which are widely cult. By some, the genus is united with Ipomœa, but it is well distinguished by the salverform rather than funnelform or bell-shaped corolla, by the exserted stamens and style, and by the night-blooming habit.

aculeàtum, House (*C. speciòsum,* Choisy. *Ipomœa Bòna-nóx,* Linn.). MOONFLOWER. Fig. 750. St. 10–20 ft. high, with milky juice: lvs. 3–8 in. long, cordate to hastate, angular or 3-lobed, acute, glabrous: peduncles 2–6 in. long, 1–7-fld., equaling the petioles; corolla 3–6 in. long, 3–6 in. wide, trumpet-shaped, white, sometimes with greenish plaits; fls. fragrant, usually closing in the morning, sometimes remaining open till noon. Aug., Sept. B.M. 752. B.R. 11:889, 917 (as *Ipomœa latiflora*). Gn. 21, p. 259; 27, p. 473. V. 10:359. Known in gardens chiefly as *Ipomœa Bona-nox* var. *grandiflora,* Hort. (*I. grandiflòra,* Roxbg. and Hort., not Lam.), which does not differ materially from the type. Most of the large-fld. and very fragrant forms in cult. may be referred here. Var. **grandiflòrum,** Hort., is sold under the following names: *Ipomœa Childsii,*



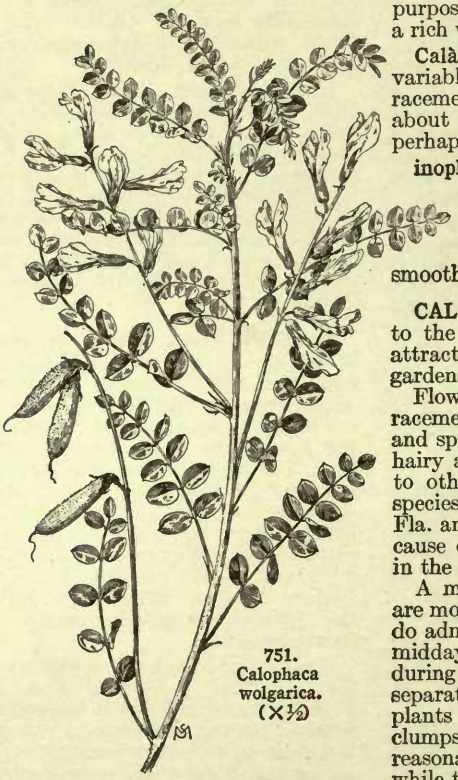
750. Moonflower—Calonyction aculeatum. (×⅓)

I. noctiphyton, I. noctiflora, I. mexicana grandiflora, I. mexicana grandiflora alba, I. mexicana grandiflora vera. These trade names represent strains of varying excellence. (*C. grandiflorum,* Choisy, is *Ipomœa Tuba.*) A form with variegated lvs. is offered. Var. **heterophýllum,** has lvs. 3–5-lobed and subhastate.—The moonflower is most popular as a garden plant, but it also does well trained along the roof of a low house or against a pillar. It is excellent for cut-fls. in the evening. Little grown in the open N. because it does not mature in the short seasons. It grows wild in swamps and thickets in peninsular Fla., and is probably indigenous there. Widespread in tropics of both hemispheres.

muricàtum, G. Don. (*Convólvulus muricàtus,* Linn. *Ipomœa muricàta,* Jacq. *Calonyction speciòsum* var. *muricàtum,* Choisy). Fls. purple, smaller than those of *C. speciosum,* the tube very slender and the expanded part of the tube not over 3 in. broad.—Tropical regions; extensively cult. in Japan and India, and often seen in American conservatories.

C. tasténse, House (Ipomœa tastense, Brandeg.), is the third species of Calonyction. It is native to Lower Calif., and not in cult. *C. grandiflòrum,* Choisy.=Ipomœa Tuba. L. H. B.

CALÓPHACA (Greek, *kalos,* beautiful, and *phaka,* lentil). *Leguminòsæ.* Ornamental plants cultivated chiefly for their bright yellow flowers appearing in summer.



751. Calophaca wolgarica. (×½)

Deciduous shrubs or herbs, with alternate, odd-pinnate, pubescent, and often glandular lvs.: stipules scarious or herabceous, adnate to the petiole: fls. papilionaceous, solitary or in racemes; calyx tubular with 5 nearly equal teeth; standard upright; wings oblong, free, as long as keel; ovary sessile with many ovules: pod pubescent and glandular, cylindrical.—About 10 species from S. Russia to E. India.

The two cultivated species are low, prostrate shrubs, with grayish green foliage, and rather large yellow flowers in erect axillary racemes, followed by decorative reddish pods. They prefer a well-drained soil and sunny position, and are well adapted for borders of shrubberies and sandy or rocky slopes. Propagated by seeds sown in spring; the young seedlings should have plenty of light and air, as they are very liable to damp-off if kept too moist and shady. Sometimes grafted high on Caragana or Laburnum, forming a very attractive small standard tree with pendulous branches.

wolgàrica, Fisch. Fig. 751. Two to 3 ft.: pubescent and glandular: lfts. 11–17, roundish-ovate or oval, ⅓–½in. long: racemes long-peduncled, with 4–7 fls.; corolla over ¾in. long. June, July. S. Russia, Turkestan. **C. grandiflòra,** Regel, is similar, but lfts. 17–25: racemes 10–16-fld.; corolla 1 in. long. S. Russia. Gt. 35:1231. ALFRED REHDER.

CALOPHÝLLUM (Greek, *beautiful-leaved*). *Guttiferàceæ.* Woody plants of the Old World and American tropics, with shining leathery leaves, sometimes planted South.

Leaves parallel-veined at right angles to the midrib: fls. polygamous in many axillary or terminal clusters; sepals and petals 4–12, in 2–3 series; stamens very numerous: fr. a drupe with a single erect seed.—Sixty species. Closely related to Garcinia, which, however, has only 4–8 sepals.

In India, several species are of considerable economic importance, especially *C. ionophyllum,* which is the source of a gum, and the seeds of which contain the well-known domba oil used extensively for lighting purposes. They must be grown in a warmhouse and in a rich well-aërated soil.

Calàba, Jacq. CALABA TREE. A tree, to 60 ft.: lvs. variable, dark glossy green, 3–10 in long.: fls. in axillary racemes, white, rarely produced in cult., the petals about 3 lines long: fr. about 1 in. diam. W. Indies, perhaps intro. from the Old World. Timber and oil.

inophýllum, Linn. A medium-sized tree, with gray smooth bark: lvs. 4–8 in. long, 3–4 in. wide, shining on both surfaces: racemes in the upper axils, the fls. about ¾in. diam. and pure white; inner sepals petal-like: fr. about 1 in. diam., yellow, smooth, almost fleshy. Trop. Asia. N. TAYLOR.

CALOPÒGON (Greek, *beautiful beard,* in allusion to the fringed or bearded lip). *Orchidàceæ.* A very attractive native orchid, sometimes planted in bog-gardens and rock-gardens.

Flowers magenta-crimson, varying to white, in a loose raceme on a naked scape; sepals and petals all distinct and spreading, the lip narrow at base but broader and hairy above; column winged at summit, not attached to other parts; pollinia 2 in each anther cell.—One species, in bogs and moist meadows, Newfoundland to Fla. and westward. Cathea is an older name, but, because of its general acceptance, Calopogon is retained in the "nomina conservanda" of the Vienna code.

A moist and shaded position and very porous soil are most suitable for this pretty plant, although it may do admirably in a rock-garden only slightly shaded at midday if the plants are watered very freely every day during hot or dry weather. Propagated by offsets, separated from the old tubers, but the old established plants should not be disturbed very often. Collected clumps of many native orchids are offered at very reasonable figures, and these give immediate results, while the small offsets would not be strong enough to flower for several years, and require much attention during the first year, or perhaps longer (J. B. Keller).

pulchéllus, R. Br. (*Limodòrum tuberòsum,* Linn., in part). Height 12–18 in., from a solid bulb or corm, bearing a single grass-like lf. at the base: scape 2–12-fld.; lip bearded with white, yellow, and purple club-shaped hairs; pretty. G.F. 10:505. J.H. III. 35:45. B.M. 116. L. H. B.†

CALOSCÓRDUM: *Nothoscordum.*

CALOTHÁMNUS (Greek, *beautiful bush*). *Myrtàceæ.* Australian shrubs (more than twenty species) somewhat similar to Callistemon but more graceful in habit; evergreen greenhouse subjects, and hardy out-of-doors in California.

Leaves long, alternate: fls. showy, usually red, in lateral clusters; stamens united in bundles opposite the petals; anthers erect, attached by the base, oblong or linear; cells parallel, turned inwards, opening by longitudinal slits. For cult., see *Callistemon.*

quadrífidus, R. Br. Height 2–4 ft.: lvs. narrow, terete or slightly flattened, heath-like, glandular-dotted: fls. rich crimson, 4-merous; calyx 2-lobed in fr.; staminal bundles nearly equal, of 15–20 or more filaments. W. Austral. B.M. 1506.

C. rupéstris, Schau. Evergreen shrub, the branches densely covered with needle-like small lvs.: fls. in small clusters on previous year's growth; stamens with crimson filaments and yellow anthers. B.M. 7906. J. Burtt Davy.

CALÓTROPIS (from Greek words referring to the beauty of parts of the flower). *Asclepiadàceæ.* Milkweed-like shrubs, or small trees, grown in the American tropics and one species offered in southern California.

Branching, glabrous or tomentose-canescent: lvs. opposite, subsessile, broad: fls. with 5-parted calyx glandular inside; corolla bell-shaped or somewhat rotate, 5-parted with broad lobes; crown of 5 narrow fleshy scales adnate to the staminal tube and free and recurved at the base; pollinia solitary in each cell, obovate-oblong and compressed, hanging from the apex: fr. short horned gibbous acuminate pods mostly in pairs; seeds with silky hairs.—Three species in Trop. Asia and Afr., sometimes grown under glass in collections but in this country practically confined to the tropics. The bark of *C. gigantea* produces a strong fiber, and the acrid milky juice dries into a substance like gutta-percha. The silk on the seeds is used in fabrics by natives; that of *C. procera* is said to be exported from the Cape Verde Isls. as kapok (kapok is usually from the ceiba or silk-cotton tree).

gigantèa, R. Br. (*Asclèpias gigantèa,* Willd.). Giant Milkweed. Tree-like, 8–15 ft., with pale bark and woolly shoots: lvs. obovate to broad wedge-shaped, entire, woolly beneath: fls. rose and purple, in simple or compound umbels with involucrate scales, the corolla-segms. bent downwards and twisted with age: fr. 3–4 in. long; seeds broadly ovate. B.R. 58. India, and planted or escaped in W. Indies.

procèra, Dry. (*Asclèpias procèra,* Ait.). Shrub or bush, to 15 ft.: lvs. more oblong and acute than those of *C. gigantea,* grayish: fls. white and purple in long-peduncled cottony umbels; corolla-lobes erect: fr. 4–5 in. long, recurved; seeds ovoid. B.R. 1792. India. —Offered in S. Calif., and said to be known in Porto Rico as Algodon de seda. L. H. B.

CALPÚRNIA (after Calpurnius, an imitator of Virgil, because these plants are allied to Virgilia). *Leguminòsæ.* Trees and shrubs from tropical and southern Africa, cultivated out-of-doors in southern California and other subtropical regions.

Leaves odd-pinnate with numerous lfts.: racemes long, axillary and terminal, the peduncles often paniculate, giving rise to a splendid showy infl.; fls. yellow, the calyx bell-shaped; petals pea-like: pods membranous-winged on one side, often flattish.—Ten species.

sylvática, Mey. Shrub, 6–10 ft. high: lvs. 2–6 in. long; lfts. in 3–10 pairs, membranous, obovate-elliptical, retuse or obtuse: fls. ½in. long; ovary glabrous. Caffraria.—Also rarely cult. N. as a greenhouse shrub.

lasiógyne, Mey. (*C. aùrea,* Benth.). A taller shrub, very rarely tree-like, with larger evergreen lvs., more coriaceous, more pubescent, and exactly elliptical or oblong lfts: fls. racemose, much like Laburnum, appearing in winter, as do the fls. of most S. African plants. The silky ovary at once distinguishes it. Natal.

N. Taylor.†

CÁLTHA (Latin name of the marigold). *Ranunculàceæ.* Beautiful hardy blooming marsh plants, the largest and best of which are used about water-gardens and moist parts of borders.

Succulent perennial herbs, glabrous, with a fascicle of strong, fibrous roots: lvs. simple, rather rounded-cordate at base: fls. yellow, white or pink; sepals large, deciduous, petal-like; petals none; stamens numerous: carpels sessile, becoming follicles, with 2 rows of seeds. —About 10 species of temperate and frigid regions. Monogr. by G. Beck, in Kaiserlich-Königliche Zoöl. Bot. Gesellschaft (Vienna, 1886), 36:347–363; E. Huth, Monogr. in Helios 9:69–74.

Calthas flourish best in wet places near running water. Though naturally bog-plants, they succeed admirably well in an ordinary border in rather rich soil. They should be introduced more liberally into the flower-garden, where they bloom very freely year after year, and usually mature a second quite abundant crop of bloom in the fall. The flowers last a long time in water, and sell readily in the cut-flower market.

The propagation is naturally accomplished by roots and by seed. The roots divide easily and several of the species send out rootstalks. The divisions may be made best in late fall or mild winter weather. If seeds are used, they must be fresh and given a moist, cool place in partial shade.

biflòra, DC. No true st.: scape slender, usually 2-fld.: lvs. as in *C. palustris:* sepals 6–9, nearly white or sometimes bluish: follicles at maturity distinctly stalked. Spring. Calif. to Alaska.

leptosépala, DC. Stout scape, 8–12 in.: lvs. all basal or barely 1 on st.; nerves at base nearly parallel, otherwise like those of *C. biflora:* sepals 7–10, oblong, becoming narrower, white: fls. solitary: follicles scarcely stalked. May, June. Alaska to Wash. and Colo. Gn. 30:340.

palústris, Linn. Marsh Marigold. St. hollow, 1–2 ft., branching, several-fld.: lvs. cordate or reniform, dentate, crenate or entire: fls. bright yellow, 1–2 in. broad; sepals 5 or 6, rarely 7: follicles compressed, ½in. long. Apr.–June. Wet ground. Carolinas to Canada and westward. Gt. 47, p. 630. Gn. 59, p. 166.—Used before flowering in the spring as "cowslip greens." Var. **monstròsa-plèno,** Hort. (var. *flòre-plèno,* Hort.). An improvement on the above: fls. larger, of greater substance, and often much doubled. Very beautiful. Var. **Tŷermanii,** Hort. A dwarf form with golden fls. G.M. 52:415.

polypétala, Hochst. Two ft. high: lvs. 10–12 in. across: fls. 3 in. across. Caucasus and Asia Minor.—The plant spreads rapidly by stolons and may thus be easily prop. Gn. 69, p. 269.

C. elàta, Duthie. Fls. smaller than in C. palustris, golden yellow with orange-colored filaments and black anthers. Himalaya. Gn.W. 21:666, desc. K. C. Davis.

CALTROPS: *Trapa.*

CALVÒA (apparently a personal name). *Melastomàceæ.* A half-dozen or more herbs and shrubs in Trop. Afr., often succulent, with terete or 4-angled branches, enlarged nodes, long-petioled ovate 3–5-nerved lvs., and red, rosy or violet fls. in scorpioid cymes. None of them is likely to be in commerce for cult., although *C. orientàlis,* Taub., is known in botanic gardens. It is a small shrub with 4-angled sts. producing aërial roots: lvs. nearly ovate, shining green and veined red at the base, the petioles red: fls. red, becoming violet, less than ¾in. across.

CALYCÁNTHUS (*Kalyx* and *anthos,* flower; the calyx is large and conspicuous). Syn. *Butnèria. Calycanthàceæ.* Carolina Allspice. Sweet-scented Shrub. Ornamental shrubs, cultivated chiefly for their fragrant flowers.

Winter-buds small, without bud-scales, hidden by the base of petiole before the lvs. fall: lvs. opposite, petioled, entire: fls. with numerous imbricate sepals and no distinct petals; stamens many, short with innate anthers; pistils many, inclosed in a hollow receptacle: fr. caps.-like, formed like the rose-hip by the calyx-tube and containing numerous achenes.—Four species in N. Amer.

These are deciduous shrubs of aromatic fragrance, with opposite rather large leaves usually rough above and brown or brownish usually fragrant flowers, terminal on leafy branchlets followed by a large capsule-like dry fruit. Except *C. occidentalis*, the species are hardy or nearly hardy North. They grow in almost



752. Calycanthus floridus.

any well-drained and somewhat rich soil, and succeed as well in shady as in sunny positions. Propagated by seeds sown in spring; also increased by layers put down in summer, and by suckers or division of older plants.

A. *Lvs. densely pubescent beneath.*

flóridus, Linn. Fig. 752. Three to 6 ft.: lvs. oval or broad-ovate, acuminate, dark green above, pale or grayish green beneath, 1½–3 in. long: fls. dark reddish brown, fragrant, about 2 in. broad. Va. to Fla. B.M. 503. Gn. 21, p. 184; 33, p. 392.—This species is much cult. for its very fragrant fls. and is the hardiest of all. Var. **ovàtus,** Lav. (*C. ovàtus*, Ait.). Lvs. ovate to ovate-oblong, rounded or subcordate at the base. L.I. 24.

AA. *Lvs. glabrous beneath or nearly so: fls. slightly or not fragrant.*

fértilis, Walt. (*C. férax*, Michx. *C. lævigàtus*, Willd. *C. nàna*, Loisel.). Three to 6 ft.: lvs. usually elliptic or oblong, acute or acuminate, green beneath, 2–5½ in. long: fls. reddish brown, 1½ in. broad; anthers oblong: fr. ovoid, contracted at the mouth as in the preceding species. Alleghanies; from Ga. to N. C. and Ala. B.R. 6:481.—Roots, lvs. and bark used for their antiperiodic properties. Fr. said to be poisonous to sheep. Var. **glaûcus,** Schneid. (*C. glaùcus*, Willd.). Fig. 753. Lvs. usually ovate or oblong-ovate, acuminate, glaucous beneath: fls. paler. B.R. 5:404. Var. **oblongifòlius,** Nutt., with oblong-lanceolate lvs. glaucous beneath.

occidentàlis, Hook. & Arn. (*C. macrophýllus*, Hort.). To 12 ft.: lvs. usually rounded at the base, ovate or oblong-ovate, green beneath and sometimes slightly pubescent, 4–6 in. long: fls. light brown, 3 in. broad; anthers linear: fr. campanulate, not contracted at the mouth. Calif. B.M. 4808. F.S. 11:1113. R.H. 1854: 341. Gn. 33, p. 392.

C. Mòhrii, Small. Shrub, 2–6 ft.: lvs. ovate to oblong-ovate at the base, rounded to subcordate or broadly cuneate, densely pubescent beneath, 2–7 in. long: fls. purple, fragrant, more than 2 in. across. Tenn. and Ala. Little-known species, very similar to C. floridus var. ovatus, but the fr. campanulate and not contracted at the mouth. It has proved hardy at the Arnold Arboretum.—*C. prærcox*, Linn.=Meratia præcox.

ALFRED REHDER.

CALYCOCÁRPUM (Greek, *cup-fruit*, alluding to the stone). *Menispermàceæ*. A tall-climbing vine: genus monotypic. **C. Lŷonii,** Nutt., in rich woods, Ky. to Kans. and south: woody twiner: lvs. large and broad, simple, deeply palmately 3–5-lobed, the lobes pointed: fls. small, greenish, in long racemose panicles, in May and June: fr. a globular drupe, the stone or pit hollowed out on one side, ripe in Aug.

CALYCÓTOME (*Kalyx*, and *tome*, a section or cut; calyx looks as if cut off). *Leguminòsæ*. Ornamental shrubs chiefly grown for their profusely produced yellow flowers; also used for low hedges.

Leaves 3-foliolate, without stipules: fls. papilionaceous; calyx turbinate, truncate, colored; standard upright; keel obtuse, curved, shorter than standard; stamens 10 with the filaments connate; ovary sessile, many-ovuled: pod linear-oblong, along the upper suture winged or strongly thickened, 2-valved.—Five species in the Medit. region.

Calycotomes are low spiny shrubs with small 3-foliolate deciduous leaves and fascicled or solitary yellow papilionaceous flowers. Hardy only in warmer temperate regions. They prefer a sunny position and well-drained soil. For propagation, see *Cytisus*.

villòsa, Link. Two to 4 ft.: branchlets grayish tomentose: lfts. obovate to oblong-obovate, densely silky beneath, under ½in. long: fls. ½in. long, 3 or more, fascicled: pod villous. May, June.—It is excellent for dense low hedges.

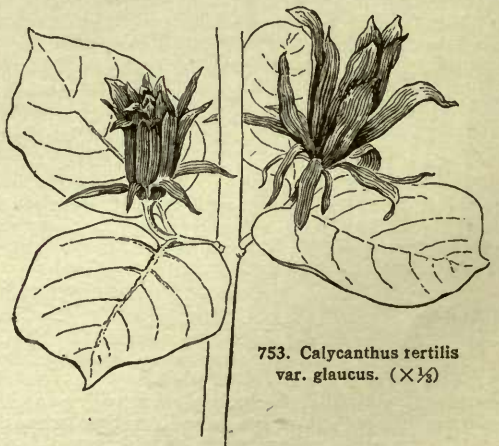
spinòsa, Link. Closely allied, but somewhat larger in every part, and with glabrous branchlets and pods: fls. solitary or few. B.R. 32:55.

ALFRED REHDER.

CALÝPSO (from the Greek goddess, whose name signifies concealment; referring to its rarity and beauty). *Orchidàceæ*. One of the rarest and most prized native orchids.

A delicate bog-plant, 3–4 in. high, with a small bulb, 1 roundish or ovate striated lf., and 1 pink fl. with a spotted sac. For culture, see *Calopogon;* but more difficult to grow than that plant. A monotypic genus.

bulbòsa, Oakes. Fig. 754. Lf. an inch wide and long: scape 3–4 in. high, with about 3 sheaths; sepals and petals similar, ascending, lanceolate, acuminate, pink; lip larger than the rest of the fl., with brown spots in lines and purple and yellow markings, woolly-hairy



753. Calycanthus fertilis var. glaucus. (×⅓)

within; column petal-like, ovate, bearing the lid-like anther just below the apex. Maine to Minn. and N.; also Eu. Abundant in parts of Ore. and Wash. B.M. 2763. G.C. II. 16:656.

CALYPTRÓGYNE (from *calyptra*, hidden, and *gyne*, woman, in allusion to the half-hidden gynœcium). *Palmàceæ*, tribe *Geonòmeæ*. Short, almost completely stemless and unarmed palms with unequally pinnate terminal leaves.

Stems frequently stoloniferous, when present, ringed below: lvs. numerous, often with the pinnate segms. joined together, in extreme youth 4-parted instead of bi-partite as in most related genera; lfts. somewhat irregularly disposed on the rachis, broadly or narrowly scythe-shaped, running at the tip to an abrupt point, at the base revolute; petiole very short or practically none: spadix simple or sometimes branched at the base, long-stalked; spathes 2; fls. a little unequal, with 3 sepals, 3 petals and 6 stamens, the style half immersed in the spadix: fr. oblong or obovoid, 1-seeded.—About 4 species, all from Trop. N. Amer. From Geonoma, a near relative and horticulturally a much more important genus, Calyptrogyne is distinguished only by the almost stemless habit, and the purely technical character of having prominently arrow-shaped anthers. In Geonoma the anthers are pendulous, but not sagittate.

Calyptrogynes are handsome palms, seldom seen outside of large collections. Special care must be given to the soil so that it will be sweet and porous, especially after the plants leave the seed-pan. Well-drained pots and a little charcoal mixed with the soil, and the plants kept in a uniformly moist state, are conditions essential to the healthy growth of the plants. In this genus, *C. Ghiesbreghtiana* is the most widely known species, another garden name for which is *Geonoma Verschaffeltii*. These are shade-loving palms, having leaves of comparatively thin texture, and consequently are subject to attacks of red spider unless properly cared for in regard to moisture. Calyptrogynes are most useful in a small state, old plants in general being rather leggy and poorly furnished. (G. W. Oliver and W. H. Taplin.)



754. Calypso borealis.

glaùca, H. Wendl. (*Geònoma glaùca*, Oerst.). Practically stemless: lvs. 4–5 ft. long, the sheathing petiole brownish, about 1 ft. long; lfts. numerous, about 2–3 in. apart, with 4 principal nerves, and scarcely any secondary ones: spadix simple, differing from the following species in which the spadix is often branched, 2–3 ft. long, the pistillate fls. half hidden in tiny pits. Cent. Amer. G.C. III. 30:179.— Not a common species, but young plants are specially attractive.



755. Camarotis rostrata.

Ghiesbreghtiàna, H. Wendl. (*Geònoma Ghiesbreghtiàna*, Lindl. & H. Wendl. *G. magnífica* and *G. Verschaffèltii*, Hort.). St. short or almost none: petiole 5 ft. long: lvs. elongate-oval; segms. in 6 pairs, unequal, almost opposite, rather remote, lanceolate, very long-acuminate, falcate, the 2 uppermost on each side very wide: spadix often branched below, the fls. half hidden in tiny pits. Chiapas, Mex. B.M. 5782.

C. sarapiguénsis, H. Wendl. St. short: lvs. 6 ft. long. Costa Rica. G.C. III. 29:217, desc.—*C. spicígera*, H. Wendl. St. evident: lvs. irregularly pinnate, 3 ft. or less long, the stalks flat on upper side. Guatemala.—*C. Swártzii*, Hort., is a Geonoma. N. Taylor.

CALYPTROSTÍGMA. *Diervilla Middendorffiana.*

CALYSTÈGIA: *Convolvulus.*

CAMARÒTIS (a *vault*, in reference to the cavity in the apex of the lip). *Orchidàceæ*. Epiphytic hothouse orchids.

Stems elongated, with short lvs., and many-fld. racemes: sepals and petals similar, spreading; lip spurred, 3-lobed; rostellum and anther beaked; pollinia 2, upon long thin stipes.—Species 2, in E. India.

rostràta, Reichb. (*C. purpùrea*, Lindl. *Sarchochìlus purpùreus*, Benth.). Fig. 755. Sts. 2–3 ft. long, climbing: lvs. oblong-linear, bifid at apex, 3–4 in. long: racemes longer than lvs.; fls. crowded, about 1 in. diam., rose-purple, the lip somewhat darker. India. P.M. 7:25.—A scarce plant, now offered in American lists. Free-growing plant with aërial roots similar to some epidendrums. The treatment accorded to the vandas and saccolabiums with similar roots will suit the camarotis. George V. Nash.

CAMÁSSIA (*Quamash* or *Camass* is the Indian name). Sometimes written *Quamasia*. *Liliàceæ*. Camass. West American spring-flowering bulbs.

Leaves all radical, long-lance-shaped, sheathing, from a true bulb that is pointed and with a rounded rather flattened base: sts. erect, 2–3 ft., bearing many bracted blossoms that open from the bottom of the raceme upward, in long succession: fls. blue, purple, white or cream, with 6 spreading 3–7-nerved segms.,

6 thread-like filaments, filiform style, and 3-angled, 3-valved, several-seeded caps.—Five or 6 species in the temperate regions of W. N. Amer. from Cent. Calif. to Brit. Col. and east to Texas and Ark. They have resemblances to Scilla, but are much handsomer. The bulbs produce no offsets unless wounded. All the



756. Camassia Cusickii. (fls. ×½)

species vary greatly in width of lvs., size and number of fls., so that definite figures mean little. The large bulb and broad bluish lvs. of *C. Cusickii*, the heavy st., regular fls., and twisted old segms. of *C. Leichtlinii*, the irregular fl. and drooping segms. of *C. Quamash*, and the time of flowering of *C. Howellii*, are good general characters to distinguish them.

Camassias are natives of rich meadows, very wet in winter and spring but dry in summer. Water often stands on the surface at flowering time. While the very best success can perhaps be attained by giving them a rather heavy soil with abundant moisture in the early season, they are most amenable to cultivation and thrive in any loam (only avoiding too rank manures), and they are perfectly hardy. They have been thoroughly tested throughout the region from Illinois east. Plant in early fall, from 3 to 4 inches apart and 3 to 6 inches deep, and do not disturb thereafter. As cut-flowers, they are excellent as they open in long succession. Seeds grow readily, but from three to four years are required to make flowering plants.

Cùsickii, Wats. Fig. 756. Bulbs very large (weighing 4–8 ozs.): lvs. numerous, broad, glaucous, somewhat undulate (15 in. long by 1½ in. wide): st. often 3 ft. high: fls. 30–100, very pale delicately blue; segms. spreading, crinkled at base, faintly 3–5-nerved. Ore. G.F. 1:174 (adapted in Fig. 756).—The very large bulb and broader and more numerous lvs. easily distinguish this species. Very easily grown.

Quâmash, Greene (*C. esculénta*, Lindl.). Common Camass. Fig. 757. This species varies greatly; some forms are low and slender, others 2–3 ft. high, stout and many-fld.; it can be distinguished by the irregular perianth in which 5 segms. are more or less on one side and 1 on the other: lvs. ⅔in. broad or less: fls. 10–40, varying from almost white to intense ultramarine in the varieties; segms. 3–5-nerved and a little longer than the stamens, narrow and channeled at the base; pedicels not exceeding the fls.: caps. ovate-oblong, obtuse, transversely veined. Calif. to Utah and north to Brit. Col. B.R. 1486. F.S. 3:275. Gn. 46:338 and p. 339.—Bulb cooked and eaten by the Indians. The fls. vary to white. The large ultramarine form is the one in the trade. The withered segments fall down about the pedicel irregularly.

Leìchtlinii, Wats. Stout, often 3 ft. or even more in height: fls. white, cream-colored, blue or purple, nearly regular; stamens and style ascending; segms. broad and flattened at the base, usually 5–7-nerved: caps. oblong-ovate, emarginate, obliquely veined. The withered segms. of the perianth twist about the caps. like bonbons; this is an infallible distinctive mark of the species. *C. Leitchlinii* is not common, but is distributed from Mendocino Co., Calif., to Brit. Col. B.M. 6287 (as *C. esculenta* var. *Leichtlinii*, Baker).—In Mendocino Co., a clear blue form grows rarely in mountain meadows. In the Umpqua Valley, Ore., the type is clear cream approaching white. In the same region and farther north, a very large deep blue or purple form is found, while in Brit. Col., the cream-colored form again appears but is rare. At their best, the sts. are stiff and heavy, the fls. large and many, and the masses of bloom approach the Eremurus in beauty and are even finer in separate fls. *C. Leichtlinii* is the finest of all camassias. Several color forms are described, as var. *atroviolàcea*, deep purple, and others.

Hôwellii, Wats. Bulb rather small: lvs. few, 1 ft. long and less than ½in. wide: st. often 2 ft. high, many-fld., with spreading pedicels twice or more the length of the linear bracts: fls. pale purple, opening in the afternoon, the segms. ½in. long, 3–5-nerved; pedicels longer than the fls.: caps. small, broadly ovate and very obtuse. S. Ore. Intro. by Pilkington & Co., 1892.

esculénta, Robbins. (*C. Fràseri*, Torr.). Scape 12–18 in. high: lvs. keeled: fls. light blue, smaller than in *C. Quamash;* segms. 3-nerved; pedicels mostly longer than fls. Pa., west and south. B.M. 1574 (as *Scilla esculenta*).

Var. **angûsta** (*C. angûsta*, Hort.). Very slender, and lvs. narrower (¼in. wide): fls. smaller, ⅓ or ¼in. long. La. and Ark. to Texas.



757. Camassia Quamash. (× ½)

Carl Purdy.

CAMÉLLIA (after George Joseph Kamel or Camellus, a Moravian Jesuit, who traveled in Asia in the seventeenth century). *Ternstrœmiàceæ.* CAMELLIA. Woody plants, chiefly grown for their showy white or red flowers and also for their handsome evergreen foliage.

Evergreen trees or shrubs with alternate short-petioled serrate lvs. and large terminal or axillary white or red fls. followed by subglobose woody caps.: fls. sessile, upright; sepals many, imbricate, deciduous; petals 5 or more; stamens numerous, more or less connate; ovary 3–5-celled, with slender styles connate, at least below: fr. a dehiscent caps., with few large subglobose seeds.—About 10 species in tropical and subtropical Asia. Often united with Thea, which differs in its nodding and stalked fls. with a persistent calyx consisting of 5 nearly equal sepals. There is a monograph of this genus by Seemann in Trans. Linn. Soc. 22:337–352 (1859) and by Kochs in Engler Bot. Jahrb. 27:577–634 (1900). Illustrated monographs of the horticultural varieties are: Curtis, Monogr. of the genus Camellia (1819); Baumann, Bollweiler Camelliensammlung (1828); Chandler, Camellieæ (1831); Berlèse, Monogr. du genre Camellia a (1839); Verschaffelt, Nouvelle Monographie du Camellia (1848–1860): the last with 576 and the previous one with 300 colored plates.



758. Camellia japonica—Abby Wilder.



759. Camellia japonica—Lucida.

Camellias grow like natives on sandy lands and even on high pine land in central Florida, but they flower best in half-shady somewhat moist places. The half-double varieties of *Camellia japonica* do best, while the very double kinds often drop their buds entirely. The flowers suffer very much from the sun and cannot be grown much farther south than central Florida. *Camellia Sasanqua*, single, half-double and double kinds, grow much more satisfactorily than the varieties of *C. japonica*. They begin to flower late in October and early November, and the double white *C. Sasangua* is a mass of pure white usually at Christmas time. All the varieties of *C. Sasanqua* have somewhat fragrant flowers. *C. reticulata* does equally well in Florida. It is very distinct in foliage from the two former species which have glossy leaves, while the leaves of *C. reticulata* are dull green. All the camellias are extremely slow growers if not carefully cultivated and fertilized. A mulch of old cow-manure, now and then a little commercial fertilizer, and thorough watering during the dry season several times a week start the bushes into a vigorous and healthy growth. They are so extremely beautiful when in flower that all the care given them is well repaid. (H. Nehrling.)

A. *Ovary and lvs. perfectly glabrous.*

japónica, Linn. (*Thèa japónica,* Nois.). Figs. 758–761. Shrub or tree, sometimes to 40 ft., glabrous: lvs very shining and dark green above, ovate or elliptic, acuminate, sharply serrate, 2–4 in. long: fls. red in the type, 3–5 in. across; petals 5–7, roundish. China, Japan. B.M. 42. S.Z. 82. F.S. 20:2121. S.I.F. 1:73. Gn. 24, p. 411; 28, p. 203; 36, p. 241. Var. **álba,** Lodd. Fls. white. L.B.C. 7:636. Gn. 54, p. 243. J.H. III. 54:227; 64:397. Var. **álba-plèna,** Lodd. Fls. white, double. L.B.C. 3:269. Gn. 53, p. 244. Var. **anemoniflòra,** Curtis. Fls. red, with 5 large petals, the stamens changed into numerous smaller and narrow petals; the whole fl. resembling that of a double anemone. L.B.C. 537. B.M. 1654. Gn. 44, p. 329. Var. **magnoliæflòra,** Hort. Fls. pale rose, semi-double, with 12–15 petals rather narrow and half upright. Gn. 76, p. 31. Var. **apucæfórmis,** Rehd. (*C. apucæfórmis,* Jacob-Mackoy). Lvs. bifid at the apex.—For the numerous other garden forms, see the above-mentioned monographs; also, Flore des Serres, L'Illustration Horticole, and other older horticultural publications contain a large number of varieties with illustrations.

AA. *Ovary and lvs. on the midrib above pubescent.*

reticulàta, Lindl. (*Thèa reticulàta,* Pierre). Large shrub, glabrous: lvs. dull green, not shining above, reticulate, flat, elliptic-oblong, acuminate, serrate, 3–5 in. long: fls. 5–7 in. across, purplish rose; petals 15–20, obovate, loosely arranged. China. B.R. 13:1078. B.M. 2784. P.M. 3:101. G.M. 35: suppl. Apr. 2. F.W. 1880:321. G. 25:59. Var. **plèna,** Hort. Fls. with twice as many petals, and more regularly arranged. B.M. 4976. F.S. 12: 1279–80.



760. Camellia japonica—H. A. Downing.

Sasánqua, Thunb. (*Thèa Sasánqua,* Nois.). Shrub of loose, straggling habit, and with the branches pubescent when young: lvs. elliptic to oblong-ovate, bluntly pointed at the apex, crenate-serrate, shining, dark green and hairy on the midrib above, 1–2 in. long: fls. 1½–2 in. across, white; petals 5 or more, obovate or oblong. China, Japan. Gn. 54:142. S.Z. 83 (except the red vars.). S.I.F. 2:52. J.H. III. 43: 131. G.M. 36:51. Runs into many forms. Var. **semi-plèna,** Hort. Fls. semi-double, white. B.R. 1:12; 13:1091. Var. **anemoniflòra,** Seem. Fls. large, double, outer petals white, inner ones much smaller, yellow. B.M. 5152. Var. **oleòsa,** Rehd. (*Thèa Sasánqua* var. *oleòsa,* Pierre. *C. oleífera,* Lindl.). Of more robust habit, with lvs. and the single white fls. larger than in the type. B.R. 11: 942. L.B.C. 11:1065. Var. **Kíssi,** Rehd. (*Thèa Sasánqua* var. *Kissi,* Pierre. *C. Kissi,* Wall.). Lvs. oval-oblong to ovate, long-acuminate, to 3½ in. long. Himalayas.



761. Camellia japonica—President Clark.

C. axillàris, Roxbg.=Gordonia anomala.—*C. cuspidàta*, Hort.=Thea cuspidata.—*C. drupífera*, Lour. Shrub, to 8 ft.: lvs. elliptic, long-acuminate: fls. 1½ in. wide, fragrant, white, petals obovate. Himalayas, India. L.B.C. 19:1815.—*C. euryoides*, Lindl. =Thea euryoides.—*C. euryoides*, Hort.=Thea maliflora.—*C. hongkongénsis*, Seem. (Thea hongkongensis, Pierre). Tree with glabrous branches: lvs. ovate-lanceolate to lanceolate, indistinctly serrate, lustrous above, coriaceous, 3–4 in. long: fls. red, 2 in. across; petals slightly emarginate; ovary pubescent. Hongkong. Trans. Linn. Soc. 22:60.—*C. maliflòra*, Lindl.=Thea maliflora.—*C. rosiflòra*, Hook.=Thea maliflora.—*C. sinénsis*, Kuntze=Thea sinensis.—*C. spectàbilis*, Champ.=Tutcheria spectabilis.—*C. Thèa*, Link=Thea sinensis.

ALFRED REHDER.

CAMOÉNSIA (Louis Camoens, Portugese poet). *Leguminòsæ*. Two species of climbing shrubs from W. Trop. Afr., with digitately 3-foliolate lvs., and large papilionaceous fls. Calyx top-shaped; petals with long claws, the standard orbicular or nearly so; stamens free; ovary stipitate, with many ovules, the stigma small and capitate: fr. a broad-linear flattened 2-valved pod. **C. máxima**, Welw., has recently been offered by an English firm. Described by Baker as "a magnificent species" and by Bull as "one of the most gorgeously beautiful of tropical climbers:" lfts. obovate-oblong, 5–6 in. long, cuspidate: fls. milk-white tinged with gold and frilled on the edges of the petals, in short-stalked 6–8-fld. axillary racemes; standard projecting 4 in. beyond the calyx, 3–4 in. broad; other petals shorter and not more than 1 in. broad: pod 6–8 in. long. Trans. Linn. Soc. 25:36. B.M. 7572. G.C. III. 20:597.

L. H. B.

CAMPÁNULA (Latin, *little bell*, from the shape of the corolla in some species). *Campanulàceæ*. BELLFLOWER. HAREBELL. BLUEBELL. A large group of attractively flowering herbs, containing some of the most popular garden plants, especially of hardy herbaceous perennials.

Annual, biennial or perennial, mostly the last, often small and tufted: root-lvs. usually larger than the st.-lvs., and often of different shape and more or less transitory: fls. blue, violet or white, sometimes yellow; calyx 5-fid; corolla 5-lobed or 5-fid; stamens 5, free; filaments wide at the base, membranaceous; stigmas 3 or 5, filiform: caps. 3–5-valved, dehiscing on the sides or (as in Fig. 762) at the base by 3–5 small valves; seeds ovate, complanate or ovoid.—Probably 250 species, nearly all in the northern hemisphere with the center of distribution in the Medit. region; about a dozen species are N. American. The species mostly inhabit swamps or moist ground, or alpine and boreal regions. Allied genera of garden value are Adenophora, Jasione, Lightfootia, Michauxia, Ostrowskia, Phyteuma, Platycodon, Specularia, Symphyandra, Trachelium, and Wahlenbergia, in which genera many species originally described as campanulas may be sought. Of these, perhaps the two best known cases are *Platycodon grandiflorum*, the "balloon flower," with its characteristic inflated buds, dark green, glossy, leathery lvs.; and *Specularia Speculum* (*C. Speculum*), "Venus' looking-glass," a pretty annual, which grows in the grain fields of S. Eu., and is cult. for its violet fls. with a white eye. The calyx-tube of Specularia is relatively much longer than in any campanula. The most prominent campanulas now in cult. seem to be the forms of *C. Medium*, *C. carpatica*, *C. persicifolia*, *C. pyramidalis*, *C. punctata*, *C. pusilla* (*cæspitosa*), *C. rotundifolia*.



762. Capsule of Campanula with basal dehiscence.

Botanically, campanulas fall into two important groups, based on the presence or absence of calyx appendages. The subgenus Medium has the appendages, and Eucodon lacks them. These appendages are often small and disguised. The genus may also be thrown into two broad groups based on the dehiscence, —the subgenus Medium with capsule opening near the base, and Rapunculus with the openings near the top. For the horticulturist, the most serviceable classification is based on the use that he makes of the plants, —whether as a garden vegetable, as border plants, or as rock-garden or alpine subjects; and this is the division attempted here. In cultivation, campanulas tend to become taller and more robust, less hairy, more branched, and more floriferous. Blue is the prevailing color in the genus. A very few have white or yellowish flowers, with no blue or violet forms. Any blue or violet-flowered form is likely to have white varieties, and double and semi-double forms are common in three or four of the most popular species. All flowers tend to become larger and more numerous on a stem. In cultivation, the three-celled species are likely to have five stigmas instead of three, and five-celled capsules, often along with normally constructed flowers on the same plant. The height is the most variable feature of all, and in the scheme below *C. carpatica*, *C. punctata* and forms of *C. glomerata* especially will seem wrongly placed to many. But the characters used by botanists are well-nigh useless to the gardener, and nothing but a distinction of height can bring out the two important cultural groups of campanulas. For a recent garden monography of dwarf campanulas, see Correvon, "The Garden," 59 (1901) pp. 276, 450; 60, pp. 51, 64, 111, 161, 218.

Cultivation.—The genus Campanula is extraordinarily rich in flowering garden plants of merit. The alpine section is distinguished by a charming grace both in character of growth and size and bearing of flowers. The peach-leaved class (*C. persicifolia*) is characterized by the noble and beautiful form of single and semi-double blossoms carried by thin erect stems 2–3 feet high. The luster and clearness of tints of the bushy biennial Medium and calycanthema type are remarkable, while the rambling habit and the marvelous floriferousness of the varieties *C. isophylla* and its descendant *C. Mayii*, indicate the wide range of ornamental usefulness of bellflowers. Considering the good lasting qualities in a cut state and the great popularity of the flowers of long-stemmed sorts for indoor decoration, it is safe to say that campanulas will steadily gain in importance as material upon the florists' counter as well as for garden planting. The greatest curiosities are *C. punctata*, *C. macrostyla*, *C. Zoysii* and *C. rotundifolia* var. *soldanellæflora*. For exhibition and for pot culture and also for large single specimens, *C. pyramidalis* is most used. For edgings, *C. carpatica* is perhaps the favorite. Of all wild forms, the best known is certainly *C. rotundifolia*, the true harebell, or "blue bells of Scotland." It is native in North America as well as in Europe, on rocky banks and shores. —Wherever rock-gardens are planned, alpine campanulas have become indispensable. The greater part of typical mountain inhabitants chiefly available for this purpose being spring-flowering plants, the summer flowers of campanulas are especially welcome. One of the best bellflowers for rock-gardens is *C. carpatica*, blue and white, with its var. *compacta* also in blue and white, var. *cælestina*, sky blue, var. *pelviformis*, light blue, and var. *Riverslea* with large dark-blue bells; but there are a number of other very handsome species possessing commercial value that deserve the attention of progressive growers. The demand is for a plant material easy to handle, resistant and free-flowering. As such may be recommended for rockeries, *C. garganica* and *C. garganica* var. *hirsuta*, both 4 inches high, flowers light blue. *C. pusilla*, in white and blue, is regarded as the hardiest low-growing alpine bellflower. Excellent effect may be secured from a number of the garden hybrids, when rightly employed; plantations of *C. Wilsonii*, cross between *C. pulla* and *C. turbinata*, dark blue, 6 inches tall, and *C. Fergusonii* and *C. Hen-*

dersonii, 12 to 18 inches, all blooming freely from late in June to early August, are good examples. *Campanula glomerata* var. *acaulis*, a clustered-flowering low-growing form, violet-blue, June and July, answers the same purpose, while *C. glomerata* var. *dahurica*, 12 to 18 inches, dark violet-blue and white, very free-flowering, is valuable also as a border plant. Other good rockery kinds are *C. fragilis* (which needs protection, but makes a good pot-plant), *C. pulla* in sheltered position, *C. Portenschlagiana*, and *C. rotundifolia*. Many of the larger-growing kinds are also good for the rock-garden. —The best two representatives of the biennial class, are *C. Medium* and *C. calycanthema*, both standard garden flowers. In the northern states, especially, they do exceedingly well. When used for mass effects, their full bloom becomes a prominent feature of June. The delicate shades of pink and pale lavender, the purity of the white, and the rich tints in purple and blue are a revelation. They transplant very easily, even in an advanced state of growth, and readily respond to mild forcing under glass in spring. In a cut state, they show remarkably good lasting qualities and are of excellent value as material for filling vases. A few other good biennials are *C. sibirica*, *C. primulæfolia*, *C. spicata*, (p. 650), *C. thyrsoides*.—The peach-leaved section comprises the most perfect forms of the bellflower family, although *C. persicifolia* has been surpassed in popular favor by the more vigorous *C. grandiflora* varieties in white and blue, which are really platycodons. *C. isophylla*, native of Italy, is not hardy in Maine and must be overwintered under glass. It is a very effective basket- and balcony-box plant, its long hanging vines being covered with large and attractive flowers in July and August. The color is a delicate light blue, while the bells of its garden descendant *C. Mayii*, have a deeper shade. For the South, both are valuable acquisitions for rockeries.—Of the perennial species, according to Robert Cameron, the best border plants are the following: *C. carpatica* and vars. *alba* and *turbinata*; *C. glomerata*, especially var. *dahurica*; *C. lactiflora*; *C. latifolia*, especially its vars. *eriocarpa* and *macrantha*; *C. nobilis* (about 2 ft. in height); *C. persicifolia* and its numerous vars., especially the white kinds; *C. punctata* (about 1½ ft.); *C. pyramidalis*, a very showy plant when well grown, but not quite reliable in the eastern states as to hardiness, making a good pot-plant for the cool greenhouse; *C. rapunculoides*, which spreads rapidly and must be so placed that it will not crowd out the other plants that are near it; *C. rotundifolia*; *C. Trachelium*; *C. Van Houttei*, a hybrid, and one of the best bellflowers.—Campanulas are raised from seed and also by division or cuttings. Seeds should be started early under glass. Cover very shallow, and place the shallow seed-pans near the light in an average temperature of 60°. Shade at midday while in process of germinating; avoid over-watering and "sticky" atmosphere. Transplant seedlings into flats as soon as they can be handled. Harden young plants gradually and transfer them to the open ground in May. *C. Medium*, *C. calycanthema*, and all the *C. persicifolia* varieties, when grown for the cut-flower trade, should be placed on beds where they are intended to be flowered and cropped the next season. They thrive best in a rather light well-manured garden soil. Some of the alpine species require a sandy humus with additions of fine limestone material. When grown for floral garden effect, the open sunny position is preferable throughout the North, while for the South half-shade at midday is likely to prolong the flowering season. Seedlings of single varieties come true to color to a high percentage. Of the semi-double and double *C. persicifolia* sorts, propagation is usually by division in September. *C. isophylla* and *C. Mayii* are shy seeders and are propagated by cuttings in spring. For winter protection, a light covering of straw, leaves or evergreen boughs is sufficient south of New York. In more northern parts, hardy campanulas require a uniform layer of leaves 2 to 3 inches thick. The annuals can be raised in the border by seeds sown late in April or May, or raised in the greenhouse and then transferred to the border. The best of the annuals are *C. ramosissima* and var. *alba*, *C. drabifolia*, *C. Erinus*, *C. macrostyla*, and *C. americana*. (Richard Rothe.)

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GROUP I. *Kitchen-garden vegetable: roots radish-like: a salad plant.*

1. **Rapúnculus**, Linn. (*Rapúnculus vèrus*, Fourr.). RAMPION. Fig. 763. Biennial or perennial, 2–3 ft.: root spindle- or long-radish-shaped, ½in. thick, white: st. erect sulcate: lower lvs. obovate, short-petioled, somewhat crenate; st.-lvs. linear-lanceolate, entire: fls. calyx-tube obconical, lobes lilac, in a spike or raceme; glabrous or bristly, erect, awl-shaped, a half shorter than or nearly equal to the funnel-shaped corolla. Eu., Orient, N. Asia, N. Afr.—The roots and lvs. are eaten as a salad. The seeds, which are very small, are sown in the open ground in early May either broadcast or in drills. A little sand mixed with the seed gives an evener sowing. Press firmly, and water carefully. Thin out the seedlings if necessary. Water freely in hot weather. A fresh sowing may be made in June, as early-sown plants may run to seed. Roots are gathered in Oct. and may be stored in sand for winter use. "Rapunculus" means a little turnip.



763. Root of rampion—Campanula Rapunculus.

GROUP II. *Tall or border campanulas, characteristically a foot or 15 in. or more high. Nos. 2–23.*

A. *Calyx with an appendage at the base of each sinus.*

B. *Caps. 5-celled and stigmas 5 (variable in No. 3).*

C. *Style excessively long, the stigma an inch or more long.*

2. **macróstyla,** Boiss. & Heldr. Annual, 1–2 ft., branched from the base, hispid with rigid spreading scattered bristles: branches stout: lvs. scattered, small for the size of the plant, sessile, bristly on both surfaces; lower ones ovate-oblong, acute; upper ovate-lanceolate, recurved, cordate, eared at the base: calyx-tube hidden by the bladdery appendages, small, broader than long; fls. solitary; on stout peduncles, 2–2½ in. broad; corolla very broad and open, pale purple without, dull purple within, marked with violet, and hairy toward the bottom; lobes very broad, short and acute. Mt. Taurus in Anatolia. Gn. 15: 356 and 12, p. 209. B.M. 6394. —The very long exserted style is brown and spindle-shaped before spreading open. Self-sown seeds sometimes remain a year before sprouting.



764. Campanula Medium, the Canterbury Bell. Modified forms are shown.

CC. *Style not excessively long.*

3. **longéstyla,** Fomine. Perennial, 1½–2½ ft., more or less hairy: basal lvs. lance-oval, lobed, the st.-lvs. oblong and sessile: fls. blue-purple, drooping; calyx-lobes lanceolate-pointed, the appendages reflexed on the peduncle; corolla almost urn-shaped, dilated below the middle; style exserted with 3, 4 or 5 stigmas: caps. 3–5-celled. Caucasus. Gn. W. 23:671. Var. **parviflòra,** Bois. Fls. smaller. R.H. 1911:548; p. 549.

4. **Mèdium,** Linn. (*Mèdium grandiflòrum,* Spach). CANTERBURY BELLS. Fig. 764. Biennial, 1–4 ft.; plant pilose: st. erect: lvs. sessile, ovate-lanceolate or lanceolate, crenate-dentate: raceme lax, many-fld.; fls. violet-blue, varying to several shades and to white, 2 in. long; calyx-lobes ovate-acuminate, the appendages half as long as the ample ovate obtuse lobes; corolla bell-shaped, inflated. S. Eu. Gn. M. 14:9. Two forms (aside from the single-fld.) occur: the double, Fig. 764*a*, with 1–3 extra corollas, and the var. **calycánthema,** Hort., Fig. 764*b*, with an enlarged spreading and petal-like outer part sometimes deeply divided and sometimes little lobed or nearly entire (varying on the same plant). The var. *calycanthema* is the CUP-AND-SAUCER form (the name hose-in-hose, sometimes applied in Campanula, would better be retained for *Primula elatior*); a fair percentage come true from seed; usually a stronger plant than the common *C. Medium.* G.C. III. 24:65. R.H. 1896, p. 301; 1897, p. 238. Gng. 5:88. Gn. 48, p. 295. F.S. 19, p. 152. G.W. 3, p. 291. G.Z. 17: 113. Var. **Wiègandii,** Hort. Lvs. golden yellow: fls. blue. Var. **imperiàlis,** Hort., is a very floriferous form or possibly a hybrid. —Canterbury bells are most commonly treated as hardy biennials, the seed being sown in the open border, but they do not flower the first year. They can also be treated as tender annuals, the seed being sown indoors in early spring and the plants set out May 1–15. They will then flower well the first season, but always better the second year. Sowings may also be made in April, May or later, in pots, boxes or beds, and plants then be transferred into some sheltered place where they can be slightly protected during the winter, and then transplanted in spring to their permanent places into good rich soil, where they will make a great show if they have had the right treatment. Let them stand 18–24 in. apart. Seedlings potted up in autumn may be brought into bloom readily indoors in spring; and even blooming plants, if not spent, may be potted direct from the garden and used in the house in autumn.

BB. *Caps. 3-celled: stigmas 3.*

5. **alliariæfòlia,** Willd. (*C. lamiifòlia,* Bieb. *C. macrophýlla,* Sims). Perennial, 1½–2 ft.: st. erect, striate, woolly, branched only at the top: root-lvs. large, heart-shaped, crenate, tomentose; st.-lvs. on petioles which gradually shorten upward, the highest being sessile: fls. white, nodding, on short stalks, borne singly in the axils of the floral lvs. as in *C. sarmatica,* but the floral lvs. larger and broader; calyx a third or a fourth shorter than the corolla, with margins rolled back, and appendages less minute than in *C. sarmatica;* corolla always white, 2 in. long, ciliated at the margin, and with characteristic tooth-like processes at the base of each sinus. Caucasus, Asia Minor. B.M. 912. Gn. M. 14:9.

6. **sarmática,** Ker-Gawl. Perennial, 1–2 ft.: st. simple, striate, pubescent: lvs. remarkable for their gray color, harsh, leathery, wrinkled, tomentose, oblong-cordate, crenate, the lower long-petioled, the upper sessile: calyx with minute reflexed appendages, and a short, densely hairy tuft: fls. about 6 on a st., nodding; corolla about 1 in. long, and 1½ in. across, pale blue, marked with 5 hairy lines. Caucasus, in subalpine places. B.M. 2019. L.B.C. 6:581.

7. **Gròssekii,** Heuff. Has the habit and infl. of *C. Trachelium,* but the calyx is appendaged; perennial, 2½ ft., branching from the base, angled, pilose: lvs. hispid, the lower cordate, unequally petioled, doubly crenate-serrate, the uppermost ovate-acute, narrowed into a petiole: calyx setose-ciliate, lobes spreading, reflexed at the apex, appendages lanceolate, a third shorter than the lobes; corolla hispid, 2 or 3 times longer than the calyx-lobes: fls. large, bell-shaped, violet, in a long raceme. Hungary. Gt. 35, p. 477. G. 27:459.

8. **mirábilis,** Alboff. Biennial or short-lived perennial, 1 ft. or more; whole plant forms a broad dense cone with such a profusion of bloom as almost to hide the foliage: lower lvs. 4–6 in. long, obovate or spatulate, obtuse, coarsely toothed, petiole winged: fls. pale lilac, erect, broadly campanulate, 2 in. across, the corolla hairy on margins and back. Caucasus. B.M. 7714. G.C. III. 24:33; 42:144–5. Gt. 47, p. 192. Gn. 54, p. 454; 60, p. 58. G.W. 12, p. 445.—A very beautiful and remarkable plant.

AA. *Calyx without an appendage at the base of each sinus.*

B. *Fls. rotate or wheel-shaped.*

9. **americàna,** Linn. Annual and biennial, 3–6 ft.: st. erect, simple: lvs. thin, serrate, somewhat pilose;

root-lvs. ovate-acute, subcordate, petiolate; st.-lvs. ovate-lanceolate, acuminate at both ends: calyx-tube long, obconical, the teeth linear-acuminate, almost entire, spreading, shorter than the 5-fid, wheel-shaped corolla; fls. light blue, 1 in. broad, in long spikes, solitary or in 3's; corolla shallow, lobes pilose outside and at the apex; style long, strongly declined and upwardly curved: caps. cylindrical, grooved. Shaded low ground Canada to Iowa, south to Fla. and Ark.—Rarely cult. It is possible that *Phyteuma canescens* is still cult. as *C. americana.*

BB. *Fls. saucer-shaped or broadly bell-shaped, i. e., the tube shallower and the limbs more widely spreading than the bell-shaped.*

C. *St.-lvs. linear-lanceolate, crenulate.*

10. **persicifòlia,** Linn. Fig. 765. Perennial, 2–3 ft.: st. erect: lvs. glabrous, rigid, crenulate; root-lvs. lanceolate-obovate; st.-lvs. linear-lanceolate or spatulate, often 3 in. long: calyx-lobes acuminate, wide at the base, entire, half as long as the broadly bell-shaped corolla: fls. blue or white, pedicelled, solitary, terminal and axillary, often 1½ in. long, 2 in. broad: caps. ovoid, 3-grooved. Eu. B.M. 397. G.C. III. 43:384. Gn. 75, p. 30. G. 6:297. Gn. M. 14:9. G.W. 3, p. 292. C.L.A. 13:478; the white form in G. 13:71 and Gn. W. 23:Suppl. Jan. 27; the double white in G.C. III. 27:409 and G. 3:563. One of the best of all perennial campanulas. Var. **macrántha** is a large-fld. form with fls. all along the st. Gt. 44, p. 148. Gn. 48, p. 306. A.F. 6:383. S.H. 1:131. Var. **álba grandiflòra** and var. **Bäckhousei** are among the popular white-fld. forms. There are double and semi-double forms in blue and white. The double white is useful for cutting. For portraits of var. *grandiflora,* see G. 27:458; 28:553, 673; G.W. 12, p. 433. Var. **coronàta,** Hort., is a semi-double white form. F.S. 7:699. The pictures in B.M. and F.S. show distinctly saucer-shaped fls. Var. **Moerheìmei,** Hort. White-fld., double, 2–3 in. diam.: excellent. G.C. III. 27:414. G.M. 49:535. G.W. 6, p. 545; 12, p. 434. A.G. 23:497. Var. **marginàta,** Hort., has white fls. tinted blue on the borders. R.B. 32, p. 252. This species occasionally runs wild, especially in England. The lvs. are very characteristic, and, once seen, are never forgotten.

CC. *St.-lvs. wider and coarsely toothed.*

11. **latíloba,** DC. (*C. grándis,* Fisch. & Mey.) Perennial, 1–1½ ft., glabrous: st. erect, simple, terete: st.-lvs. 3–5 in. long, 4–6 lines wide, lanceolate, narrowed at both ends, crenate-serrate: calyx-lobes ovate-acute, broad, entire, erect, one-half shorter than the broadly bell-shaped corolla: fls. blue, often 2 in. wide, sessile, solitary or somewhat clustered, sometimes equaling the ovate-acute, dentate bracts. Mt. Olympus. P.M. 10:31. H.U. 3, p. 137. Gt. 7:202.—Fls. like *C. persicifolia.* Quickly forms a dense carpet. Variable in color. Var. **álba,** Hort. White fls. G. 19:440.

BBB. *Fls. bell-shaped or tubular, not saucer-shaped.*

C. *Infl. a dense roundish head.*

12. **glomeràta,** Linn. One of the most variable: perennial, 1–2 ft., typically pubescent: st. erect, simple, terete: lvs. serrulate, lower ones rough with very short, stiff hairs, 1½–3 in. long, 1–2 in. wide, with a cordate, ovate-oblong blade shorter than the petiole; upper ones sessile, ovate, acute: fls. violet-blue to white, in dense heads or glomes, 15–20 in the terminal heads, fewer in axillary ones. Eu., Armenia, Persia, Siberia; sometimes escaped in this country. Gn.M. 14:9. B.M. 2649 is var. **speciòsa,** which has the largest fls. L.B.C. 6:505 is var. **sparsiflòra,** with much smaller clusters.—This is one of the earliest flowering and easiest of cult. Fls. typically dark purple, running into lighter varieties. Var. **dahùrica,** Hort., is probably the commonest form: terminal clusters 3 in. or more thick, a very characteristic infl. The fl. has a longer tube than *C. lactiflora* and *C. thyrsoides.* G. 26:305. Var. **acaùlis,** Hort., is an almost stemless form with very large fls.: sts. only 3–5 in. high. G.W. 9, p. 272. Var. **supérba,** Hort., is a cross of the dwarf variety with var. *dahurica:* large heads of deep violet fls.

CC. *Infl. a spike or raceme, dense or loose.*

D. *Color of fls. normally white or yellowish.*

E. *Corolla small, short-tubed.*

13. **lactiflòra,** Bieb. Perennial, 2½–6 ft.: st. erect, branching: lvs. sessile, ovate-lanceolate, acutely serrate: calyx-lobes very broad, acute, serrulate, one-half shorter than the broadly bell-shaped corolla: fls. in a loose or dense panicle, which may be 3½ in. long and thick; corolla white or pale blue, 1 in. long, nearly 1½ in. broad: caps. ovoid, erect. Caucasus, Siberia. B.M. 1973. G.C. III. 50:438. Gn. 61, p. 29; 63, p. 90; 71, p. 418; 75, p. 89. G.M. 46: 168; 48:545. Gn. W. 23:623. The normally milk-white blue-tinged fls. are characteristic. Var. **cœrùlea,** Hort., has light blue fls.—*C. celtidifòlia,* Boiss., referred to the above, may be a strongly marked variety. *C. biserràta,* Koch, is also referred here.



765. A narrow-flowered form of Campanula persicifolia.

14. **thyrsoìdes,** Linn. Biennial, 1–1½ ft.; st. grooved: lvs. all covered with long hairs at the margin; root-lvs. sessile, spatulate or obtusely lanceolate, 2½ in. long, ¾in. wide, in a dense rosette, lying on the ground; upper lvs. more narrow and acute: fls. 40–50, sulfur or creamy yellow, in a dense thyrse-like spike, which may be 6 in. long and 2½ in. broad; style exserted. Alps and Jura, 3,000–6,000 ft. B.M. 1290. L.B.C. 17:1644.—Intermingled with the fls. in the spike are lvs. which are longer than the fls., which is not true of *C. lactiflora.* Should not be confounded with *C. thrysoidea,* Lapeyr., which = *C. speciosa,* (see supplementary list). Apparently no blue or purple forms are known. The picture in B.M. shows a characteristic red-tipped calyx. Garden hybrids are reported with *C. spicata* (see Kew Bull. 1910, p. 322).

EE. *Corolla large, long-tubed.*

15. **Vidálii,** H. C. Wats. Perennial, 1–2 ft.: st. branching from the base: some branches short, sterile, others tall, floriferous, all grooved, clammy, glossy: lvs. 3–4 in. long, oblong-spatulate, coarsely serrate, thick, fleshy, firm, viscid, the upper ones gradually becoming bracts: fls. 2 in. long, nodding, about 9 in a loose terminal raceme; calyx-lobes triangular, thick, one-fourth shorter than the corolla; corolla tubular, swelled below, constricted above, white with a yellow base. Azores. B.M. 4748. F.S. 7:729. A. F. 3:116. G.C. III. 18:95; 34:330–1. Gn. 54, p. 299; 63, p. 297; 74, p. 402; 75, p. 410. J.F. 3, pl. 274.—Very distinct.

DD. *Color of fls. normally blue or purple (with white varieties).*

E. *Size of fls. large.*

F. *Raceme pyramidal or long-conical, usually dense.*

16. **pyramidàlis,** Linn. Chimney Campanula. Fig. 766. Glabrous perennial, 4–5 ft.: lvs. glandular-den-

tate, lower petiolate, ovate-oblong, subcordate; st.-lvs. sessile, ovate-lanceolate: calyx-lobes acuminate, spreading, half as long as the broadly bell-shaped corolla: fls. numerous, in pyramidal racemes, pale blue varying to white and darker at the base. G.C. III. 32:388. Gn. 45, p. 67; 48, p. 306; 51, p. 221 (a staked pot plant); 47, p. 86 (with extensive cultural notes); 53, p. 535; 62, p. 254; 64, p. 96; 68, p. 137; 69, p. 4; 74, p. 548. R.H. 1897, p. 238. G.M. 46:612; 53: 811. G.W. 1, p. 39; 7, p. 7; 11, p. 137; 13, p. 571. Var. **àlba,** Hort., has white fls. Gn. 74, p. 645. J.H. III. 51:257. Var **compácta,** Hort. Dwarfer: fls. larger and of better substance. The compact variety is very floriferous and convenient for conservatory, but lacks the characteristic erect, pyramidal habit. Gn. 73, p. 54. G. 18:64. S.H. 2:97. *C. Férgusonii,* Hort., is a hybrid of *C. pyramidalis* and *C. carpatica,* resembling a dwarf form of the former in growth, 18 in.: petals more pointed than those of the latter: fls. bright lilac. Gn. 66, p. 276. Hybrids between *C. pyramidalis* and *C. versicolor* are reported.



766. Campanula pyramidalis.

FF. *Raceme not pyramidal, usually looser.*

17. **latifòlia,** Linn. Perennial, 3–4 ft.: lvs. large, doubly serrate; root-lvs. sometimes 6 in. long, petiolate, cordate, covered with soft hairs; st.-lvs. sessile, more acuminate: peduncle 1-fld.; calyx-lobes long-acuminate, one-third shorter than the corolla; fls. 6–15 in a loose spike or raceme about 8 in. long, erect, very large, 2½ in. long, purple or dark blue, hairy. Eu., Persia. G.W. 8, p. 445. Var. **macrántha,** Sims (*C. macrántha,* Fisch.) is commoner in cult. than the type, a little hairier, with a glabrous calyx and very large fls. B.M. 2553, 3347. R.H. 1897, p. 239. J.H. III. 60:263. Var. **eriocárpa,** DC., has the st. and lvs. pilose and more pallid, and a hispid calyx-tube. There is a white-fld. form. It is native to England, and is easily naturalized there in wild gardens. The st.-lvs. are probably the largest of any of the garden kinds, often 3½ in. long and 2 in. wide.

EE. *Size of fls. small, less than 1 in. long.*

18. **bononiénsis,** Linn. Perennial, 2–2½ ft.; scabrous: st. simple: lvs. serrulate, ovate-acuminate, pallid beneath; root-lvs. cordate-petiolate; upper lvs. clasping: calyx-lobes acuminate, one-fourth shorter than the funnel-shaped corolla: fls. normally purplish, in a long, loose, pyramidal spike, which may be 2 ft. long, with 60–100 small fls.; corolla ¾in. long and broad. E. Eu., W. Siberia, and Caucasus. Var. **ruthénica** (*C. ruthénica,* Bieb.), has lvs. wider and tomentose beneath. Caucasus and Tauria. B.M. 2653. There is a white-fld. form. The fls. are much smaller than in *C. latifolia,* and the raceme is much larger.

19. **rhomboídalis,** Linn. Perennial, 1 ft., sometimes 2 ft.: st. simple, erect: lvs. sessile, ovate-acute, serrate: calyx-lobes awl-shaped, one-half shorter than the bell-shaped corolla; fls. 8–10 in an almost corymbose raceme, the lower pedicels of which may be 3 in. long, the uppermost 1 in. or less; corolla purplish blue, 1 in. long, and a little wider. Mts. of Eu. B.M. 551 (as *C. azurea*). J.H. III. 50:541. Var. **álba,** Hort., has white fls. G.W. 3, p. 14.—It flowers in July and August, after which the sts. and lvs. die down quickly.

20. **Trachèlium,** Linn. THROATWORT. Fig. 767. Perennial, 2–3 ft.: st. angular, somewhat bristly (as also the fls.): lvs. rough, acuminate, coarsely crenate-dentate; root-lvs. cordate, ovate, short-stalked: calyx-lobes erect, triangular-acuminate, one-third shorter than the bell-shaped blue or white corolla: peduncle 1–3-fld.; fls. erect at first, at length tending to droop in a loose raceme, which may be 12–18 in. long: caps. nodding. Eu., Caucasus, Siberia, Japan, and run wild in parts of N. Amer. R.H. 1897, p. 239. There is a double-fld. form and variations in color.—One of the commonest and hardiest of the border plants, often running out the other campanulas, and passing under many names, especially as *C. urticifolia.*

21. **rapunculoìdes,** Linn. Fig. 768. Perennial, 2–4 ft.: st. indistinctly pubescent or almost smooth: lvs. rough, ovate-acuminate; root-lvs. petiolate, cordate, crenulate; st.-lvs. serrulate: calyx a little rougher than in *C. Trachelium,* the lobes linear-lanceolate, at length reflexed, one-fourth length of the oblong-campanulate bright blue corolla; fls. soon declined or nodding, in long mostly 1-sided racemes or spikes, bright blue. Eu., Caucasus, Siberia, and common in patches on old roadsides and about yards. Summer. Gn. M. 14:9.

22. **versícolor,** Sibth. & Smith. Perennial, 3–4 ft.; plant glabrous: st. ascending: lvs. serrate; root-lvs. long-petioled, ovate-acute, subcordate; st.-lvs. short-petioled, ovate-lanceolate, acuminate: calyx-teeth acuminate, spreading, at length reflexed, one-half as long as the corolla: fls. in long, spicate racemes; style exserted: caps. spheroid. Greece.

CCC. *Infl. an open, compound panicle.*

23. **divaricàta,** Michx. Glabrous perennial, 1–3 ft.: st. erect, slender, paniculate above: branches slender, divergent: lvs. sparse, subsessile, ovate-lanceolate, acuminate at both ends, coarsely serrate: calyx-lobes awl-shaped, one-half shorter than the tubular, bell-shaped corolla; fls. small, nodding, pale blue, in a very open and compound panicle; style straight, exserted. Alleghanies, from Va. to Ga.—Rare in gardens.



767. Campanula Trachelium. (×½)

GROUP III. *Low-growing or rock-garden campanulas, mostly less than a foot or 15 in. high.* Nos. 24–49.

A. *Calyx with an appendage at the base of each sinus, often minute or disguised in form.*

B. *Throat of corolla spotted violet.*

24. **punctàta,** Lam. (*C. nóbilis,* Lindl.). Named from the spotted whitish corolla, the purplish spots being inside and showing through faintly in the fresh fl. but

more plainly in the dried specimen: like *C. alliariæfolia*. Perennial, 1 ft., with long and loose hairs: upper lvs. nearly sessile, and more sharply toothed than the lower: calyx-lobes one-third as long as the corolla, longer, looser and hairier than in *C. alliariæfolia*, and the margins much more recurved: peduncle 1–4-fld.; fls. nodding; corolla cylindrical, 2¼ in. long, white, spotted within, strongly ribbed. Siberia, Japan. G.C. III. 38, supp. Aug. 26; 42:96. Gn. 73, p. 423; 75, p. 458. G.M. 51:781. G. 29:595.—*C. nobilis* has been considered distinct. In F.S. 3:247 the corolla is dark violet without, the limb hairy, while in B.M. 1723 (*C. punctata*) the corolla is white outside and not bearded. In F. S. 6:563 (*C. nobilis* var. *alba*) the limb is not bearded and the st. is red, and not hairy. The three pictures show great differences in foliage, pubescence and appendages. This is one of the most interesting of all campanulas, and is, unfortunately, usually considered more quaint than beautiful. The spotted throat readily separates it from other campanulas.

BB. *Throat of corolla not spotted.*

C. *Sts. commonly 1-fld.*

25. **Van Hoùttei,** Carr. Perennial, 2 ft.: root-lvs. long-petioled, roundish cordate, more or less lobed; st.-lvs. sessile, oval-lanceolate, irregularly bi-dentate, 2½–4 in. long, more or less villous, strongly nerved: fls. usually solitary, nodding at the end of a small branchlet, 2 in. long, half as broad, indigo-blue, or violet; calyx-lobes linear, spreading, 1 in. long.—A garden hybrid resembling *C. punctata*. Intro. into France 1878 by Thibaut and Keteleer. Var. **pállida,** Hort., has pale lavender fls.

26. **Alliònii,** Vill. Perennial, 3–5 in.: rootstock slender, creeping underground, sending up sts. at intervals of ½–1 in.: lvs. few, about 7 on a st., 1–2 in. long, linear-lanceolate, sessile, slightly hairy, entire, midrib distinct, lower ones in a whorl of about 5, upper ones similar but more erect: calyx-lobes lanceolate, half as long as the corolla, the appendages ovate, reflexed, one-third the length of the calyx-lobes; fls. purple, with a rare white variety, only one on a st., inclined or nodding, 1½ in. long, and as broad across the mouth, probably the largest for the size of the plant of any campanula. A very local species, found only in the western Alps. B.M. 6588. G.C. III. 52:52. Gn. 60, p. 51.

CC. *Sts. usually several-fld.*

D. *Margin of corolla bearded.*

27. **barbàta,** Linn. Perennial, 6–9 in.: st. pilose: lvs. villous, entire or nearly so; root-lvs. tufted, lanceolate; st.-lvs. few, ligulate (?): raceme loose, 3–4-fld.; fls. nodding, pale blue; calyx appendage ovate, obtuse, half as long as the lobes; corolla bell-shaped, shorter than in *C. Allionii*, and with a bearded mouth. Alps. L.B.C. 8:788. G.C. III. 48:388. Gn. 48, p. 297. G.W. 12, p. 447. —There is a white-fld. form, but apparently no purple. Readily distinguished from *C. Allionii* by the different colored, bearded and smaller fls., which are rarely borne singly, and by the dense, soft hairs of the st. Alps, 2,400–6,000 ft., widely distributed; mts. of Norway, and the Carpathians. Becomes coarse when grown in rich ground.

DD. *Margin of corolla not bearded.*

E. *Fls. erect.*

28. **móllis,** Linn. Perennial, velvety gray, 6–8 in.: sts. procumbent, about 2-fld.: root-lvs. tufted, obovate or spatulate; st.-lvs. ovate or rotund: fls. loosely panicled; calyx-lobes lanceolate, erect, half shorter than the glabrous, bell-shaped corolla; appendages minute, shorter than the calyx-tube; corolla erect, dark purplish blue or lavender, with a white throat, the tube long, segms. short, broad, spreading, acute. Spain, Crete. B.M. 404.—Rock or border plant.

EE. *Fls. nodding.*

29. **alpìna,** Jacq. Perennial, 3–8 in.: st. furrowed: lvs. smaller than in *C. barbata*, more narrowly lanceolate, entire, hairy: fls. typically deep blue, bell-shaped, with broader and shorter segms. than in *C. barbata;* calyx-lobes proportionately very long, surpassing the fl.-bud, and nearly as long as the flower, but widely spreading. Alps of Austria, Lombardy and Transylvania, 6,000–7,000 ft. altitude. B.M. 957. J.H. III. 29:5.—There is a white-fld. var. The plant has a characteristic shaggy appearance from the hairy lvs. Easy of cult.



768. Campanula rapunculoides. (×⅝)

30. **sibírica,** Linn. (*C. Hòhenackeri*, Fisch.). Biennial or perennial, setaceous-pilose: st. erect, simple, panicled above: lvs. crenulate; root-lvs. petioled, obovate, obtuse; st.-lvs. lanceolate-acuminate: calyx hairy, the lobes long-acuminate, a third shorter than the corolla; calyx appendages like the lobes but half shorter and reflexed; fls. 25 or more, violet, with a longer and narrower tube than in *C. alpina*, and longer divisions of the limb. N. Asia, Caucasus, W. Eu. B.M. 659. R.H. 1861:431.—The type is rare, but var. **exímia,** Hort., is somewhat commoner: it is dwarfer, much branched, with long, scabrous lvs. and pale bluish to violet fls. Var. **divérgens,** Willd., has larger fls. and broader lvs. than the type. G.C. III. 16:597. *C. sibirica* usually does best when treated as a biennial.

AA. *Calyx without appendages.*

B. *Fls. very wide-spreading, i.e., rotate, wheel-shaped, almost flat.*

C. *Blossoms all erect.*

31. **Waldsteiniàna,** Roem. & Schult. Perennial, 4–6 in.: sts. rigid, glabrous: lvs. fleshy, sessile, gray-green,

lanceolate, slightly serrate-dentate, the lower obtuse, the upper long-acuminate: calyx-lobes awl-shaped, spreading or recurved, one-fourth shorter than the corolla: fls. 5–9 in a corymbose raceme 1¼ in. long, ¾in. wide, pale purplish blue; corolla rotate, almost starlike, with a dark spot in the throat; pistil large, white, twice the length of the corolla, with a yellow stigma. S. Austria. Gn. 8, p. 173. G. 18:81. G.W. 12, pp. 446, 710. *C. Tommasiniàna*, Hort., is an allied plant, with very wiry growth and pendent pale blue fls. *C. Stánsfieldii*, Hort., is a supposed hybrid, perhaps between *C. Waldsteiniana* and *C. carpatica*.



769. Campanula carpatica. (×⅔)

32. **ramosíssima,** Sibth. & Smith (*C. Lòrei*, Poll.). Annual, 1 ft. or less, branching: lower lvs. obovate and crenate; upper lvs. narrow, entire: fls. violet with white base and blue intermediate parts, erect on long simple pedicels. Eu. B.M. 2581. Var. **álba,** Hort. Fls. white.

CC. *Blossoms not all erect.*

D. *Habit trailing or pendulous.*

33. **frágilis,** Cyrill. Perennial, 4–6 in.: st. diffuse, trailing: root-lvs. long-petioled, roundish-cordate, obtusely dentate, or crenately lobed; st.-lvs. smaller, scattered, the uppermost ovate-lanceolate: fls. pale purplish blue with a white center, 1½ in. wide, in loose corymbs; calyx-lobes linear-lanceolate, acuminate, erect, almost equaling the corolla; style exserted: caps. ovoid. Italy. B.M. 6504. P.M. 11:25. G.C. III. 43:378. Gn. 8, p. 174; 47, p. 278; 63, p. 53. G. 18:120. G.W. 2, p. 381. Var. **hirsùta,** DC., is a hairier form.—This is the best species for hanging-baskets, window- and veranda-boxes, and for covering large stones in the rockery. Prop. by cuttings in spring, the roots being too fragile to divide well. Not so hardy as *C. garganica*.

34. **gargánica,** Tenore. Perennial, 3–6 in.: st. diffuse, with pendent branches: lower lvs. reniform-cordate, crenate-dentate; upper lvs. ovate-acute, dentate: raceme lax; peduncles 1–2-fld.; calyx-tube spheroid, the lobes spreading, a third or fourth shorter than the glabrous blue rotate corolla. Mt. Gargano in Italy, and elsewhere. B.R. 1768. Gn. 48, p. 295; 43, p. 25. G.M. 54:664. G.W. 4, p. 255. Var. **hirsùta,** Hort., is a hairier form. Gn. 46, p. 253; 48, p. 297.—Half-shaded position. Prop. by cuttings or by division.

DD. *Habit not trailing or pendulous.*

35. **Elatìnes,** Linn. Perennial, more or less pubescent, 5–6 in.: lvs. cordate, coarsely and acutely dentate, lower rotund, others ovate-acute: raceme lax; calyx-tube spherical, the lobes spreading, linear-lanceolate, somewhat unequal, a half shorter than the rotate purplish corolla; style exserted. Piedmont. Gn. 60, p. 64.—Rare rock-plant for light, stony soil.

36. **Portenschlagiàna,** Roem. & Schult. (*C. muràlis*, Port.). Perennial, 6–9 in.: sts. somewhat erect: lvs. all alike petiolate, cordate, roundish, acutely angular-dentate: calyx-tube spheroid, lobes erect, acuminate, a third shorter than the infundibuliform blue-purple corolla: fls. racemose. Dalmatia.—Allied to *C. garganica*, but the corolla not so deeply 5-cut. Gn. 61, p. 225; 72, p. 469. Var. **màjor,** Hort. Fls. nearly twice larger than in the type, 1½ in. across, making a large mound of purple-blue. G.C. III. 48:58. Gn. 60, p. 111; 63, p. 110. G.W. 3, p. 13.

BB. *Fls. broadly bell-shaped, less widely spreading than in* B, *wider than in* BBB (*except perhaps in No. 40*).

C. *Height 2–3 in.*

37. **Ràinerii,** Perpenti. Perennial, 2–3 in.: sts. suberect, branching: branches 1–3-fld.: lvs. subsessile, ovate, distantly serrate, the lower smaller and obovate: calyx-tube obconical, the lobes long-acuminate, erect, half shorter than the broadly infundibuliform corolla: fls. large, solitary, erect, dark purplish blue; style short, not exserted: caps. obovate. Mts. N. Italy. F.S. 18:1908. Gn. 60, p. 163.—One of the choicest rock-plants, but somewhat rare. Several forms of the hybrid *C. Wilsonii* are often cult. under this name, but their lvs. are lighter green and less tomentose than *C. Rainerii*. Thrives in a well-drained, sunny position.

CC. *Height more than 2–3 in.*

D. *Style not exserted.*

38. **Tenòrii,** Moretti. Perennial, 8–12 in., glabrous: st. ascending or prostrate: lvs. leathery; root-lvs. long-petioled, ovate, subcordate, irregularly serrate; st.-lvs. petiolate, ovate-acute, coarsely serrate: calyx-lobes linear-lanceolate, spreading, half as long as the broadly bell-shaped corolla: fls. racemose, blue: caps. spherical. Apennines, near Naples.—This is referred by botanists to the Grecian species *C. versicolor*, which is typically taller, but is kept distinct by Correvon and others. In the garden, *C. Tenorii* resembles *C. pyramidalis* in foliage and fl., but is shorter.

39. **carpática,** Jacq. Fig. 769. Perennial, 9–18 in., glabrous: st. branching: lower lvs. thin, long-petioled, ovate-rotund, cordate, coarsely dentate, undulate; upper ones shorter petioled, ovate-acuminate: peduncles long, terminal and axillary, 1-fld.; fls. large, often 1½ in. wide, bright deep blue; calyx-tube obconical, the lobes acute, wide at the base, subdentate-erect, a third or half as long as the broadly bell-shaped corolla; style not exserted: caps. ovoid-cylindrical. Carpathian Mts. of Austria. B.M. 117. G.C. III. 46:412. G.W. 12, p. 436. Gn. 48, p. 297; 62, p. 326. Var. **cœlestìna,** Hort. Fls. sky-blue. Var. **álba,** Hort. Fls. white. G.M. 55:615. Var. **turbinàta,** Hort. (*C. turbinàta*, Schott), is dwarfer, more compact, with fls. more bell- or top-shaped, and often 2 in. across, purplish blue. It also has larger lvs. and more decumbent habit. Gn. 45, p. 171; 68, p. 179; 75, p. 201. G.W. 12, p. 446. F.E. 17:15. A form



770. Campanula pulla. (Detail ×⅔)

with pallid fls. is rarer. Var. **Wilsonii**, Hort. (*C. Wilsonii*, Hort.), is a hybrid of var. *turbinata* and *C. pulla*, with the large fls. of the former and the handsome dark foliage of the latter: it is compact, dwarf, and small, ovate, very hairy lvs., with crenate-serrate margin. Gn. 60, p. 219. Var. **haylodgénsis**, Hort. (*C. haylodgénsis*, Hort.), is a garden hybrid, probably between *C. carpatica* and *C. cæspitosa*. Raised by Anderson Henry, Hay Lodge, Edinburgh. Height 6–9 in.: root-lvs. tufted, roundish cordate, slightly dentate; st.-lvs. light green, ovate-cordate, conspicuously toothed: fls. light blue, bell-shaped, few, at the ends of sts. Var. **pelvifórmis**, Hort., from Crete, has very large, pale lilac, almost saucer-shaped fls. R.H. 1882, p. 509. G.C. III. 44:64. Var. **Héndersonii**, Hort., is often referred to var. *turbinata*, but is more robust; there is doubt as to its origin, *C. pyramidalis* or *C. alliariæfolia* possibly having played some part in it: lvs. ovate and ovate-cordate, 1½ in. long, ¾in. broad, slightly hairy on both sides, folded upwards, serrate; petioles 1–1½ in. long: fls. dark blue, 1½–2 in. wide, in short, 6–9-fld. racemes. G.W. 8, p. 65; 14, p. 581. Var. **riverslèa**, Hort. Fls. dark blue, 2–3 in. across: sts. 12–15 in. long but spreading; parts of corolla often 6 or 7. G.M. 43:627. Var. **compácta**, Hort., is a condensed dwarf form. *C. Stánsfieldii*, Hort., is supposed to be a hybrid between *C. carpatica* and *C. Waldsteiniana* (No. 31).—This species is very variable in height and in shape of fls.

DD. *Style exserted.*

40. **isophýlla**, Moretti (*C. floribúnda*, Viv.). Perennial: st. suberect: lvs. all of same form, petiolate, roundish cordate, crenate-dentate: calyx-lobes acuminate, half shorter than the broadly bell-shaped or saucer-shaped corolla; fls. pale blue, 1 in. or more wide, corymbose; style exserted: caps. ovoid. Italy. B.M. 5745. Gn. 49, p. 483; 48, p. 297.—A desirable basket or rock plant in sun or half shade. The white form, Var. **álba**, is most excellent: free-flowering. **C. Mâyii**, Hort., is supposed to be a derivative of this species: lvs. soft and woolly. Choice.



771. Campanula rotundifolia. (×1)

BBB. *Fls. bell-shaped.*

C. *Style exserted.*

41. **Scoùleri**, Hook. Perennial, 3–12 in.: st. simple or branched: lvs. acutely serrate, somewhat hirsute; lower ones ovate-acute, petioled; middle ones ovate-lanceolate; upper linear-lanceolate, sessile; calyx-lobes awl-shaped, erect, one-third shorter than the corolla: fls. pale blue, racemose, or more or less panicled; style exserted: caps. ovoid. N. Calif. to Puget Sound.—The capsular valves are a little above the middle, while in *C. carpatica* and *C. persicifolia* they are near the apex.

CC. *Style not exserted.*

D. *Color dark purple.*

42. **púlla**, Linn. Fig. 770. Perennial, 3–8 in., tufted or in clumps, showy: st. normally 1-fld.: lvs. glabrous, crenulate-dentate; lower ones short-petioled, ovate-rotund; upper sessile, ovate-acute: calyx-lobes long-acuminate, erect, a half shorter than the bell-shaped, nodding corolla. Mts. of Austria, 4,000–6,000 ft. In B.M. 2492 the calyx-lobes are short-acuminate, a sixth as long as the corolla. L. B.C. 6:554. Gn. 63, p. 440. *C. pulloìdes*, Hort., is a supposed hybrid between *C. pulla* and *C. turbinata*, with habit of former: 5 in.: fls. glistening purple-blue. Gn. 66, p. 203.



772. Campanula rotundifolia var. soldanellæflora. (×¾)

DD. *Color not dark purple, but violet or blue (varying to white.)*

43. **drabifòlia**, Sibth. & Smith (*C. áttica*, Boiss.). Annual, hispid, 3–4 in.: lower lvs. oblong or elliptic, dentate, tapering into a petiole: fls. large, blue and lighter on the tube, bell-shaped, on forking sts. Greece.

44. **rotundifòlia**, Linn. HAREBELL. HAIRBELL. BLUE BELLS OF SCOTLAND. Fig. 771. Perennial, 6–12 in.: root-lvs. petiolate, orbicular or cordate, crenate-dentate: st.-lvs. linear or lanceolate, usually entire: calyx-lobes awl-shaped, erect, a third shorter than the bell-shaped bright blue corolla; fl.-buds erect. Eu., Siberia, N. Amer. Gn. 53:42; 62, p. 59. Gn. M. 14:10.—This is one of the most cosmopolitan of all campanulas, and the true harebell or bluebell of literature. In the wild it is usually slenderer and taller than in the garden. In shady woods it often grows 2 ft. high. The type has a white-fld. variety which is much less popular, but G.C. 1861:698 shows an excellent pot-plant of it. Var. **alaskàna**, Gray. Dwarfer, leafy to the top: radical lvs. cordate, lowest st.-lvs. ovate and the upper ones becoming lanceolate: calyx-lobes attenuate, becoming deflexed; corolla ½–1½ in. long. Alaska. Var. **árctica**, Lange. Rigid, 1- to few-fld.: corolla 1 in. long, the calyx-lobes very slender and soon spreading or deflexing. Canada north. Var. **velùtina**, DC. Herbage whitish pubescent. Var. **Hòstii**, Hort. (*C. Hòstii*, Baumg.), has larger fls. than the type and stouter sts. The lower st.-lvs. are lanceolate, remotely dentate, the upper linear entire: calyx-lobes longer than in the type, a half shorter than the corolla. The white-fld. form is not so vigorous. [G. 5:207. The most pronounced variant is var. **soldanellæflòra**, Hort. (*C. soldanélla*, Hort.). Fig. 772. With semi-double blue fls. split to the base into about 25 divisions. F.S. 18:1880. Gn. 60, p. 162. This curious variation is unique in the genus. The alpine soldanellas are famous among travelers for melting their way through the ice. They have fringed blue fls.—The name *C. rotundifolia* seems singularly inappropriate until one finds the root-lvs. in early spring. *C. stenocòdon*, Boiss. & Reut., by some referred to *C. rotundifolia*, is more slender and with narrower st.-lvs.: fls. long and narrow, tubular, rich lilac-purple. Alps.

45. **Scheùchzeri**, Vill. (*C. linifòlia*, Willd.). Perennial, 4–12 in.: st. 1–4-fld., usually 1-fld.: root-lvs. roundish, ovate, or cordate; st.-lvs. linear or narrowly lanceolate, sessile, denticulate, the lowest st.-lvs. spatulate: calyx-lobes slender, linear-awl-shaped, nearly as long as the bell-shaped dark blue corolla. Alpine and subarctic regions of Newfoundland, Labrador, Alaska, and Rocky Mts. to Colo., also in Eu. and N. Asia. F.S. 21:2205, not L.B.C. 5:485, which DeCandolle states is *C. rotundifolia*. Var. **álba**, Hort. Fls. white. Gn. 60, p. 164. The st.-lvs. of *C. Scheuch-*

zeri are distinctly serrate, while in *C. rotundifolia* they are entire; the fl.-buds nod in the former, but are erect in the latter. The calyx-lobes are relatively longer in *C. Scheuchzeri*, and perhaps the bell is deeper.

46. **cæspitòsa,** Scop. (*C. pùmila,* Curt. *C. pusílla,* Hænk.). Perennial, 4–6 in.: root-lvs. tufted, short-petioled, ovate, glandular-dentate, shining: calyx-lobes linear, erect, a third shorter than the bell-shaped corolla: fls. nodding, blue; pollen violet-colored. B.M. 512. Gn. 43:24; 48, p. 297; 60, p. 161. G. 25:307. R.H. 1908, p. 223.—Dwarfer than *C. rotundifolia,* with root-lvs. never reniform, shorter-petioled, and lasting until after fls. have gone. Perennial, quickly forms a dense mat, and blooming from June till Oct. The European trade catalogues usually offer *C. cæspitosa* and *C. pusilla* separately, and doubtless plants of distinct horticultural value are passing under these names, but there seem to be no sufficient botanical characters to distinguish them. Correvon says that *C. pusilla* differs from *C. cæspitosa* only by its less stoloniferous character. Var. **álba,** Hort., has white fls. G.C. III, 48:96. Gn. 72, p. 143; 75, p. 368. G.M. 54:466. Var. **pállida,** Hort., has pale blue fls. G.M. 53 : 612.

47. **excìsa,** Schleich. Perennial, glabrous, height 4–5 in.: sts. slender, 1-fld.: root-lvs. spatulate; upper lvs. linear; calyx-lobes bristly, spreading, at length reflexed, a third shorter than the bell-shaped corolla: fls. pale blue, divided to about half their depth, with a round hole at the base of each sinus, which easily distinguishes it from *C. pulla* and all other campanulas. Rare in Alps. B.M. 7358. L.B.C. 6:561. Gn. 60, p. 64.—A rare rock-plant. Likes cool, moist air, and not too full exposure to sun.

BBBB. *Fls. tubular, often long and narrow.*

48. **Zóysii,** Wulf. Perennial, 3–4 in.: plant tufted, glabrous: sts. few-fld.: root-lvs. entire, crowded, petiolate, ovate-obovate, obtuse; st.-lvs. obovate-lanceolate and linear: peduncles 1-fld., terminal, rarely axillary; fls. azure-blue, large for the plant, terminated by a stellar process before expansion; calyx-lobes linear, awl-shaped, spreading, a fourth shorter than the corolla; corolla long-cylindrical, constricted at the apex, wider at the base, sharply angled, pale blue. Austrian Alps, 6,000–8,000 ft. Gn. 8, p. 173. G.C. III. 20:183; 38:228.—A rare and abnormal species.

49. **Erìnus,** Linn. Annual: plant hispid: height 3–9 in.: lvs. small, glossy, ¼–¾in. broad, cordate, deeply cut, the pointed lobes conspicuous: fls. sessile, pale blue with a light center, tubular, ½in. broad, with acute narrow lobes; style long, conspicuous, colored like corolla: racemes long, semi-prostrate, 10–12-fld. Medit.—Rare, short-lived rock-plant; also for edgings and pots.

C. abietìna, Griseb. Rare tufted rockery plant, with slender, wiry sts. 9–15 in. high: fls. light blue, in loose branching spikes. July, Aug. E. Eu.—*C. acutángula,* Ler. & Lev. Dwarf, with trailing sts. from a rosette of ivy-like lvs.: st.-lvs. small, rounded and toothed: fls. solitary on each st., rather large and star-like, purple-blue. N. Spain. G.C.III. 50:220.—*C. amàbilis,* Leicht.=C. phyctidocalyx.—*C. Beaverdiàna,* Fomine. Slender, to 2 ft., glabrous or finely hairy: lower lvs. oblong-ovate to broadly ovate, obtuse, crenate-serrate: fls. few or solitary, slender-pedicelled, blue, 1¼ in. across. B.M. 8299. Caucasus.—*C. calycánthema,* Hort.=C. Medium var. calycanthema.—*C. centsia,* Linn. A rare rock-plant from Mt. Cenis and other mts. of the Alps, with solitary deep blue fls. on sts. 2 in. high. Root-lvs. obovate, obtuse; st.-lvs. ovate-oblong; all lvs. sessile-entire: calyx hirsute, the lobes linear-lanceolate, a half shorter than the deeply 5-cut, spreading corolla.—*C. grandiflòra,* Jacq.=Platycodon.—*C. hederàcea,* Linn.=Wahlenbergia.—*C. imeretìna,* Rupr. Dwarf, branching, resembling C. sibirica: lvs. small: fls. violet-blue. Caucasus.—*C. incúrva,* Aucher=C. Leutweinii.—*C. kolenatiàna,* Mey. Perennial, 9 in. or less: lvs. mostly radical ovate, about 1 in. long: fls. in long-stalked raceme, bluish violet, 1 in. long, inside hairy. Caucasus.—*C. laciniàta,* Linn. Robust much-branched biennial, 2 ft., somewhat pubescent: lower lvs. 8 in. long by 2½ in. broad, deeply cut: fls. about 2 in. across, upwards of 1 in. long, pale blue. Greece. G.C. III. 40:165.—*C. Leutweinii,* Heldr. (C. incurva, Aucher). Perennial, simple, 1 ft. or more: lvs. cordate, white-downy, crenate, rounded at apex: fls. pale blue, 1½ in. long. Greece.—*C. Marièsii,* Hort.=Platycodon.—*C. michauxoides,* Boiss. Tall-growing: fls. bluish white, the segms. recurved. Asia Minor.—*C. Lamárckii,* D. Dietr.=Adenophora Lamarckii.—*C. nítida,* Ait.=C. planiflora.—*C. petræa,* Linn. Biennial, with ascending st., hairy, 6–12 in.: lower lvs. lance-oblong, narrowed to the base, toothed; upper lvs. ovate and sessile: fls. small, pale yellow, in dense terminal and axillary heads. N. Italy.—*C. phyctidocàlyx,* Boiss. & Noé (C. amabilis, Leicht.). Like C. Rapunculus in habit, 2–2½ ft.: lvs. lanceolate or cordate: fls. 10–12 in raceme, dark blue with black styles, resembling those of C. persicifolia. Armenia.—*C. planiflòra,* Lam. (C. nitida, Ait.). Glabrous: height 3–9 in.: st. simple: lvs. sessile, leathery, shining; root-lvs. crowded in a dense rosette, ovate or obovate-obtuse, crenulate, 1½ in. long; st.-lvs. linear-lanceolate, acute, nearly entire: fls. blue or white, with double varieties, in spicate racemes; calyx-lobes ovate, acute, broad, erect, a third shorter than the broadly bell-shaped or saucer-shaped corolla. Not American, though commonly so stated. Habitat unknown. J.H. III. 33:283.—Rock-plant, for sunny position.—*C. primulæfòlia,* Brot. St. hairy, simple, 1–3 ft.: lowest lvs., lanceolate, st.-lvs. oblong: fls. blue, downy at bottom, nearly rotate. Portugal. B.M. 4879.—*C. Raddeàna,* Trautv. Perennial, glabrous, 1 ft.: lvs. cordate, long-stalked: fls. large, dark purple. Caucasus.—*C. speciòsa,* Pourr., is a rare species. Most of the plants passing under this name are likely to be C. glomerata. B.M. 2649 is C. glomerata var. speciosa. C. thyrsoidea, Lapeyr., is referred here.—*C. Spéculum,* Linn.=Specularia.—*C. spicàta,* Linn. Biennial, 1–2 ft.: lvs. very narrow, nearly or quite entire: fls. 1–3, sessile, in a long interrupted spike, blue. Eu. J.H. III. 47:267.—*C. sulphùrea,* Boiss. Annual: fls. size of those of C. rotundifolia, pale straw-color outside and sulfur-yellow inside. Palestine.—*C. urticifòlia.* This name is now abandoned. Plants are likely to be C. Trachelium.

WILHELM MILLER.
L. H. B.†

CAMPANUMÆA (variant of Campanula). *Campanulàceæ.* Twining or loose-growing perennial herbs, with rhizomes or tubers, rarely grown in greenhouses. Lvs. mostly opposite, simple and often cordate, petioled: fls. yellowish or greenish, broadly bell-shaped, 4–6-lobed: fr. a berry.—Five species occur in the Himalayan and E. Asian region and the Malay Archipelago. *C. javánica,* Blume, and *C. inflàta,* Clarke, both with yellowish brown-veined fls. are mentioned in gardening literature: the fls. are about 1¼in.; in the former the calyx is nearly free from the berry, which is hemispherical; in the latter the calyx is adnate to the berry, which is ellipsoidal; both are twiners. *C. grácilis,* Hort., is of the genus Leptocodon, and *C. lanceolàta,* Sieb. & Zucc., is a Codonopsis.

CAMPHÒRA: *Cinnamomum.*

CAMPION: *Silene.*

CAMPSÍDIUM (alluding to its similarity to *Campsis*). *Bignoniàceæ.* Ornamental vines grown for their bright orange flowers and also for their handsome evergreen finely pinnate foliage.

Evergreen shrubs, high-climbing, without tendrils and without rootlets, with odd-pinnate, opposite lvs. and tubular, orange, slender-pedicelled fls. in terminal, loose and short racemes: calyx turbinate, 5-toothed, glandless; corolla tubular, slightly ventricose, straight, with 5 short equal lobes; stamens, 4, the 2 longer with the anthers exserted; anther-sacs parallel; disk cupular, flat: fr. a narrow caps. with many winged seeds.—Two species in Chile and in the Fiji Isls.

They are adapted only for subtropical regions and do not seem to bloom readily, but even without flowers they are worth planting for their foliage alone. In Old World gardens, they are sometimes cultivated as stove plants, but *C. valdivianum,* judging from its habitat, might do better in the cool greenhouse. Propagated by greenwood cuttings under glass. For further culture, see *Campsis.*

Campsidium filicifolium, from the Fiji Islands, has never flowered in the writer's garden (in Florida) and is cut down by frost almost every winter, but it is a strong grower and worth planting for the foliage alone. *C. valdivianum* has proved to be a very poor grower and is very difficult to keep in health for any length of time. (H. Nehrling.)

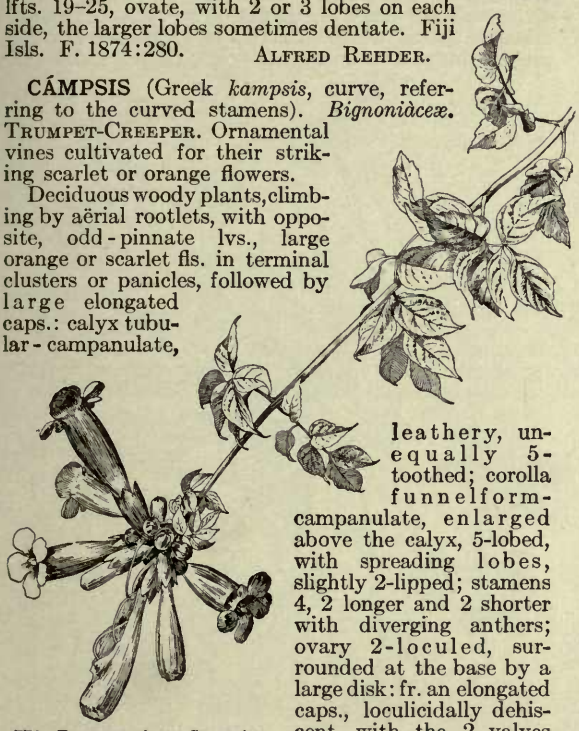
valdiviànum, Seem. (*C. chilénse,* Reissek & Seem. *Técoma valdiviàna,* Phil.). Climbing, to 50 ft.: branches angular, glabrous: lvs. glabrous, 4–6 in. long; lfts. usually 11–13, sessile, elliptic-oblong, ¾–1½ in. long, serrate near the apex or almost entire: racemes pendulous, 6–10-fld.;

fls. about 1½ in. long, orange: caps. 3–4 in. long, narrowly elliptic-oblong. Chile. G.C. 1870:1182. B.M. 6111. F.S. 20:2142.

filicifòlium, Van Geert (*Técoma filicifòlia,* Nichols.). Climbing evergreen shrub: lvs. odd-pinnate, 5 in. long; lfts. 19–25, ovate, with 2 or 3 lobes on each side, the larger lobes sometimes dentate. Fiji Isls. F. 1874:280. ALFRED REHDER.

CÁMPSIS (Greek *kampsis,* curve, referring to the curved stamens). *Bignoniàceæ.* TRUMPET-CREEPER. Ornamental vines cultivated for their striking scarlet or orange flowers.

Deciduous woody plants, climbing by aërial rootlets, with opposite, odd-pinnate lvs., large orange or scarlet fls. in terminal clusters or panicles, followed by large elongated caps.: calyx tubular-campanulate, leathery, unequally 5-toothed; corolla funnelform-campanulate, enlarged above the calyx, 5-lobed, with spreading lobes, slightly 2-lipped; stamens 4, 2 longer and 2 shorter with diverging anthers; ovary 2-loculed, surrounded at the base by a large disk: fr. an elongated caps., loculicidally dehiscent, with the 2 valves separating from the septum to which the seeds are attached; seeds numerous, compressed, with 2 large translucent wings.—One species in N. Amer. and one in China and Japan. By some botanists, Bignonia is considered the correct name for this genus, because the original description was chiefly based on *C. radicans,* while Tecoma is the proper name for the genus known as Stenolobium.

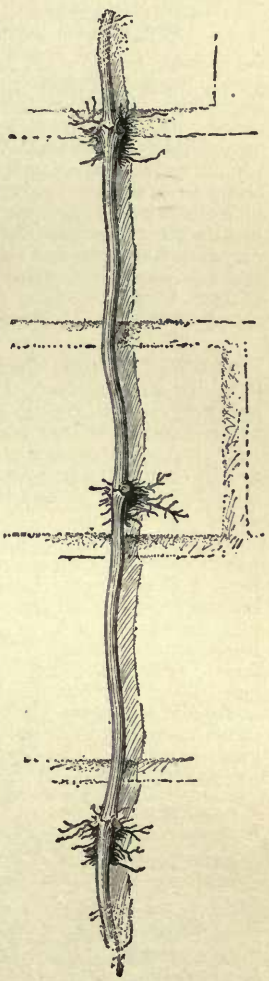


773. Trumpet-vine—Campsis radicans. (×⅙)

The hardiest species is *C. radicans,* which may be grown as far north as Massachusetts, at least in sheltered positions, while *C. chinensis* is more tender; the hybrid is intermediate between the two in hardiness. *C. chinensis* and *C. hybrida,* as well as *C. radicans* var. *speciosa,* can be grown as bushy specimens and will bloom freely on the young shoots, even if cut back almost to the ground by frost. Such plants can be easily protected during the winter by laying them down and covering them with earth. *C. radicans* is particularly adapted for covering walls and rocks, as it climbs with aërial rootlets and clings firmly to its support. The species of campsis prefer rich rather moist soil and sunny positions. Propagated by seeds, by greenwood cuttings under glass, or by hardwood and also by root-cuttings and layers.

Trumpet-vines in the South.—The trumpet-vines are very successfully cultivated in Florida, being well adapted to the soil and climate, but to do their best need to be planted from the start in rich soil; and in addition they should be well fertilized at least once a year. They prefer a fertilizer rich in nitrogen; and a heavy mulch will also prove very beneficial. They should be grown on posts and tall stumps, or they may be trained over small oaks, persimmon trees or catalpas. Other bignoniads of similar culture are *Tecomaria capensis,* a half-climbing species with scarlet flowers effectively used for decoration of the veranda, and *Tecoma stans.* That and *Campsis chinensis* are the two showiest bignoniads cultivated in Florida, the latter being a climber, flowering abundantly in May and June, while the first one is a large-growing bushy species opening its immense corymbs of vivid yellow flowers the latter part of November and early in December. The Chinese trumpet creeper, *C. chinensis,* is the most floriferous and gorgeous. In the writer's garden a large pine stump, about 16 feet high, in May and June is completely covered with masses of brilliant fiery orange-scarlet flowers which can be seen at a distance of half a mile. The flowers are much larger, more brilliant and much more abundantly produced than those of the native *C. radicans.* It is sometimes infested by a voracious caterpillar, which devours the leaves greedily. The lubber grasshoppers also attack the lower foliage. *C. chinensis* grows well in the poor sandy soil, perfecting luxuriant shoots 25 to 30 feet long in one season if well fertilized. The native trumpet creeper, *C. radicans,* is very common in the southern woodlands and fields. There is a great variety in the brilliancy of the blossoms. This is an excellent plant for covering the bare trunks of palmettos. (H. Nehrling.)

radìcans, Seem. (*Técoma radìcans,* Juss. *Bignònia radìcans,* Linn.). TRUMPET-CREEPER. TRUMPET-VINE. TRUMPET-HONEYSUCKLE. Figs. 773, 774. High-climbing shrub, clinging with rootlets: lvs. odd-pinnate; lfts. 9–11, oval to ovate-oblong, acuminate, serrate, dark green above, pale and pubescent beneath, at least along the midrib, 1½–2½ in. long: fls. in terminal racemes; corolla tubular-funnelform, about 3 in. long, with 5 spreading lobes, usually orange with scarlet limb, tube almost thrice as long as the short-toothed calyx: fr. cylindric-oblong, keeled along the sutures, stalked and with a beak at the apex, 3–5 in. long. July-Sept. Pa. and Ill. to Fla. and Texas. B.M. 485. Gn. 22, p. 339. F. 1873, p. 220. A. F. 12:34. Mn. 2:9. Var. **atropurpùrea,** Voss (var. *grandiflòra atropurpùrea,* Hort.). With large, deep scarlet fls. Var. **speciòsa,** Voss. Scarcely climbing, usually forming a bush with long and slender branches: lfts. small, oval, abruptly narrowed into a slender point often ¾ in. long: fls. orange-red, with rather straight tube; limb about 1¼ in. across. Var. **præcox,** Schneid. Large scarlet fls. in June. Var. **aùrea,** Hort. Fls. yellow.



774. The Trumpet-creeper climbs by means of aerial roots.—Campsis radicans.

chinénsis, Voss (*Técoma grandiflòra,* Delaun. *T. chinénsis,* C. Koch. *Bignònia chinénsis,* Lam. *C. adrèpens,* Lour.). CHINESE TRUMPET-CREEPER. Fig. 775 (adapted from Gardening). Climbing shrub, with few or no aërial rootlets: lvs. odd-pinnate;

lfts. usually 7–9, ovate to ovate-lanceolate, serrate, glabrous beneath, 1½–2½ in. long: fls. in terminal racemes; corolla funnelform-campanulate, shorter and broader than that of the preceding species, scarlet, about 2 in. across; calyx 5-lobed to the middle, about as long as the tube of the corolla: fr. obtuse at the apex. Aug., Sept. China, Japan. B.M. 1398; 3011. F.S. 11:1124–5. Gn. 27, p. 94; 33, p. 348; 47, p. 373. G.F. 3:393. F.R. 2:27. Gng. 4:195.—Less high-growing and sometimes shrubby; blooms when quite small and can be grown as a pot-plant, also suited for forcing. Var. **Thúnbergii,** Voss (*Técoma Thúnbergii,* Sieb.). Fls. bright scarlet, with very short tube and reflexed lobes. Often a var. of *C. radicans* is cult. under the name *C. Thunbergii.* Var. **Príncei,** Voss (*Técoma grandiflòra* var. *Príncei,* Dipp.), probably belongs to the following hybrid.



775. Campsis chinensis on a clothes-post.

hýbrida, Schneid. (*Técoma hýbrida,* Jouin. *T. intermèdia,* Schelle. *T. radìcans grandiflòra atropurpùrea,* Hort. *T. Príncei grandiflòra,* Hort. *T. chinénsis aurantìaca,* Hort.). Hybrid between the two preceding species: somewhat climbing, often forming a bush with straggling branches: lfts. 7–11, ovate to elliptic-ovate, usually pubescent along the veins beneath: fls. in terminal loose panicles; calyx divided for about one-third into ovate long-acuminate lobes much shorter than the corolla-tube; corolla funnelform-campanulate with orange-yellow tube and scarlet limb, about 2 in. across and 3 in. long. July–Sept. Garden origin. S.T.S. 1:47. M.D.G. 1904:123.—The fls. are almost as large and showy as those of *C. chinensis* and the plant is hardier.

ALFRED REHDER.

CAMPTOSÒRUS (Greek, *bent sori,* alluding to the irregular arrangement). *Polypodiàceæ.* Two species of hardy ferns, with simple pointed lvs., which take root at the apex, and are hence known as "walking-leaf ferns." A single species is native mostly on lime-bearing rocks, and an allied species is known from Japan and N. Asia.

rhizophýllus, Link. Fig. 776. Lvs. evergreen, simple, tapering from a heart-shaped base, 4–12 in. long; veins forming meshes near the midrib; sori irregularly scattered, linear, straight or bent. Canada to Ala. —Sometimes grown in rockeries and wild gardens.

L. M. UNDERWOOD.

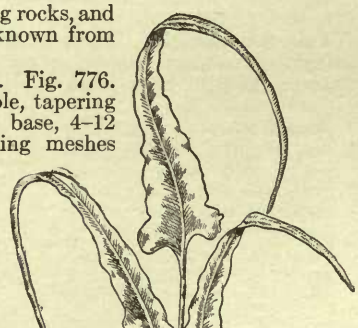
CAMPYLOBÒTRYS: *Hoffmannia.*

CAMPYLONEÙRON: *Polypodium.*

CANADA: *British North America.*

CANAIGRE: *Rumex hymenosepalus.*

CANÁNGA: | *Canangium.*



776. Camptosorus rhizophyllus. (×⅓)

CANÁNGIUM (Makassar, *kananga;* Malay, *kenanga*). *Annonàceæ.* Perfume-yielding tropical trees.

Closely allied to Desmos but differing in having the apex of the connectives of the stamens prolonged into a point, instead of being broadened into a hood-like covering for the pollen-sacs: sepals 3; petals 6 in 2 series, valvate, nearly equal, flat, linear; stamens many, closely crowded on the convex torus, the connective produced into a long tapering point; carpels indefinite,



777. Canangium odoratum. *a*, flowering branch; *b*, stamens; *c*, longitudinal section of fruit; *d*, fruit cluster.

clustered in the center of the mass of stamens; ovules in 2 columns or apparently in a single column; style linear or linear-oblong, terminating in an obtuse swelling; ripe carpels (fr.) several, pedicelled, ovoid or oblong and more or less constricted between the seeds. The name Cananga, usually applied to this genus, was used by Aublet in 1775 for an entirely different genus, and cannot therefore be valid for the present one. Baillon recognized this fact, and proposed the name Canangium, without, however, coupling it with specific names. It was taken up by Sir George King in his Annonaceæ of British India, 1893, and was applied by him to the celebrated ylangylang tree, *Canangium odoratum.*

odorâtum, King (*Uvària odoràta,* Lam. *Unòna odoràta,* Dunal. *Canánga odoràta,* Hook. f. & Thoms.). YLANGYLANG. ILANGILANG. ALANGILANG. MOSO'OI. MOTO-OI. Fig. 777. A tree bearing a profusion of greenish yellow fragrant fls. with long narrow petals, from which the celebrated ilangilang is made. The tree is found in S. India, Java, the Philippines, the Malay Archipelago, and many islands of the tropical Pacific. It occurs spontaneously as well as in cult., and its seeds are widely scattered by fruit-pigeons and other birds. In the Samoan Isls. it is much beloved by the natives, who make garlands of "moso'oi" with which to adorn themselves, and they celebrate its fragrance in their songs. The fls. yield a fragrant volatile oil known in commerce as the oil of ilangilang, usually obtained by steam distillation. The natives use a much simpler process in securing oil for anointing their heads and bodies. Fls. are put into coconut oil and, after remaining a short time, are replaced by fresh ones,

the oil being subjected to a gentle heat. "Macassar oil" is prepared in this way, fls. of *Michelia Champaca* being often added to those of the ylangylang.

Brandisànum, Safford (*Unòna Brandisàna,* Pierre. *Unòna latifòlia,* Hook. f. & Thoms., not Dunal). A tree endemic in the forests of lower Cochin China and Cambodia, with very fragrant fls. resembling those of *C. odoratum* but with the petals relatively broader, constricted at the base, and thicker, and the lvs. usually cordate at the base and tomentose beneath, instead of rounded at the base and pubescent beneath: the fr. resembles that of the preceding species but with fewer seeds arranged almost in a single row, but on close inspection seen to be biseriate. The fls. yield a perfume similar to that of the true ylangylang of commerce. W. E. Safford.

CANARÌNA (from the Canary Islands). *Campanulàceæ.* Cool-house tuberous-rooted herb closely allied to Campanula, but with the tubes of the calyx and corolla grown together, and the floral parts in 6's.—Three species. **C. Campánula,** Lam., is a tender perennial from the Canaries, about 6–8 ft. tall, with drooping, inflated buds and solitary, bell-shaped fls. more than 1 in. long and 1½ in. wide, dull yellow, flushed and veined with dull purplish brown: the lobes of the corolla strongly reflexed: lvs. hastate, coarsely repand-dentate: fr. a fleshy berry. B.M. 444.—Intro. by Franceschi in 1895.

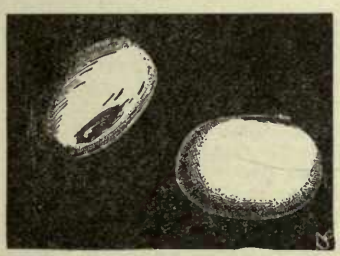
CANARY-BIRD FLOWER: *Tropæolum.*

CANARY GRASS: *Phalaris.*

CANAVÀLIA (an aboriginal name). Including *Malócchia. Leguminòsæ.* Bean-like plants, some of them producing edible seeds and some more or less grown for ornament.

Prostrate trailing or twining herbs, with pinnately 3-foliolate lvs.: fls. in axillary racemes or fascicles, often large, violet, rose or white, with bell-shaped, 2-lipped calyx, papilionaceous corolla, 9 stamens united and 1 free for all or part of its length: pods large and ribbed on edges.—A dozen species, widely distributed in warm countries.

ensifórmis, DC. (*C. gladiàta* var. *ensifórmis,* DC.). Jack Bean. Chickasaw Lima. Figs. 485 (Vol. I), 778. Glabrous or nearly so: lfts. ovate-oblong or ovate, mucronate: upper lip of calyx longer than the tube, recurved and notched; keel blunt, curved: seeds white, with a dark raphe. Tropics of both hemispheres.—B. M. 4027. A.G. 14: 84.—Grown in the southern states for stock, but the pods make passable snap beans when not more than 4–6 in. long. In warm countries it is a bushy plant, with little tendency to climb. The pods reach a length of 10–14 in., the walls being very hard and dense when ripe; the halves of the pod, when split apart, roll up spirally often into an almost perfect cylinder. The large white turgid beans, bearing a very prominent brown seed-scar, are packed crosswise the pod, imbedded in a very thin white papery lining. The fls. are small and light purple, resembling those of the cowpea (but larger) and of various species of Dolichos. The lfts. are large and broad (5–8 in. long and half or three-fifths as broad), strongly veined and dull, dark green, abruptly pointed and smooth. Beans said to be used as a coffee substitute.



778. Seeds of Canavalia ensiformis. (×1)

C. bonariénsis, Lindl. Twining: lfts. ovate, with the long apex obtuse: fls. purple in drooping racemes that exceed the lvs., the standard large broad and notched. Uruguay and S. Brazil. B.R. 1199. H.U. 4, p. 129.—*C. obtusifòlia,* DC. Prostrate or climbing: lfts. nearly orbicular to oval or obovate, rounded or cuneate at base: fls. pink, in racemes exceeding the lvs.: seed brown, oblong. Fla. and Texas south. Known as "mato de la playa" in Porto Rico.—*C. rusiospérma,* Urban. Large and tall, ascending highest forest trees: seeds red. Known as "Mato colorado." W. Indies. L. H. B.

CANDELILLO: *Euphorbia antisyphilítica.*

CANDLEBERRY, CANDLENUT: *Aleurites.*

CANDÒLLEA (A. P. DeCandolle, 1778–1841, famous botanist of Geneva, Switzerland). *Candolleàceæ;* formerly referred to *Dilleniàceæ.* Herbs or woody plants sometimes grown under glass or in the open far South for the mostly yellow flowers.

Shrubs or undershrubs or herbs, mostly glabrous: lvs. simple, mostly narrow, sometimes with margins revolute: fls. few or solitary at the ends of the branches; sepals and petals 5; stamens many, united into 5 bundles or sets, each set bearing several anthers; carpels 2–3–5, with 1–3 ovules in each.—As now understood, probably 80–90 species, mostly W. Australian, but 1 in Trop. Asia and S. China and 1 in the E. Indies. Little known in cult., but the following Australian species are now offered.

tetrándra, Lindl. Shrub, with branches angular, pubescent: lvs. narrow-oblong to oblong-ovate, obtuse or short-acuminate, 2½ in. or less long, clasping, margins not revolute: fls. much larger, paler yellow, the petals 1 in. long and the acute sepals ¾in. long: fr. with orange aril. B.R. 29:50.—Offered as a greenhouse plant.

cuneifórmis, Labill. Erect shrub, 6 ft. and more, with short crowded branches that are somewhat hairy when young: lvs. oblong-cuneate to obovate, truncate or few-toothed at apex, 1 in. long: fls. bright sulfur-yellow, sessile in the crowded floral lvs.; sepals about ½in., and the notched petals somewhat longer. B.M. 2711.—Offered in S. Calif., where it blooms March–June. L. H. B.

CANDYTUFT: *Iberis.*

CANE-BRAKE: Species of *Arundinaria* (treated under Bamboo).

CANÍSTRUM (Greek, a *basket*). *Bromeliàceæ.* Epiphytic or terrestrial hothouse plants, requiring the treatment of billbergias.

Leaves in a dense tuft, acute, spinulose on the margin: infl. compound, in a cup of lvs., on a very short st. as in Nidularium, or on a longer exserted st.; fls. usually green, rarely golden or blue.—A genus of about 10 species, natives of Brazil. They are sometimes referred to Nidularium.

Líndenii, Mez (*Æchmèa ebúrnea,* Baker. *Guzmània frágrans,* Hort. *Nidulàrium Líndenii,* Regel). Lvs. about 20, in a dense rosette, tomentose, green-spotted, the bract-lvs. cream-white: fls. white or greenish.

amazónicum, Mez (*Karàtas amazónica,* Baker. *Nidulàrium amazónicum,* Lind. & André. *Æchmèa amazónica,* Hort.). Lvs. 15–20, 10–20 in. long, and rather wide at the middle, greenish brown above and light brown beneath, not spotted or scurfy, the bract-lvs. greenish brown: fls. white, with a green tube, in a dense head.

C. aurantiacum, E. Morr. (Æchmea aurantiaca, Baker). Plant vigorous: lvs. expanded in the middle: fls. yellow, 2 in. long. S. Amer. B. H. 1873:15. George V. Nash.†

CÁNNA (name of oriental origin, of no application). *Cannàceæ.* Popular tall ornamental plants, prized for their stately habit, strong foliage and showy flowers; much used for bedding.

Stout, unbranched: fls. mostly red or yellow, in a terminal raceme or panicle, very irregular: caps. 3-loculed and several- to many-seeded (Fig. 779, *p.*); sepals

(*s*) 3 and small and usually green; petals (*ccc*) 3, mostly narrow and pointed, green or colored; style (*e*) single and long; the stamens are commonly petal-like, oblanceolate bodies or staminodia (*aaab*), 2 or 3 of which are usually much produced and broadened, and one is deflexed and narrower and forms the lip of the fl. (*b*); the pollen is borne in a single-loculed anther (*f*), borne on the side of a narrow and more or less coiled staminodium.—In the latest monograph, 1912 (Kränzlin, in Engler's Pflanzenreich, hft. 56), 51 species of Canna are described from subtropical and tropical Amer. and Asia.



779. The parts of the Canna flower.

A generation or two ago, cannas were grown for their foliage or mass-effect. They were tall and long-jointed, with small and late flowers (Fig. 780). An old-time garden race of tall cannas was *C. Annæi*, raised by M. Année, of France, from seeds of the true *C. nepalensis*, sown in 1848. The flowers from which the seeds were taken probably had been pollinated by some other species, most likely with *C. glauca*. In 1863, a new race appeared, as the result of the union of *C. iridiflora* with *C. Warscewiczii*. This hybrid was known as *C. Ehemanni* (and *C. iridiflora hybrida*). This was of intermediate stature, with showy foliage and better drooping flowers. Under this name plants are still sold, but they may not be identical with the original *C. Ehemanni*. This race has been variously crossed with other species and forms, and from innumerable seedlings there have been selected the dwarf and large-flowered cannas (Figs. 781, 782), which have now practically driven out the old tall small-flowered forms. These dwarf cannas are often known as French cannas, from the country of their origin; also, as Crozy cannas, from a renowned breeder of them. Within recent years, another race of cannas has arisen from the amalgamation of our native *C. flaccida* with the garden forms and with *C. iridiflora*. These have come mostly from Italy and are known as Italian cannas; also as orchid-flowered cannas. The flowers are characterized by soft and flowing iris-like outlines, but they are short-lived. Of this class are the varieties Italia (Fig. 783), Austria, Bavaria, Burgundia, America, Pandora, Burbank and others. For a sketch of the evolution of the garden cannas, see J. G. Baker, Journ. Roy. Hort. Soc., Jan., 1894; also, for the history of the Italian race, Revue Horticole, 1895, 516, and Gardeners' Chronicle, Dec. 14, 1895; Kränzlin, cited above.


780. Old-time canna.

The culture of cannas is simple and easy. They demand a warm, friable, rich and moist soil. They are injured by frost, and therefore should not be planted out until the weather is thoroughly settled. For dense mass effects, set the plants not more than 1 foot apart each way, but if it is desired to show individual plants and their flowers at the best, give three times that amount of room to a single plant. Pick the flowers as soon as they wilt, to prevent the formation of seeds (which causes the plant to lessen flowering), and keep the plants in tidy condition. Give the soil and treatment that produce the best results with Indian corn.

New varieties are raised from seeds. The seeds usually germinate slowly, and sometimes not at all, unless the integument is cut or filed, or is softened by soaking in water; these precautions taken, they germinate quickly. Sow late in winter, in rather strong bottom heat, in flats or pots. Prick out, and give plenty of room. They should make blooming plants the first year.

Commonly, cannas are propagated by dividing the rootstock. This rootstock is a branchy mass, with many large buds. If stock is not abundant, as many plants may be made from a rootstock as there are buds, although the weak buds produce weak plants. Leave as much tissue as possible with each bud. These one-bud parts usually give best results if started in pots, so that the plant is 6 to 12 inches high at planting time. The commercial canna plants are grown mostly in pots. If one has sufficient roots, however, it is better not to cut so close, but to leave several strong buds on each piece (as shown in Fig. 784). These pieces may be planted directly in the ground, although more certain results are to be secured by starting them in the house in boxes or pots. If strong effects are desired, particularly in shrub borders, it is well to plant the entire stool. In the fall, when the plants are killed by frost and the tops have dried a few days, dig the roots, and let them dry, retaining some of the earth on them. Then store them on shelves in a cellar that will keep Irish or round potatoes well. Take care that the roots do not become too warm, particularly before cold weather sets in; nor too moist. Well-cured roots from matured plants usually keep without much difficulty. If they do not hold much earth, it is well to throw a thin covering of light soil over them, particularly if they are the highly improved kinds.


781. Modern flowering canna.

Cannas are commonly used only in formal beds, but most excellent effects may be secured by scattering them singly or in very small clumps in the hardy border or amongst shrubbery. Against a heavy background of green, the gaudy flowers show to their best, and the ragged effect of the dying flowers is not noticed. They also make excellent centerpieces for formal beds. The tall-growing cannas, with small and late flowers, have given way almost wholly to the modern race of Crozy or French dwarf cannas, which usually remain under 4 feet high, and give an abundance of large early flowers. The canna always must be used for bold planting effects, because the flowers

have not sufficient durability to be very useful as cut-flowers. As individual blooms, the flowers are not usually attractive, but they are showy and interesting in the mass and at a distance. The new race of Italian or Flaccida cannas has more attractive flowers, but even these are most useful when on the plant.

It is impossible for the gardener to determine species of canna in the common garden forms. In fact, the species are little known except in herbaria and as wild plants growing in their original habitats. The monographers do not agree as to the definitions of what have been described as original or wild species. The following account of species is included more for the purpose of showing the range within the genus and of making a catalogue of leading botanical names than to set specific limits or to indicate what species-forms are in cultivation. The Crozy experiments began with crossing *C. Warscewiczii* with a variety of *C. nepalensis* of gardens (*C. flaccida?*) having large yellow flowers and very long creeping tubers; and some of the progeny was crossed with *C. aureopicta* (a garden form). The recent attractive orchid-flowered cannas spring largely from the *C. flaccida* forms.

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A. *Petal-like staminodia none.*

1. **paniculàta,** Ruiz & Pav. (*C. excélsa*, Lodd.). St. very tall, slender, glabrous: lvs. oblong or ovate and acute, green and glabrous above and pubescent beneath: racemes lax, disposed in a squarrose panicle, the fls. in 2's; sepals lanceolate, ⅘in. long, obtuse; petals lanceolate, yellow-green, 2–3 in. long; lip rather longer than the petals, crimson. Subequatorial Andes.

AA. *Petal-like staminodia 2.*

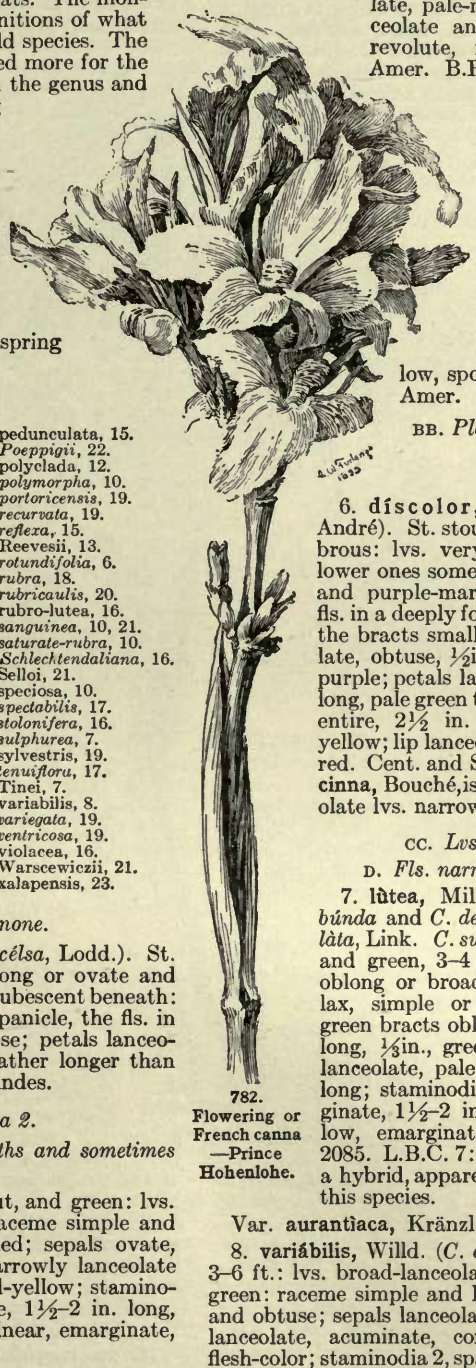
B. *Plant woolly-pubescent on the sheaths and sometimes on the lf.-blades.*

2. **compácta,** Roscoe. St. tall, stout, and green: lvs. many, oblong to ovate and acute: raceme simple and densely many-fld., the rachis 3-angled; sepals ovate, acute, ½in. long; petals unequal, narrowly lanceolate and long-acuminate, 1½ in. long, red-yellow; staminodia oblanceolate, slightly emarginate, 1½–2 in. long, scarlet or deep orange-red; lip broad-linear, emarginate, red-yellow. S. Amer.

3. **lanuginòsa,** Roscoe (*C. Achìras*, Litt.). St. green, woolly, 4–6 ft., densely lvd.: lvs. ovate-oblong, acute, green: raceme long and contracted, many-fld., simple, the bracts obtuse, small and green; sepals ovate-lanceolate, greenish red, ½in. or less long; petals long-lanceolate, 1½ in. long, tinged with red; staminodia entire, red or red-yellow; lip the same color, and revolute. Brazil, Peru. B.R. 1358.

4. **lagunénsis,** Lindl. Differs from *C. lanuginosa* in having long pale yellows fls., by some referred to *C. lutea:* plant of medium size, lightly lanate on the sheaths: lf.-blades ovate-oblong, short-acute and apiculate, pale-margined: petals linear-lanceolate and acuminate: lip strongly revolute, red-spotted. Mex., Cent. Amer. B.R. 1311, 1358. Aug.–Nov.

5. **pállida,** Roscoe (*C. Moritziàna*, Bouché). Plant medium height: lf.-blade elongate-elliptic, acuminate and filamentous at end, sometimes white-margined: raceme simple and narrow, the bracts broadly oblong-cuneate; sepals ovate and obtuse, green; petals lanceolate and acuminate, greenish-sulfur-color; lip linear, 2-tipped, revolute, pale yellow, spotted. W. Indies and N. S. Amer.



782. Flowering or French canna —Prince Hohenlohe.

BB. *Plant glabrous on sheaths and lf.-blades.*

C. *Lvs. of 2 colors.*

6. **díscolor,** Lindl. (*C. rotundifòlia*, André). St. stout, 6–10 ft., purple and glabrous: lvs. very broad-oblong, acute, the lower ones sometimes 3 ft. long, dark green and purple-margined, red-purple beneath: fls. in a deeply forked panicle of lax racemes, the bracts small and oblong; sepals lanceolate, obtuse, ½in. long, green, tinted with purple; petals lanceolate, acuminate, 1½ in. long, pale green tinted with rose; staminodia entire, 2½ in. long, bright red, exterior yellow; lip lanceolate and emarginate, brick-red. Cent. and S. Amer. B.R. 1231. **C. concinna,** Bouché, is a related species with lanceolate lvs. narrowed at both ends. S. Amer.

CC. *Lvs. unicolored, green.*

D. *Fls. narrow, the parts connivent.*

7. **lùtea,** Miller (*C. commutàta, C. floribúnda* and *C. densifòlia*, Bouché. *C. maculàta*, Link. *C. sulphùrea*, Hort.). St. slender and green, 3–4 ft., distantly foliated: lvs. oblong or broad-lanceolate, acute: raceme lax, simple or rarely forked, the small green bracts oblong and obtuse; sepals oblong, ⅛in., green, white-margined; petals lanceolate, pale yellowish white, 1–1¼ in. long; staminodia pale yellow, often emarginate, 1½–2 in. long; lip linear, pale yellow, emarginate. Mex. to Brazil. B.M. 2085. L.B.C. 7:646. **C. Tinei,** Tod., perhaps a hybrid, apparently is to be associated with this species.

Var. **aurantìaca,** Kränzl. Fls. orange; lip yellow.

8. **variábilis,** Willd. (*C. cárnea*, Roscoe). St. green, 3–6 ft.: lvs. broad-lanceolate or elliptic, acute, bright green: raceme simple and lax, the small bracts oblong and obtuse; sepals lanceolate, green, ½in. long; petals lanceolate, acuminate, concave, 1½ in. long, pale flesh-color; staminodia 2, spatulate-linear, mostly entire, variable in color but mostly orange or rose; lip linear or ligulate and entire: caps. small, globose. S. Brazil, the particular place unknown.

DD. *Fls. ringent or gaping, or open-spreading.*

E. *Infl. simple or only moderately branched.*

9. **hùmilis,** Bouché (*C. exígua,* Bouché). Low, 3 ft. or less, slender: lvs. short-petioled, the blade oblong, acute or short-acuminate, glabrous above and below, 10–16 in. long: raceme sub-simple (rarely paniculate), bearing fls. large for size of plant (about 3 in. long); sepals very unequal, ovate-oblong; petals long-lanceolate, concave, connate at base into a tube, scarlet; staminodia spatulate, more or less 2-lobed at apex; lip rather narrow, about 2¼ in. long. Farther India, China, etc. **C. cinnabarìna,** Bouché (*C. fúlgida,* Bouché), is a related species but larger and with yellow and scarlet rather smaller fls. Mex., Cent. Amer., W. Indies.

10. **speciòsa,** Roscoe (*C. leptochìla* and *C. saturàte-rùbra,* Bouché. *C. polymórpha,* Loud. *C. sanguínea,* Hort.). Large: st. green, 5–6 ft.: lvs. broad-oblong, acute: fls. in an elongated raceme or sometimes paniculate; sepals lanceolate, ¾in. long, pale purple; petals linear-lanceolate, 1½ in. long, erect, pale purple; staminodia 3 in. long, emarginate, bright red; lip emarginate, yellow. Himalayas. B.M. 2317. B.R. 1276. **C. chinénsis,** Willd. (*C. nepalénsis,* Wall.), differs in having reflexed petals.



783. Italia canna.

11. **orientàlis,** Roscoe (*C. flavéscens,* Link). St. slender, glabrous, 3–4 ft.: lvs. ovate-oblong, a foot or more long: raceme lax, simple or forked, the bracts oblong; sepals oblong-lanceolate, obtuse, ½in. or less long, pale green and rose-tinted; petals lanceolate, acuminate, 1½ in. long, pale rose; upper staminodia 2½ in. or less long, bright red, often emarginate; lip red-yellow: caps. globose and very small. Malaysian tropics.

EE. *Infl. much-branched; fls. purple.*

12. **polyclàda,** Wawra (*C. eximia,* Bouché. *C. cearénsis,* Huber). St. tall and very slender: lvs. ovate or ovate-lanceolate, acute: fls. (often in pairs) in a long, much-branched panicle, the bracts nearly orbicular; sepals lanceolate, ½in. long; petals long-lanceolate and unequal, acuminate, the longest about 2½ in., purple; staminodia acute, scarcely longer than the petals; lip oblanceolate, scarlet-spotted. Brazil.

AAA. *Petal-like staminodia 3 (exception in No. 18).*

B. *Lvs. lanceolate: fls. mostly yellow or orange.*

C. *Petals deflexed.*

13. **fláccida,** Salisb. (*C. glaùca* and *C. angustifòlia,* Walt.). St. green and glabrous, 4–6 ft., very leafy below: lvs. ovate-lanceolate to narrowly elliptic, acute, green: raceme simple, lax and few-fld., the bracts very small; sepals lanceolate or oblong, acuminate, 1 in. long, green; petals broadly linear-lanceolate to obovate and reflexed, to 3 in. long (as is also the tube); staminodia obovate, sulfur-yellow, 2–3 in. long by 1½ in. broad; lip large, yellow. Swamps S. C. to Fla., near the coast. L.B.C. 6:562. G.W. 12, p. 253.—Useful for its good habit and iris-like fls. **C. Reèvesii,** Lindl., of India and the Philippines, has the outside staminodia acute rather than all obtuse or emarginate as in *C. flaccida,* and fls. less than 4 in. across rather than about 6 in. across. B.R. 2004.

14. **Fíntelmannii,** Bouché. St. green and glaucous, 4–5 ft.: lvs. oblong or ovate-elliptic and acute, bright green: raceme few-fld. and rather dense, the bracts green and oblong; sepals oblong, ½in., green; petals lanceolate, acuminate, greenish yellow, 1½–2 in.; staminodia obtuse and entire (or 2-lobed at apex), 2–3 in., yellow; lip linear, strongly reflexed, yellow, mottled red: caps. large. Mex. and Cent. Amer.

15. **pedunculàta,** Sims (*C. Buékii,* Weinm. *C. refléxa,* Nees). St. tall, slender, green and glaucous, 5–6 ft.: lvs. oblong-lanceolate, green and glaucous, 1–2 ft. long and 3–4 in. broad: fls. in a many-fld. long raceme, with a hairy rachis and long-spreading pedicels, the bracts small, oblong and obtuse; sepals oblong, small and green; petals linear-lanceolate, greenish yellow, reflexed, 2 in. long; staminodia emarginate, about 2 in. long, pale yellow; lip oblanceolate, yellow: caps. globose, small. W. Indies, S. Amer. B.M. 2323. L.B.C. 7:622.

CC. *Petals erect.*

16. **glaùca,** Linn. (*C. Schlechtendaliàna,* Bouché. *C. Annæi,* André. *C. mexicàna,* and *C. stolonífera,* Bouché. *C. lanceolàta,* Lodd.). St. green and glaucous, 5–6 ft., from a long and stoloniferous rhizome: lvs. green and glaucous, oblong-lanceolate and very acute, tapering both ways (the middle of the blade 4–6 in. wide), white-margined: raceme lax, simple or forked; sepals ovate-obtuse, green, ½in. long; petals linear-lanceolate, yellow-green, 1½–2 in.; staminodia entire, 2½–3 in., yellow, not spotted; lip linear or obovate-oblong, emarginate, pale yellow: caps. oblong, 1½–2 in. long. W. Indies, S. Amer. Var. **rùbro-lùtea,** Hort., has fls. deep yellow tinted red, or in some portraits represented as deep purple. B.M. 3437. **C. longifòlia,** Bouché, from Mex. and Cent. Amer., has the petals all free, whereas they are united in a tube in *C. glauca,* and with curved sulfur-yellow fls. **C. leucocárpa,** Bouché, S. Amer., has petals united into a short tube, the fls. small, pale orange with broad leafy style. **C. violàcea,** Bouché, habitat unknown, has petals united in short tube, fls. violet, strongly gaping, plant deciduous-woolly above.

BB. *Lvs. broadly oblong or elliptic: rhizome tuberous.*

C. *Plant low or medium in height (mostly 5 ft. or less).*

D. *Staminodia entire at apex.*

17. **índica,** Linn. (*C. pàtens,* Roscoe. *C. cròcea,* Hort. *C. tenuiflòra* and *C. spectábilis,* Bouché. *C. coccínea,* Link). Indian Shot. St. slender, glabrous, green, 3–5 ft.: lvs. oblong and acute, green, not glaucous, half as broad as long (1–1½ ft. long): racemes simple or very nearly so and lax, some of the fls. in pairs, the bracts green and nearly orbicular; fls. small; sepals oblong and green, ¼in. long; petals lanceolate, pale green, about 1½ in. long; upper staminodia bright red, entire, 2 in. long but narrow; lip linear, red-yellow, minutely spotted with red: caps. globose, 1 in. diam. W. Indies, Cent. and S. Amer. Naturalized in parts of southern states. B.M. 454. B.R. 776. L.B.C. 17:1693.

18. **coccínea,** Miller (*C. rùbra,* Willd.). St. slender, green, 4–5 or sometimes 6 ft.: lvs. oblong, or oblong-lanceolate, and acute: raceme simple and lax, with small green, orbicular bracts; sepals lanceolate, ½in. or less

long, green tinged with red; petals lanceolate. acuminate, 1½ in. long, pale scarlet; staminodia 2, long and narrow, mostly emarginate; lip yellow-spotted: caps. globose and small. W. Indies, Cent. and S. Amer. **C. formòsa,** Bouché, Brazil, has 3 unlike staminodia.

DD. *Staminodia 2-lobed.*

19. **sylvéstris,** Roscoe (*C. portoricénsis,* Bouché). Plant stout, 4–5 or 6 ft.: lvs. long-oblong or oblong-lanceolate, acuminate, bright green, to 2½ ft. long and one-third as wide: raceme slender, usually squarrose, rarely simple; fls. narrow and elongated, red; sepals lanceolate and acute, ½in. long; petals much longer, lanceolate and very acuminate; staminodia sub-equal, narrow-spatulate; lip narrow, strongly revolute. W. Indies, Cent. Amer. **C. limbâta,** Roscoe (*C. pàtens,* Hook. *C. aùreo-vittàta,* Lodd. *C. floribúnda, C. variegàta, C. recurvàta, C. làta* and *C. ventricòsa,* Bouché), of S. Brazil, has unlike staminodia, the largest being 2-lobed, the medium one emarginate, the other entire, all red with yellow margins. B.R. 771. L.B.C. 449.

CC. *Plant tall, often up to 10 ft. (No. 21 perhaps excepted).*

D. *Staminodia of medium length (3 in. or less).*

E. *The staminodia not united.*

20. **edùlis,** Ker (*C. esculénta,* Lodd. *C. rubricaùlis,* Link). Rootstock thick and edible: st. stout, 8–12 ft., purple: lvs. large, oblong, or ovate-oblong, green or bronze, 1–2 ft. long: raceme lax, forked or simple; fls. red or brick-red, usually in pairs, the bracts orbicular or oblong; sepals oblong-lanceolate, ½in. long, tinged with red; petals oblong-lanceolate, 1½ in.; staminodia entire or emarginate, 2½ in. long, bright red or orange; lip bright red or yellow-red: caps. large. W. Indies, S. Amer. B.M. 2498. B.R. 775.—Starch is procured from the roots, and for this purpose the plant is widely cult. in the tropics.

21. **Warscewíczii,** Dietr. (*C. sanguínea,* Warsc.). St. claret-purple and glaucous, 3–4 ft.: lvs. oblong and acute, more or less claret- or bronze-tinged, ½ft. long and nearly one-half as broad: raceme simple and rather dense, with ovate, brown, glaucous bracts; sepals lanceolate, ½in., glaucous purple; petals lanceolate, acuminate, nearly 2 in. long, reddish and glaucous; staminodia oblanceolate, entire, 2½–3 in. long, bright scarlet; lip oblanceolate, emarginate, bright scarlet. Costa Rica, Brazil. B.M. 4854. **C. Sellòi,** Hort. (*C. pàtens,* Baker), of S. Brazil, is tomentose: sepals ovate; petals oblong-lanceolate, united into a tube; staminodia strongly reflexed, one 2-parted.

EE. *The staminodia united into a tube, or at least connate at base.*

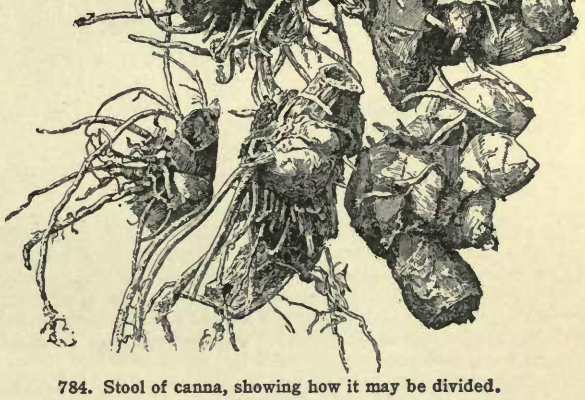
22. **Lâmbertii,** Lindl. (*C. Pæppigii,* Bouché). St. stout, very tall (to 10 or 11 ft.): green and glabrous, 12–14 ft.: lvs. oblong-lanceolate to elliptic, green, acute: raceme simple or forked, lax and few-fld., the bracts large and oblong, green; sepals lanceolate, pale purple or lilac, ½in. long; petals lanceolate, acuminate, 1½ in. long, purple; staminodia unlike, obovate, entire, scarcely longer than the petals, connate at base, bright crimson; lip bright crimson-purple: caps. oblong, large. W. Indies, S. Amer. B.R. 470.

23. **latifòlia,** Miller (*C. gigantèa,* Desf. *C. macrophýlla,* Hort. *C. neglécta,* Weinm. *C. gemélla,* Nees. *C. Altensteìnii,* Bouché). St. stout, very tall (10–16 ft.) pubescent: lvs. ovate or ovate-oblong, acute, green, but purple-margined when young, the lower ones often 3–4 ft. long: fls. in several racemes forming a panicle, the bracts oblong or the lower ones becoming several inches long; sepals oblong and green, ½in. long, very unequal, petals lanceolate, acuminate, 2 in. long, scarlet; staminodia united into a tube, entire at apex or one of them 2-lobed, somewhat twisted, brick-red; lip brick-red: caps. large. S. Amer. L.B.C. 7:634.—**C. heliconiifòlia,** Bouché, Texas to Venezuela, has the staminodia more or less connivent: fls. orange-red: lvs. long-petioled, more or less woolly, oblong-acuminate: plant 7–8 ft. Var. **xalapénsis,** Kränzl (*C. xalapénsis,* Bouché), has narrower lvs. and smaller stature.

DD. *Staminodia large (5 in. or less long), united into a tube.*

E. *Fls. pendulous, rose-colored.*

24. **iridiflòra,** Ruiz & Pav. St. green, 6–12 ft.: lvs. broad-oblong, bright green, slightly pubescent beneath: racemes paniculate, drooping; fls. large, beautiful rose-color; tube of corolla and staminodia as long as the blade; sepals lanceolate, 1 in. long; corolla-lobes lanceolate, 2½ in. long; 3 upper staminodia somewhat longer than the corolla-lobes, obovate, nearly or quite 1 in. broad, rose-crimson; lip narrow, deeply emarginate, rose-crimson. Andes of Peru. B.M. 1968. B.R. 609. L.B.C. 10:905. R.H. 1861:110.



784. Stool of canna, showing how it may be divided.

EE. *Fls. erect-spreading, white and red.*

25. **liliiflòra,** Warsc. St. robust, green, 8–10 ft.: lvs. many, oblong, green, 3–4 ft. long, spreading from the st. at a right angle: fls. in a corymbose panicle; sepals linear, as long as the tube of the corolla; corolla-lobes lanceolate, 2–3 in. long, pale green, the tube of equal length; 3 upper staminodia white, united into a tube for half their length, the blade obovate and spreading; lip oblanceolate, as long as the staminodia. Colombia. R.H. 1884:132. F.S. 10:1055–6.—A fine species. The white fls. finally become tinged with brown; lonicera-scented.

L. H. B.

CÁNNABIS (the ancient Greek name). *Moràceæ.* Hemp. A widely cultivated fiber plant, and also used occasionally as an ornamental subject, being grown from seeds and treated as a half-hardy annual.

Hemp is dicœcious: staminate fls. in axillary panicles, with 5 sepals and 5 drooping stamens and no petals; pistillate fls. in short spikes, with 1 sepal folding about the ovary: lvs. digitate, with 5–7 nearly linear, coarse-toothed lfts.: fr. a hard and brittle achene. **C. satîva,** Linn., probably native in Cent. Asia, is now escaped in many parts of the world: tall, rough and strong-smelling, 8–12 ft.: lfts. 5–11, linear-lanceolate, toothed, the upper lvs. alternate and the others more or less opposite. Only one species, but various forms have received specific names. In gardens, the form known as *C. gigantea* is commonest; this reaches a height of 10 ft. and more. The seeds are usually sown where the

plants are to stand; but if quick effects are wanted, they may be started indoors in pots or boxes. Hemp makes excellent screens in remote places. It thrives best in a rich rather moist soil. For field cult. for fiber (which is derived from the inner bark), see Cyclo. Amer. Agric., Vol. II, p. 377. L. H. B.

CANTELOUPE: *Muskmelon.*

CANTERBURY BELL: *Campanula Medium.*

CÁNTUA (from Cantu, Peruvian name). *Polemoniàceæ.* Showy flowering shrubs, with variable foliage, in greenhouses, and out-of-doors far South.



785. Capparis spinosa. (×⅙)

Flowers corymbose; calyx campanulate, of 5 (rarely 3) sepals, which are much shorter than the long tubular corolla; stamens inserted at the base of the corolla, but exceeding it in length.—Six species in S. Amer. One kind is recommended in Eu. as a coolhouse shrub. No tenderer than fuchsias. Prop. by cuttings in sand under a bell-jar.

buxifòlia, Juss. (*C. depéndens,* Pers.). Much-branched shrub, about 4 ft. high; branches more or less downy: lvs. very variable, generally oblong-obovate, acute, tapering at the base, entire or serrate, downy or glabrous: fls. 5–8, drooping vertically, in a kind of leafy, terminal corymb; calyx pale, membranous, green-streaked, 5-toothed, a fourth shorter than the corolla-tube; corolla long-funnel-shaped, the tube 2½ in. long, red, usually streaked; limb of fringed, obcordate, crimson lobes which are much shorter than the tube; stamens included. Peru. Apr., May. B.M. 4582. F.S. 7:650. R.H. 1858, p. 294. R.B. 27:181.—One of the choicest of European greenhouse plants. Very liable to red spider.

C. bícolor, Lem. Distinguished from the above by the entire lvs. which are shorter, about 1 in. long, and the solitary fls. with a short, yellow tube, the limb not fringed. The fls. droop, but not vertically. Peru. B.M. 4729. F.S. 4:343. Probably less desirable than the above.—*C. pyrifòlia,* Juss. Lvs. generally broader and more toothed than in C. bicolor: fls. as many as 17, in an erect, terminal, compound corymb; calyx red-tipped, nearly half as long as the yellow corolla-tube; corolla about 1¼ in. long, with a white limb; stamens long, exserted. Peru. B.M. 4386. F.S. 4:383.

WILHELM MILLER.
N. TAYLOR.†

CAOUTCHOUC TREE: *Hura, Manihot, Ficus elastica, Castilloa, Hevea, Landolphia,* and others, not treated here.

CAPE BULBS. A name applied to bulbous and bulb-like plants native to South Africa. They are dry-region plants, and often bloom with us in summer and autumn. Some of the leading genera are Amaryllis, Brunsvigia, Nerine, Ixia, Tritonia, Watsonia. See *Bulbs.*

CAPE'CHESTNUT: *Calodendrum capensis.*

CAPE GOOSEBERRY: *Physalis.*

CAPE JESSAMINE: *Gardenia.*

CAPER: *Capparis.*

CAPE-SPURGE: *Euphorbia Lathyrus.*

CÁPPARIS (Greek, *caper,* said by some to have been derived from the Arabic name of the plant). *Capparidàceæ.* CAPER-BUSH, or CAPER-TREE. Greenhouse plants North, and suited to the open in Florida and California.

Trees and shrubs, with simple lvs.: sepals 4, rarely 5; petals usually 4; stamens usually many, inserted on the receptacle, the filaments thread-like and free; ovary long-stalked, 1–4-celled, with many ovules.—More than 150 species distributed throughout the warm regions of the earth. Differing from Cleome and most other cult. genera of the family in having baccate, not capsular, fr.

Capers are pickles made by preserving the flower-buds of *C. spinosa,* a straggling shrub which grows out of old walls, rocks, and rubbish in Mediterranean regions and India. Also rarely cultivated as a greenhouse flowering shrub. Propagation is by cuttings of ripe wood, under a bell-jar, in greenhouses, and by seeds South.

spinòsa, Linn. Fig. 785. Spiny shrub, 3 ft. high, often straggling and vine-like: lvs. roundish or ovate, deciduous: fls. borne singly, alternately, and fading before noon; sepals 4; petals 4, oblong, clawed, wavy, white, 1½ in. long; stamens 40–50; filaments purple above, perhaps the chief beauty of the plant. B.M. 291. —What seems to be the long style with a short unopened stigma, is really the elongated peduncle or torus topped by the pistil, which has no style and a minute stigma. Var. **rupéstris** (*C. rupéstris,* Sibth. & Smith) is a spineless form.

Mítchellii, Lindl. A much-branched shrub, usually very spiny, and more or less densely tomentose: lvs. ovate-oblong, 1–1½ in. long, narrowed into a short petiole: fls. few, axillary, white or yellowish, followed by a tomentose globular berry 2 in. diam. Sand plains of Austral.—Suitable for dry places outdoors in S. Calif.

C. acuminàta, Lindl. St. shrubby, with flexuose, smooth branches: lvs. petiolate ovate-lanceolate, acuminate: fls. large, solitary, white, the conspicuous stamens 3–4 times as long as the petals. China. B.R. 1320.

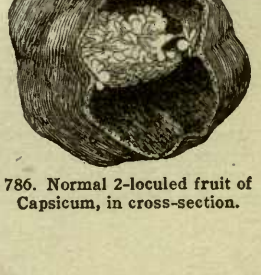
WILHELM MILLER.
N. TAYLOR.†

CAPRIFÒLIUM: *Lonicera.*

CAPRIÒLA: *Cynodon.*

CÁPSICUM (name of uncertain origin, perhaps from *kapto,* to bite, on account of the pungency of the seed or pericarp; or from *capsa,* a chest, having reference to the form of fruit). *Solanàceæ.* RED PEPPER. CAYENNE PEPPER. Herbs or shrubs, originally from tropical America, but escaped from cultivation in Old World tropics, where it was once supposed to be indigenous.

Stem branchy, 1–6 ft. high, glabrous or nearly so: lvs. ovate or subelliptical, entire, acuminate: fls. white or greenish white, rarely violaceous, solitary or sometimes in 2's or 3's; corolla rotate, usually 5-lobed; stamens 5, rarely 6 or 7, with bluish anthers dehiscing longitudinally; ovary originally 2–3-loculed: fr. a juiceless berry or pod, extremely variable in form and size, many-seeded, and with more or less pungency about the seeds and pericarp. Fig. 786. The fr. becomes many-



786. Normal 2-loculed fruit of Capsicum, in cross-section.

loculed and monstrous in cult.—About 90 species have been named, most of which are now considered forms of one or two species. Monogr. by Irish, 9th Ann. Rept. Mo. Bot. Gard. For cult., see *Pepper*.

A. *Plant annual or biennial.*

ânnuum, Linn. Fig. 787. Herbaceous or suffrutescent, grown as annuals in temperate climates, but in warmer latitudes often treated as biennials. All of the leading commercial varieties in the U. S. readily find classification within the types or botanical varieties. The species has never been found wild. It is the pimento of Trop. Amer.

B. *Fr. oblong-linear.*

C. *Calyx usually embracing base of fr.*

Var. **conoìdes,** Irish (*C. conoìdes,* Mill.). Suffrutescent: lvs. numerous, rather small, 2–3 in. long, ¾–2 in. wide: peduncles slender, straight, erect; fls. small; calyx obconical or cup-shaped, usually embracing base of fr.; corolla greenish white, spreading, ⅜–⅝in.: fr. erect, subconical or oblong-cylindrical, about 1¼ in. long or less, usually shorter than the peduncles and mostly borne above the lvs., very acrid. Coral Gem, Tabasco. Gn. 66, p. 381.

Var. **fasciculàtum,** Irish (*C. fasciculàtum,* Sturt.). Red Cluster Pepper. Fig. 788. St. herbaceous, round or nearly so: branches few: lvs. clustered or crowded in bunches about the summit, elliptical-lanceolate, pointed at both ends: fr. also clustered, erect, slender, about 3 in. long by ¼in. diam., very acrid.

Var. **acuminàtum,** Fingh. (*C. chilénse,* Hort.). Long Cayenne. Herbaceous, very branchy, about 2½ ft. high, bearing a dense mass of foliage: fl. medium size, spread ½–¾in.: fr. larger than the preceding, either erect or pendent. Chile.

CC. *Calyx not usually embracing base of fr.*

Var. **lóngum,** Sendt. (*C. ánnuum,* Linn. *C. lóngum,* DC.). Plant herbaceous, about 2½ ft. high, with comparatively few branches: lvs. large, often 4 in. long by 2½ in. wide: fl. large; corolla spreading, ⅞–1¼ in., dingy white; calyx usually pateriform or funnelform, rarely embracing base of fr.: fr. often a foot long by 2 in. diam. at base; flesh thick and in some varieties very mild. Garden varieties are: Black Nubian, County Fair, Elephant's Trunk, Ivory Tusk.



787. A form of Capsicum annuum.

BB. *Fr. of various shapes, but not oblong-linear.*

Var. **grò̀ssum,** Sendt. (*C. gróssum,* Linn.). Herbaceous, about 2 ft. high, with few branches: lvs. very large, often 3 by 5 in., sometimes coriaceous, lower ones usually pendent; petioles deeply channeled: peduncles stout, about 1 in. long; corolla large, spreading, ⅞–1¼ in.: fr. large, oblate, oblong, or truncated, 3–4-lobed, usually with basal depression, more or less sulcate and rugose; flesh thick, firm, and of a mild flavor. Emperor, Monstrous, Bell, Sweet Mountain, Golden Dawn, Ruby King, Golden King, Brazilian Upright, Golden Upright, Squash, and others, are garden varieties.

Var. **abbreviàtum,** Fingh. (*C. umbilicàtum,* Vell. *C. lùteum,* Lam.). Suffrutescent: lvs. broadly ovate, 2–4 in. long: peduncles slender, straight or curved, as long as or longer than the berry: fr. about 2 in. long or less, varying much in the different horticultural varieties, in general ovate, quite rugose, except in one variety, sometimes turbinate. While this variety is used to some extent for pickling, it is noted more as an ornamental plant. Some garden forms are: Celestial, Etna, Kaleidoscope, Red Wrinkled, Yellow Wrinkled.



788. Capsicum annuum var. fasciculatum.

Var. **cerasifórme,** Irish (*C. cerasifórme,* Mill.). Suffrutescent: lvs. medium size, ovate or oblong-acuminate, about 1¼–3½ in.: calyx seated on base of fr.; corolla large, spreading, ⅞–1½ in.: fr. spherical, subcordate, oblate, or occasionally obscurely pointed or slightly elongated, smooth or rarely minutely rugose or sulcate; flesh firm, ½–⅞in. thick, extremely pungent. Garden forms are: Cherry, Yellow Cherry, Oxheart.

AA. *Plant perennial.*

frutéscens, Linn. Fig. 789. Shrubby perennial, 3–6 ft. high, with prominently angled or somewhat channeled st. and branches: branches loosely spreading or trailing: lvs. broadly ovate-acuminate, 3–6 in. long, 2–3½ in. wide: peduncles slender, 1–2 in. long, often in pairs, usually longer than the fr.; calyx cup-shaped, embracing base of fr.; corolla often with ocherous markings in the throat: fr. red, obtuse or oblong-acuminate, ¾–1¼ in. long, ¼–¾in. diam., very acrid.—Cult. only S., as the seasons in temperate latitudes are not long enough to mature fr.

Var. **baccàtum,** Irish (*C. baccàtum,* Linn.). Plants not so tall, but more erect than the species: branches slender, fastigiate, flexuose: corolla small, spreading, about ½in.: fr. ovate or sub-round, about ¼in. diam.

H. C. Irish.

CARAGÀNA (*Caragan,* its Mongolian name). *Leguminòsæ.* Pea Tree. Ornamental shrubs chiefly grown for their bright yellow flowers; some species are also used for hedges.

Leaves abruptly pinnate, often with persistent spiny-pointed rachis; lfts. small, entire; stipules deciduous or persistent and spiny: fls. papilionaceous; standard upright, like the wings with long claws; keel obtuse and straight; stamens 10, 9 connate, 1 free; ovary scarcely stipitate: pod linear, terete, straight, 2-valved, with several seeds. —More than 50 species from S. Russia to China, most of them in Cent. Asia. Monograph by Komarov in Act. Hort. Petrop. 29:179–388 (1908), with 16 plates.



789. Capsicum frutescens.

The caraganas are deciduous unarmed or spiny shrubs

with yellow, rarely whitish or pinkish flowers axillary and solitary or fascicled, followed by linear pods. The cultivated species are quite hardy, except a few Himalayan species. They grow in almost any soil, but best in a sandy soil and sunny position, and are well adapted for shrubberies. *C. arborescens* is the only one which grows into a small tree, and is of upright habit, like *C. frutex*, which is about half as high and more graceful; most of the other species are low shrubs, of usually spreading habit. *C. arborescens* is one of the best hedge shrubs for the prairies of the Northwest.

Propagation is by seeds sown in fall or in spring; if kept dry during the winter, soaking in tepid water for two or three days before sowing will be of advantage; also increased by root-cuttings and layers, or by grafting on seedling stock of *C. arborescens* in spring.



790. Caragana microphylla. (×½)

A. *Lfts. 12–18, 1/6–½ in. long: rachis deciduous.*

microphýlla, Lam. (*C. Altagàna*, Poir. *C. arboréscens* var. *arenària*, Hort.). Fig. 790. From 4–6 ft.: lfts. 12–18, obovate, pubescent when young, grayish green, ⅓in. long or shorter: fls. 1 or 2, yellow, ¾in. long; pedicel about as long as the fl. Siberia, China. L.B.C. 11 : 1064.—Under this name a dwarf form of *C. arborescens* is often cult. Var. **megalántha,** Schneid. Lfts. bright green, ⅓ or sometimes ½in. long: fls. 1¼ in. long.

AA. *Lfts. 8–14, ½–1 in. long: rachis deciduous.*

arboréscens, Lam. Shrub or small tree, to 20 ft.: lfts. 8–12, obovate or oblong, sparsely pubescent beneath or glabrous at length: fls. 2–4, pale or bright yellow, ¾in. long; pedicels usually longer than the fls.: pods about 2 in. long. May, June. Siberia, Manchuria. G.O.H. 67. Var. **péndula,** Dipp., with pendulous branches, is the most remarkable; it should be grafted high. M.D.G. 1897:425. Var. **Lorbérgii,** Koehne. Lfts. linear to linear-oblanceolate, about 1 in. long. A very peculiar and striking form.

fruticòsa, Bess. (*C. Redówskii*, Fisch. *C. arboréscens* var. *arenària*, Sims). Shrub, to 6 ft., very similar to the preceding: lfts. 10–14, oblong-elliptic to obovate, cuneate at the base, rounded at the apex; stipules herbaceous or somewhat spiny; pedicels and calyx puberulous, calyx-teeth very short: pods about 1 in. long; seeds brown. Amurland, Korea. B.M. 1886 (not good).

AAA. *Lfts. 2–4.*

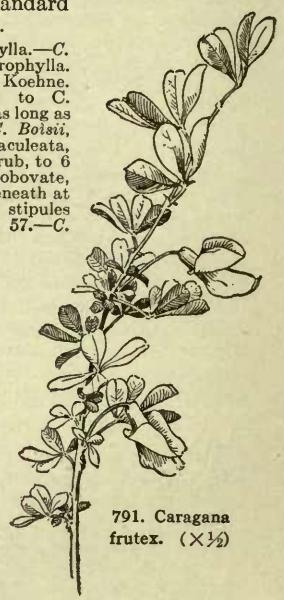
B. *Rachis of the lvs. deciduous: pedicels as long as or longer than the fls.*

frùtex, Koch (*C. frutéscens*, DC.). Fig. 791. From 6–10 ft.: lfts. 4, approximate, nearly digitate, cuneate, obovate or oblong, rounded or emarginate at the apex, glabrous, ⅓–1 in. long: fls. solitary, ¾–1 in. long, yellow. May. S. Russia to China. Gt. 10:348. S.B.F.G. 3:227. Var. **grandiflòra,** Koehne. Fls. somewhat longer than 1 in.: lfts. usually large and broad. Var. **latifòlia,** Schneid. (var. *obtusifòlia*, Hort.). Lfts. more than an inch long and about ½ in. broad: fls. as in the type.

BB. *Rachis persistent, spiny: pedicels shorter than the fls.*

Châmlagu, Lam. Shrub, 2–4 ft.: spines long: lfts. 4, in 2 somewhat remote pairs, chartaceous, obovate, emarginate or rounded at the apex, glabrous, ¼–¾in. long: fls. solitary, reddish yellow, 1¼ in. long. May. N. China. G.O.H. 30.

pýgmæa, DC. (*C. grácilis*, Hort.). One to 3 ft.: spines short, ¼in.: lvs. nearly sessile; lfts. 4, approximate and almost digitate, cuneate, linear-elliptic or linear-lanceolate, glabrous, ⅓–½in. long: fls. solitary, ¾in. long, golden yellow. Caucasus to Siberia and Thibet. B.R. 12:1021.—Grafted high on *C. arborescens*, it forms a graceful standard tree, with pendulous branches.



791. Caragana frutex. (×½)

C. Altagàna, Poir.=C. microphylla.—*C. arboréscens arenària*, Hort.=C. microphylla.—*C. arenària*, Dipp.=C. aurantiaca, Koehne.—*C. aurantiàca*, Koehne. Allied to C. pygmæa. Fls. orange-yellow; calyx as long as broad; ovary glabrous. Siberia.—*C. Boisii*, Schneid. (C. microphylla var. crasse-aculeata, Bois). Allied to C. arborescens. Shrub, to 6 ft.: lfts. 10–12, obovate or narrowly obovate, about ½in. long, silky pubescent beneath at least when young, whitish beneath; stipules spiny: fls. solitary. W. China. V.F. 57.—*C. brevispìna*, Royle (C.triflora, Lindl.). Spines 2–3 in. long: lfts. 12–16, pubescent: fls. 2–4, on a common peduncle. Himalayas. P.F.G. 2: 184.—*C. decórticans*, Hemsl. Allied to C. microphylla. Shrub or small tree, spiny: lfts. 8–12, oval, less than ½in. long: fls. 1–2. Afghanistan. H.I. 18:1725.—*C. frutéscens*, DC. =C. frutex.—*C. Gerardiàna*, Royle. Spines 1½–2 in. long: stipules large, scarious: lfts. 8–12, densely pubescent: fls. 1–2, short-pedicelled. Himalayas.—*C. grácilis*, Hort.=C. pygmæa.—*C. grandiflòra*, DC. Allied to C. pygmæa. Lfts. cuneate-oblong, glabrous or pubescent: fls. 1¼ in. long; calyx gibbous at the base. Caucasus.—The plant sometimes cult. under this name is a variety of C. frutex.—*C. jubàta*, Pall. Sparingly branched shrub with very thick, spiny and villous branches: stipules large, scarious: lfts. 8–14, linear-oblong, villous beneath: fls. whitish, 1 in. long, short-pedicelled. Siberia. F.S. 19:2013. L.B.C. 6:522. Gt. 10:331. A very distinct and curious-looking species: hardy.—*C. sophoræfòlia*, Bess. (C. arborescens×C. microphylla. C. cuneifolia, Dipp.). Lfts. usually 12, oblong to elliptic, cuneate, acute: pods ¾in. long. Garden origin.—*C. spinòsa*, DC. Spines 1 in. long: lfts. 4, rarely more, approximate, cuneate-lanceolate, glabrous: fls. solitary, short-pedicelled. Siberia.—*C. spinosissima*, C. Koch=C. spinosa.—*C. tragacanthoides*, Poir. Spiny: lfts. 4–8, cuneate, oblong, pubescent: fls. solitary, short-pedicelled; calyx villous-pubescent. Himalayas.—*C. triflòra*, Lindl.=C. brevispina.—*C. vulgàris*, Hort.=C. arborescens.

ALFRED REHDER.

CARAGUÀTA. By the latest monographer referred to *Guzmania*, which see.

CARALLÙMA (aboriginal name). *Asclepiadàceæ.* Low succulents, sometimes seen in collections; about 40 species, from S. Spain and Afr. to Arabia and India. They resemble stapelias, and require similar treatment. The sts. are leafless, somewhat branched, erect, 4-sided and the angles toothed: fls. near the summit of the sts., more or less clustered, purple, brown and yellow, and other colors; corolla rotate and 5-parted: fr. long and slender follicles. The carallumas are probably not in the American trade. Some of the names that may be expected in collections are *C. adscendens*, R. Br.; *C. affinis*, Wildem.; *C. campanulata*, N. E. Br. (Boucerosia campanulata, Wight); *C. commutata*, Berger (sometimes grown as C. Sprengeri); *C. fimbriata*, Wall.; *C. inversa*, N. E. Br.; *C. Luntii*, N. E. Br.;

C. Sprengeri, N. E. Br.; *C. Simonis*, Berger (Boucerosia Simonis, Hort.); *C. torta*, N. E. Br.

CARAMBÒLA: *Averrhoa.*

CARAWAY (*Càrum Càrvi*, Linn.). *Umbellíferæ.* A biennial or annual herb grown for its seeds, which are used in flavoring bread, cakes and cheese; also occasionally for the young shoots and leaves, which are eaten. It grows a foot or two high, has finely-cut, pinnately compound foliage, and small white flowers, in umbels. It is of the easiest culture. The seed is usually sown in spring and the crop of seed taken the following year. It thrives in any garden soil. The plant occasionally runs wild. See *Carum.*

CARBÈNIA: An incorrect or doubtful name for *Cnicus*, which see.

CARDÁMINE (Greek name of a cress). *Cruciferæ.* Small mostly leafy-stemmed perennials (the annual species apparently not cultivated), growing in low rich land, blooming in spring or early summer.



792. Cardamine pratensis. Root-leaves not showing.

Flowers sometimes large for size of plant, white or purple; petals obovate or spatulate: pods linear and straight, more or less flattened, the wingless seeds in 1 row, valves usually separating elastically from the base: lvs. simple or pinnate or lyrate: root often tuberous or rhizomatous.—About 50 species, largely in boreal or alpine regions. Of easy cult. Only *C. pratensis* is much known among growers.

praténsis, Linn. Cuckoo Flower. Fig. 792. Plant slender and usually glabrous, 12–20 in., somewhat branched: lvs. pinnately divided; lfts. of root-lvs. small and rounded (½in. or less across), those of the upper st.-lvs. oblong or even linear and entire or somewhat toothed: fls. ½in. long, in a corymb, white or rose-color, pretty. Eu. and Amer., in the northern parts.—In the gardens it is chiefly known in the double-fld. form, which probably has been derived from European rather than American sources. There are other forms of it. It is an excellent little plant to grow in moist places, particularly along creeks and about springs. It is also useful in drier places, as in rockeries.

trifòlia, Linn. Attractive spring bloomer, 6 in., creeping: lvs. ternate, the toothed parts or segms. irregularly roundish: fls. snow-white, on a naked scape. S. Eu. B.M. 452.

angulàta, Hook. Erect, 1–2 ft. high: lvs. 3–5-foliolate, the lfts. ovate or oblong, and the middle one usually coarsely toothed: fls. rather large, white, in short, few-fld. racemes. Mts. of Ore. and Wash.—Intro. 1881 by Gillett.

L. H. B.

CARDAMON: *Amomum* and *Elettaria.*

CARDIÁNDRA (Greek, *heart*, and *man* or *stamen:* alluding to the shape of the anthers). *Saxifragàceæ.* Ornamental half-shrubby plants, rarely cultivated for their white, lilac or pink flowers.

Suffruticose deciduous plants with alternate rather large lvs. and small pink, lilac or white fls. in terminal loose corymbs surrounded by large sterile fls.: calyx-tube cupulate, adnate to the ovary; petals 5; stamens numerous with filiform filaments and suborbicular anthers; ovary inferior, incompletely 3-celled; styles 3, short; sterile fls. with 3 large sepals: caps. loculicidal.—Three species in Japan and China. Tender plants, thriving in any good garden soil; best in a partly shaded and moist position. Prop. by greenwood cuttings under glass.



793. Fruit of Cardiospermum. (×½)

alternifòlia, Sieb. & Zucc. One to 3 ft.: lvs. broadly elliptic to elliptic-lanceolate, tapering into a very short petiole, coarsely serrate, sparsely pilose, membranaceous, 3–7 in. long: fls. pink, lilac or white. Summer. S.Z. 66, 67. Gt. 14:486.

Alfred Rehder.

CARDINAL FLOWER: *Lobelia cardinalis.*

CARDIOSPÉRMUM (Greek, *heart-seed*, from the white heart-shaped spot on the round black seed; hence the plant was thought a cure for heart diseases). *Sapindàceæ.* Tendril-climbing tropical herbs.

Leaves alternate, biternate; lfts. coarsely serrate: fls. small, white, polygamous or dicœcious, in axillary racemes or corymbs; sepals and petals 4, in pairs; stamens 8; ovary 3-celled, followed by a membranous caps.—A dozen species widely distributed. The most popular is the interesting balloon-vine, which is a rapid-growing, woody perennial, behaving as an annual, curious for its inflated seed-vessels. Fig. 793. Prop. by seeds.



794. Balloon-Vine—Cardiospermum Halicacabum. (×⅓)

Halicácabum, Linn. Fig. 794. Balloon-Vine. Heart-Seed. Heart-Pea. Height 10 ft.: st. and branches grooved: lvs. glabrous, oblong-acuminate, deeply dentate: balloons an inch or more thick. Trop. India, Afr., and Amer. B.M. 1049.—A general favorite, especially with children. Grown as a garden annual.

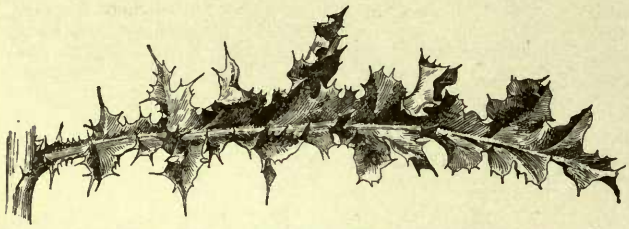
hirsùtum, Willd. Creeping or ascending perennial vine with densely hairy grooved st. and lvs. as in the preceding, but usually hairy on the under surface: fls. not showy: fr. pointed, hirsute; the globular chocolate-brown seed is borne on the detaching parachute-like dissepiment. Afr.—A useful perennial in S. Calif. for covering arbors; evergreen and blooming continuously.

N. Taylor.†

CARDOON (*Cýnara Cardúnculus*, Linn.). A thistle-like plant of southern Europe, cultivated for the thick leaf-stalk and midrib.

It is thought to be of the same species as the artichoke, and to have been developed from it by long cultivation and selection. See *Cynara.* The plant has been

introduced into South America, and has run wild extensively on the pampas. Darwin writes that "no cultivated plant has run wild on so enormous a scale as the cardoon." From the artichoke it differs in taller and more prickly growth and smaller heads. The cardoon is perennial, but it is not hardy, and is treated as an annual. Seeds are sown in spring, either in pots under glass or in the open where the plants are to stand. The later sowing is usually preferred. The plants are given



795. Leaf of Canada thistle.—Carduus arvensis or Cirsium arvense. (×⅓)

rich soil and should have abundant moisture supply, for they must make continuous and strong growth. When the leaves are nearly full grown, they are tied together near the top, straw is piled around the head, and earth is banked against it. This is to blanch the plant, for it is inedible unless so treated. From two to four weeks is required for the blanching. The procedure is not very unlike that adopted for the blanching of celery or endive. If the plants are late, they may be dug just before frost and blanched in a storage pit. The plants are usually grown 2 to 3 feet apart, in rows which are 4 feet apart. They are sometimes grown in trenches, after the old way of growing celery. Cardoon is very little known as a vegetable in America except among foreigners.

L. H. B.

CÁRDUUS (the ancient Latin name of these plants). *Compósitæ.* THISTLE. Spiny-leaved annual, biennial or perennial herbs, sometimes grown in borders and rock-gardens for the interesting habit and the heads of purple or white flowers.

Carduus is sometimes united with Cirsium, but is here kept distinct, being separated chiefly by non-plumose or only indistinctly serrate pappus-bristles (see *Cirsium*). The common weedy thistles are referred either to Carduus or Cirsium, depending on the definition of the genus. Fig. 795 shows the spiny leaf of one of these. Under the restricted use of the name, Carduus comprises about 80 species, from the Canary Isls. to Japan. For *C. benedictus*, see *Cnicus*.

acanthoìdes, Linn. A much-branched perennial about 18–24 in. high: lvs. bright green, pinnately parted, the nerves very prominent beneath, spinose margined: the solitary heads long-peduncled, the fls. purple and showy. S. Eu.—Scarcely known in Amer.

C. Marianus, Hort., is a Silybum, and *C. taùricum*, Hort., is a Cirsium. Both are advertised in England, but are unknown in Amer.

N. TAYLOR.†

CÀREX (name of obscure origin). *Cyperàceæ.* SEDGE. Grass-like perennials of very many kinds, a few of which are grown in bogs or as border plants.

Flowers unisexual, in spikes, the staminate naked and subtended by a bract or scale, the pistillate comprising a single pistil inclosed in a thin sac or perigynium; monœcious or rarely dicœcious: sts. or culms solid, not jointed, mostly 3-angled: lvs. grass-like but 3-ranked. One large group has 2 styles and a lenticular achene, and the spikes are commonly androgynous or contain both sexes (Fig. 796); another division has 3 styles and a triangular achene, and the spikes are commonly unisexual, the staminate being above (Figs. 797, 798).

Carices are very abundant in cool temperate regions, both in species and in individual plants. There are more than 800 known species. Many of them grow on dry land, but the largest species grow in low grounds and swales, and often form much of the bulk of bog hay. Carices cover great areas of marsh land in the upper Mississippi region and are employed in the manufacture of "grass carpets" or Crex fabrics. The species are difficult to distinguish because they are very similar, and the study of them is usually left to specialists. Some of our broad-leaved native species make excellent borders and interesting clumps in corners about buildings and along walls. Of such are *C. platyphylla*, *C. plantaginea*, *C. albursina*. Many of the lowland species are excellent adjuncts to the pond of hardy aquatics. Others have very graceful forms, with drooping spikes and slender culms (Fig. 798). The following native species, and probably others, have been offered by collectors: *C. aurea*, *C. eburnea*, *C. flava*, *C. Grayi* (one of the best), *C. hystricina*, *C. lupulina* and its var. *pedunculata*, *C. lurida*, *C. paupercula*, *C. pennsylvanica*, *C. plantaginea*, *C. Pseudo-Cyperus*, *C. retrorsa*, *C. Richardsonii*, *C. riparia*, *C. Tuckermanii*, *C. utriculata*, *C. vulpinoidea*. The species present no difficulties in cultivation if the natural habitat is imitated. Propagated readily by seed sown in late fall (germinating in spring) or by division of the clumps.

Mórrowi, Boott (*C. japónica*, Hort., not Thunb. *C. tenuissima*, Hort. *C. acutifòlia*, Hort.). Fig. 799. Lvs. stiff and evergreen, long-pointed, in the common garden form with a white band near either margin: culm 1 ft. with a terminal staminate spike and 2 or 3 slender pistillate spikes (1 in. long) from sheaths: perigynium small and firm, somewhat excurved, 2-toothed, glabrous. Japan. G.C. III. 13:173. R.B. 20, p. 9.—A very handsome plant, suited for pots or the border. The stiff clean white-edged foliage keeps in condition for months, making the plant useful for decorations in which pot-plants are used. It is perfectly hardy in Cent. N. Y., holding its foliage all winter. A useful florists' plant.



796. Carex (C. scoparia), with androgynous spikes and lenticular achenes. (×1). N. Amer.



797. Carex (C. lurida), with staminate terminal spikes and trigonous achenes. (×½). N. Amer.

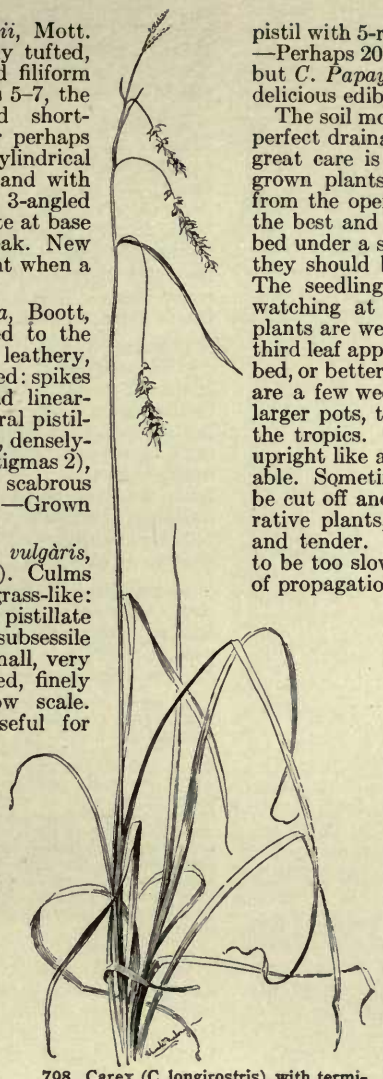
intuméscens, Rudge (*C. tenària*, Hort. *C. ténera*, Hort.). Slender, but stiff, to 30 in.: lvs. narrow, rolling more or less when dry: staminate spikes long-stalked: pistillate spikes 1 or 2, short-stalked, short, with few large, turgid, tapering, shining perigynia and awl-like, rough-pointed scales. N. Amer.

...mans, Berger (*C. Vilmorinii*, Mott. *C. Vilmoriniàna*, Hort.). Densely tufted, with many very narrow lvs., and filiform culms 1½ ft. or less high: spikes 5–7, the terminal staminate, linear and short-stalked, the lateral pistillate (or perhaps staminate at base), oblong or cylindrical and dense-fld., about 1 in. long, and with aristate scales: perigynium 3-angled (stigmas 3), lance-ovate, attenuate at base and with a 2-toothed scabrous beak. New Zeal.—A good hardy edging plant when a tufted grassy effect is desired.

Buchánanii, Berger (*C. lùcida*, Boott, var. *Buchánanii*, Kuek.). Allied to the preceding: densely tufted: lvs. leathery, semi-terete, very narrow, brown-red: spikes 5–8, the terminal staminate and linear-cylindrical, long-stalked, the lateral pistillate and cylindrical, 1½ in. long, densely-fld.: perigynium plano-convex (stigmas 2), produced into a long margined scabrous deeply bidentate beak. New Zeal.—Grown for its reddish foliage.

Gaudichaudiàna, Kunth (*C. vulgàris*, Fries, var. *Gaudichaudiàna*, Boott). Culms erect, 1–2 ft.: lvs. long and grass-like: staminate fls. in terminal spikes: pistillate fls. in 2–3 cylindrical, sessile or subsessile spikes: perigynium lenticular, small, very short-beaked, obscurely 2-toothed, finely nerved, longer than the narrow scale. Japan, Austral. New Zeal.—Useful for bog planting.

Fràseri, Andr. (*Cymophýllus Fràseri*, Mack.) Lvs. 1 in. or more broad, stiff, but with no midnerve, flat and thick, evergreen: culm 16 in. or less high-bearing at its summit a single whitish spike which is staminate at top: perigynium ovoid, thin and inflated. Rich mountain woods, Va. B.M. 1391 (as *C. Fraseriana*).—Rare, and a very remarkable plant.



798. Carex (C. longirostris), with terminal staminate spikes and drooping pistillate spikes. (×⅓). N. Amer.

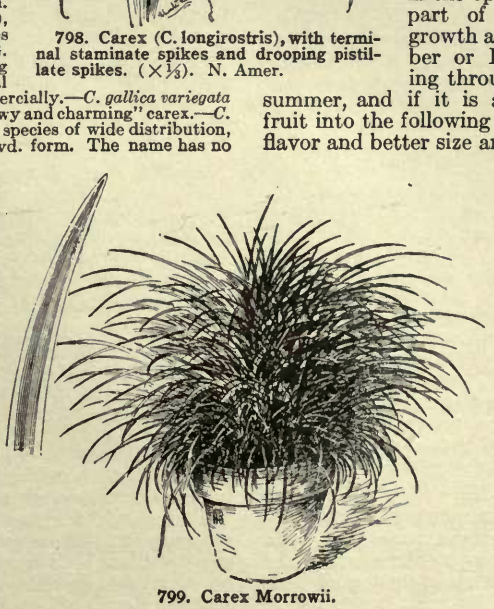
C. bàccans, Nees. Robust, with curving lvs. to 2 ft. long and ½in. broad: fr. berry-like (whence the name), crimson or vermilion, in clustered spikes standing well above the lvs. India. G. 1:461. Useful for pots or for planting in a conservatory, for its ornamental fr., but probably not now in cult. commercially.—*C. gallica variegata* is offered abroad as a "very elegant, showy and charming" carex.—*C. ripària*, Curt., a rank-growing lowland species of wide distribution, is sometimes grown in a variegated-lvd. form. The name has no botanical standing.—With the extension of wild gardening, and particularly of bog- and water-gardening, many other species of Carex may be expected to appear in the trade lists.

L. H. B.

CÀRICA (a geographical name). *Papayàceæ.* PAPAYA. Small, rapid-growing, unbranched trees, commonly grown in greenhouses as foliage plants and often bearing fruit under such conditions. Juice milky.

Leaves large, soft, long-stalked, in clusters at the top of the trunk: usually dicœcious, the male fls. on long axillary peduncles, funnel-shaped, with 10 anthers in the throat, the pistillate fls. larger and with 5 distinct petals and a single pistil with 5-rayed stigma, sessile in the axils of the lvs. —Perhaps 20 species, all native to the American tropics, but *C. Papaya* is cult. throughout the tropics for its delicious edible fruits. See *Papaya.*

The soil most suited for caricas is a rich loam, having perfect drainage. As the stem is succulent and tender, great care is necessary to avoid bruising, hence pot-grown plants are much to be preferred to seedlings from the open ground. Seeds should be selected from the best and largest fruits and sown in a well-worked bed under a slight shade. If seeds are quite dry or old, they should be soaked in warm water before sowing. The seedling plants are delicate, and require close watching at first to avoid damping-off. As soon as plants are well up remove the shading, and after the third leaf appears they may be pricked out into a larger bed, or better, potted off in fairly rich soil. After plants are a few weeks old, and have been shifted once into larger pots, they may be set permanently outdoors in the tropics. Caricas seldom branch, but usually grow upright like a palm, hence cuttings are not often available. Sometimes small branches form, and these may be cut off and as readily rooted as most tropical decorative plants, provided the cutting is not too young and tender. This method has been found in Florida to be too slow, and what is evidently a better method of propagation, by means of graftage, has been devised by Edward Simmonds, of the Plant Introduction Field Station, Miami, Florida. Numerous shoots are formed by the buds at the leaf-scars when a papaya tree is topped, as many as fifty or more being produced. "One of these shoots is taken when a few inches long and about the diameter of a lead pencil, is sharpened to a wedge point, the leaf surface reduced, and inserted in a cleft in a young seedling which has been decapitated when 5 to 10 inches high, and split with an unusually sharp, thin grafting-knife. At this age the trunk of the young seedling has not yet formed the hollow space in the center. Seeds planted in the greenhouse in February produce young seedlings large enough to graft some time in March; these grafted trees, which can be grown in pots, when set out in the open ground in May or the latter part of April, make an astonishing growth and come into bearing in November or December; they continue bearing throughout the following spring and summer, and if it is advisable, can be left to bear fruit into the following autumn." Varieties of superior flavor and better size and shape for shipping, as well as hermaphrodite varieties, may now be successfully maintained. For complete description of this method see "The Grafted Papaya as an Annual Fruit Tree," by David Fairchild and Edward Simmonds, Circular No. 119, Bureau of Plant Industry, 1913. In temperate climates, caricas have been found to be good decorative plants for both conservatory and summer bedding, the deeply cut, palmate leaves forming a striking contrast to ordinary vegetation. In bedding out, select open, sunny exposure, with perfect drainage, and make the soil rich and friable. Constant cultivation with a light hoe will cause a



799. Carex Morrowii.

luxuriant growth under these conditions, and the planter will be amply repaid for his trouble by beautiful showy specimens as tropical-appearing as palms.

Papàya, Linn. (*Papàya Cárica,* Gaertn.). PAPAYA. PAWPAW. The commonest species in cult., sometimes growing to a height of 20 ft., with large palmately 7-lobed lvs., sometimes 2 ft. across, and fr. shaped like a roughly angled melon up to 12 in. long and half as thick, hanging, especially from the lower axils of the pistillate plant. B.M. 2898–9.—From the frs., which vary in size up to 15 lbs. and in number to the tree from 20–50, is extracted the papaya juice, which furnishes the papain of commerce. This is obtained by slashing the fr., and collecting the milky juice in porcelain-lined receptacles, where it is allowed to evaporate. When evaporated to a granular condition, it is ready for the market and brings from $4–$6 a lb. in the crude state. The papaya has of recent years become one of the commonest table frs. of the tropics. The flesh, which is usually of a salmon-pink or yellow color, is excellent when one becomes accustomed to its peculiar flavor, and resembles somewhat a most luscious muskmelon. From its large content of papain, it may be eaten without injury in considerable quantities and assists in the digestion of other foods. As the tree grows with great rapidity in tropical climates, it may be treated as an annual, the seeds being sown early in protected beds, well cared for and transplanted to their permanent places when well established. They will then bear fr. late in the succeeding autumn. The method of graftage described on p. 663 is preferable, however. The frs. have a considerable cavity, which, in the smaller rounded frs., is well filled with the small brownish or blackish seeds. The firm skin, the firmness of which may be increased by selection, will permit of shipping to a distance. The plant is sometimes polygamous, and from such plants in Hawaii there have been bred types which appear to have great promise as a shipping fr. The green frs. are frequently used as vegetables, and the lvs., if cooked with tough meat, are said to make it tender, due to the digestive principle.

candamarcénsis, Hook. f. (*C. cundinamarcénsis,* Lindl.). This is a more hardy ornamental species with numerous lvs., dark green above and pale beneath, rounded-heart-shaped, 1¼ ft. across, 5-lobed to the center with pinnatifid lobes: fls. green and pubescent: frs. small, pointed, 5-angled, golden yellow. B.M. 6198. —Hardy in S. Calif., but the frs. of no value as such.

quercifòlia, Benth. & Hook. (*Vasconcéllea quercifòlia,* St. Hil.). Lvs. shaped like those of the English oak, palmately 3-lobed, and containing a greater percentage of papain than *C. Papaya;* frs. small.—Hardy in S. Calif.

grácilis, Solms. (*Papàya grácilis,* Regel). Habit of *C. Papaya;* trunk simple, 4–6 ft. high, slender, very glabrous: lvs. 5-digitate, the lobes sinuate-lobed, the middle one 3-lobed, the whole blade suborbicular in outline, petioled. Brazil. Gt. 1879:986.

S. C. STUNTZ.

CARÍSSA (aboriginal name). *Apocynàceæ.* Very branchy spinose shrubs of the tropics of the eastern hemisphere, cultivated for ornament or hedges, but here mainly for the edible berry-like fruits.

Flowers white, solitary or in cymes; lobes of calyx and corolla 5, the 5 stamens free and included in the throat, the ovary 2-loculed: lvs. opposite and thick, simple.—About 30 species. Used abroad as greenhouse plants but grown in this country only in S. Fla., and Calif. Prop. by seeds and cuttings of ripe wood.

Carándas, Linn. CARAUNDA. CHRIST'S-THORN. Evergreen shrub or small tree, with dark green ovate or elliptic mucronate entire lvs., strong axillary spines (which are often forked) and fragrant white fls. in clusters of 2–3, the corolla twisted to the left in the bud: fr. the size of a cherry (1 in. diam.), reddish, pleasant-flavored. India. L.B.C. 7:663.—Reaches 20 ft. Half-hardy in Cent. Fla. The frs. are eaten from the hand or made into a jelly much like currants when ripe, and pickled when green.

bispinòsa, Desf. (*C. arduìna,* Lam.). AMATUNGULU. MARITZGULA. Spines strong, often 2 in. long: lvs. ovate and subcordate, mucronate, glabrous and entire: fls. white, the corolla twisted to the right in the bud. S. Afr.—A choice evergreen shrub, rather hardy, with thick camellia-like very glossy lvs.: fls. large, fragrant, white, and borne profusely and continuously: fr. dark red, size of a cherry, good. L.B.C. 4:387.—Closely resembles *C. grandiflora,* but fls. slightly smaller and frs. in clusters; seeds lanceolate.

grandiflòra, DC. NATAL PLUM. Spiny shrub: lvs. ovate-acute, tapering to the base: fls. large, white, fragrant, solitary and terminal, twisted to the right, heterogonous: fr. red, 1–1½ in. long, resembling cranberries in flavor when cooked, and having a papery skin, milky juice and few small almost circular seeds. Sauce made from this fr. is almost indistinguishable in flavor from cranberry sauce, but the frs. ripen so irregularly, although almost continually, as to make the fr. suitable only for home-garden use unless handled on a large scale. Said to be the finest hedge plant in S. Afr. B.M. 6307.

acuminàta, DC. Spines weak: lvs. smaller, ovate-acute, subcordate, mucronate; peduncles short, forked, axillary: fls. with lance-acuminate calyx-lobes, the corolla twisted to the right in the bud. S. Afr.—Perhaps not different from *C. bispinosa.*

C. edùlis, Vahl. A straggling shrub with small purple edible fr. from Trop. Afr. Intro. from Abyssinia, but has not yet been thoroughly tested. The plant in the American trade under this name is described as much taller than C. Carandas and more vigorous: lvs. persistent, ovate-acuminate: fls. 10–25 in axillary clusters, white and pink, jasmine-scented: berries oval, red but turning black at maturity, 1-seeded.—*C. ovàta,* R. Br., from Austral., a more open shrub than any of the preceding, the small frs. of which are edible and used for jams, has been intro. by the Office of Foreign Seed and Plant Introduction as a possible stock for the more tender species, in the hope of extending the range of these frs.—*C. spinàrum,* DC., a small edible-fruited evergreen shrub from India is said to be an important element in reforestation since it persists on the poorest and rockiest soils in spite of being greedily eaten by sheep and goats.

S. C. STUNTZ.†

CARLÌNA (said to have cured the army of Charlemagne [Carolinus] of the plague). *Compósitæ.* Low rather coarse annuals, biennials or perennials, with thistle-like foliage, large white or purplish heads, a feathery pappus, and chaffy receptacle: outer involucral bracts coriaceous, usually spiny, the inner ones colored or shiny and petal-like: fr. a silky-hairy achene. —Some 15 or 20 species in the Medit. region.

An open sunny place and ordinary garden soil are all they require. They are capital for the sunny part of a rockery. Propagated by cuttings or seeds.

acaùlis, Linn. A very dwarf hardy perennial; height 3–6 in.: lvs. glossy, pinnatifid, divided, with spiny ends: fl. rising barely above the foliage, solitary, very interesting, the scales surrounding the fl.-head being long and narrow and ray- or petal-like, silky, shiny: head 6 in. across when expanded, white. June, July and late fall. G.C. II. 13:720–1. G.L. 19:178.

acanthifòlia, Linn. A white-tomentose thick-lvd. biennial, the lvs. oblong, the upper pinnatifid and spiny: fl.-heads 4 in. wide, yellowish purple. S. Eu. July and later. G.C. III. 47:68.—Little known in U. S.

N. TAYLOR.†

CARLUDÓVICA (Charles IV, and his Queen Louisa, of Spain). *Cyclanthàceæ.* Palm-like, sometimes merely herbaceous plants, of tropical America.

The plants are stemless, or sometimes with a lax creeping st., and usually have stalked, sometimes sessile, flabellate lvs.: fls. monœcious, the two sexes being on the same spadix, which is inclosed in a 4-lvd. spathe; staminate fls. with many stamens and many-

lobed calyx, 4 of them surrounding a pistillate fl.—the latter have a 4-sided ovary, 4 barren stamens, and 4-lobed calyx: fr. a 4-sided, many-seeded berry. The carludovicas are usually regarded and treated as stove palms by gardeners. They are useful for decoration. The family Cyclanthaceæ is exclusively tropical American, of about 45 species and 6 genera (Stelestylis, Carludovica, Sarcinanthus, Ludovia, Evodianthus, Cyclanthus); it is often united with the Pandanaceæ or screw-pine family.

The genus is an important economic one, as *C. palmata*, and perhaps other species, are the source of Panama hats. In making these, the leaves are cut young, the stiff veins removed, after which the leaves are slit into shreds, but not separated at the stalk end. It is said that hats of superior quality are plaited from a single leaf, without any joinings. U. S. Dept. Agric., Fiber Investigations. Rept. 9:112 (1897).



800. Carludovica palmata.

Carludovica palmata is the species most frequently met with under cultivation. Under favorable conditions it grows to a height of about 8 feet. All of the kinds need stove treatment during the winter months; in summer they may be used for subtropical bedding with good results. They have a certain palm-like appearance, but the leaves are of a softer texture than any of the palms. They may be propagated by division, choosing the early spring for the operation. *C. palmata* seeds freely. The fruit, when ripe, has an ornamental appearance for a short time after bursting open. The seeds are very small, and should be carefully washed free from the pulp, and sown on the surface of a pan of finely chopped sphagnum moss. Germination takes place in two weeks from sowing if kept in a brisk, moist heat. The species are not particular as to soil but the drainage must be perfect, as the plants require an abundance of water when growing. (G. W. Oliver.)

A. *Lvs. 3–5-lobed.*

palmàta, Ruiz. & Pav. Fig. 800. No trunk: petioles 3–6 ft. long, glabrous, terete and unarmed; blades 4-lobed, the lobes again cut into narrow segms., dark green, gracefully spreading, and drooping at the margin. Peru. R.H. 1861, p. 36.—The common species, and a very useful plant.

rotundifòlia, Wendl. Much like the last, but more compact under cult., owing to the shorter petioles, but growing much larger: petiole distinctly pubescent; lf.-blade large and orbicular, 3- or 4-lobed. Costa Rica. B.M. 7083.

élegans, Williams. Blades with 4 or 5 lobes, which are very deeply cut into straight strap-like divisions. Probably of horticultural origin.

AA. *Lvs. 2-lobed.*

atròvirens, Wendl. Blades very deeply 2-lobed and very deep, rich green (whence the name, *dark green*), glabrous. Colombia.

hûmilis, Poepp. & Endl. Dwarf: blades angular, 2-lobed at the summit, the segms. more or less jagged but not divided, a foot or less broad. Colombia. R.H. 1869, p. 327.—One of the best.

Plûmerii, Kunth (*C. palmæfòlia*, Sweet). Caudex erect: blades with 2 lanceolate and plicate divisions, bright green above and pale beneath: spadices pendulous. Martinique.

imperiàlis, Lind. & André. Caudex short and prostrate: blades with 2 ovate-lanceolate entire segms., with very prominent veins, the lobes about 5 in. wide and shining green; petiole purplish, canaliculate, tumid at the base. Ecuador. I.H. 21:166 (by error 165).

The following species are in cult. in this country but not as yet known to the trade: *C. funífera*, Kunth. Stemless or sometimes creeping and with a round, sparsely branched st.: lvs. alternate 1–2 ft. S. Amer.—*C. incìsa*, Wendl. A much cut, low plant from Cent. Amer.—*C. macrópoda*, Klotzsch. St. scarcely 1 ft. long: lvs. faintly 3-nerved, deeply 2-parted, 1½-2 ft. Colombia.—*C. microcéphala*, Hook. f. St. a few inches high: lvs. numerous, 10–18 in. long, split into 2 8-nerved segms.; petiole slender, purplish at base. Costa Rica. B.M. 7263.—*C. plicàta*, Klotzsch. St. short: lvs. divided into 2 1-nerved segms.; petioles channeled: spadix about 6 in. long: the thick woody caudex may not rise more than 1 ft. Colombia.—*C. scándens*, Cowell. St. creeping, often 25 ft. long: lvs. several at the summit, about 18 in. long. St. Kitts.

N. Taylor.†

CARMICHÆLIA (Capt. Dugald Carmichael, Scotch botanist, who wrote on the flora of the Cape and certain islands). *Leguminòsæ.* Shrubs, leafless or usually becoming so, either erect or depressed, with reddish or purplish small fls., rarely cult. There are about 20 species in New Zeal., very difficult of delimitation. Lvs. 1- or 3–5-foliolate, wanting or deciduous after the bloom has passed: fls. in lateral racemes; calyx cup-shaped or bell-shaped, 5-toothed; corolla papilionaceous, the standard orbicular and usually reflexed, the wings oblong and obtuse and somewhat falcate, the keel oblong and incurved and obtuse; upper stamen free: pod small, leathery, oblong to orbicular. **C. grandiflòra,** Hook. f., is recently offered in S. Calif.: it is much-branched, to 6 ft. high, with compressed and grooved glabrous erect branches: lvs. pinnately 3–5-foliolate, appearing in spring and early summer and then caducous, the lfts. glabrous and obcordate-cuneate: fls. about ¼in. long, in drooping racemes of 5–12, white or lilac. **C. odoràta,** Colenso, has pubescent drooping branches, and much smaller fls. in 10–20-fld. racemes: pod smaller (¼in. or less long) and longer-beaked.

L. H. B.

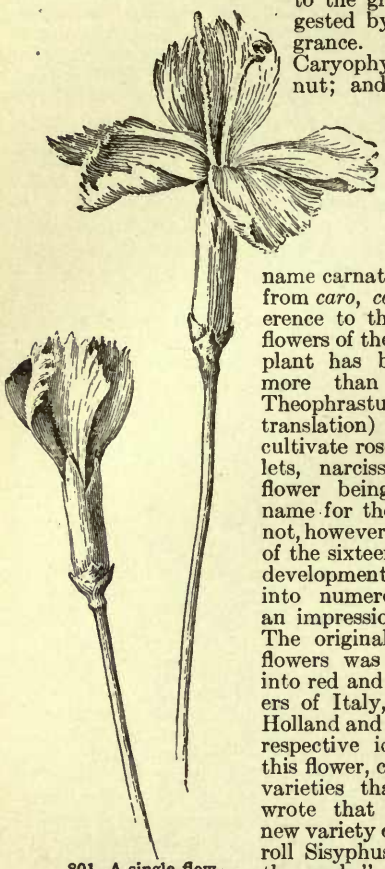
CARNATION (*Diánthus Caryophýllus*, Linn.). *Caryophylláceæ.* Choice and popular flower-garden and greenhouse plants of the pink tribe; in North America grown mostly under glass as florists' flowers. Pl. XXII.

The carnation is a half-hardy perennial, herbaceous, suffrutescent at base: height 2 ft.: st. branching, with tumid joints: lvs. linear, glaucous, opposite: fls. termi-

nal, mostly solitary; petals 5, flesh-colored, very broad, beardless, margins toothed; calyx cylindrical, with scaly bracts at base. June–Aug. S. Eu.; occasionally met in the wild state in England, where it was intro. through cult. A single-fld. and undeveloped carnation is shown in Fig. 801. A section of a single fl. is depicted in Fig. 802, showing the 2 styles and the 5 stamens; also the bracts at the bottom, in 2 series, beneath the calyx. In Fig. 803 some of the beginnings of doubling are shown.

General development. (By Geo. C. Butz.)

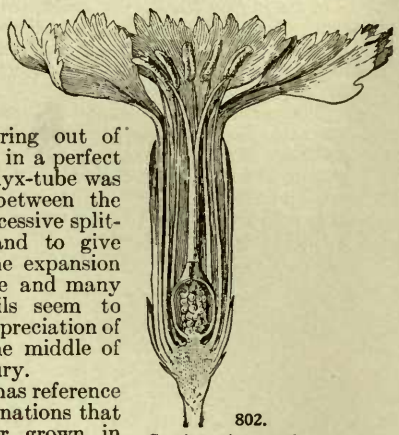
Theophrastus, who lived about 300 years B.C., gave the name Dianthus (Greek *dios*, divine; *anthos*, flower) to the group, probably suggested by the delightful fragrance. The specific name Caryophyllus (Greek, *caryon*, nut; and *phyllon*, leaf) has been applied to the clove-tree (*Caryophyllus aromaticus*), and because of the clove-like fragrance of the carnation this name was applied to it. The name carnation (Latin, *carnatio*, from *caro*, *carnis*, flesh) has reference to the flesh-color of the flowers of the original type. This plant has been in cultivation more than 2,000 years, for Theophrastus (History of Plants, translation) says: "The Greeks cultivate roses, gillyflowers, violets, narcissi, and iris," gillyflower being the old English name for the carnation. It was not, however, until the beginning of the sixteenth century that the development of the carnation into numerous varieties made an impression upon its history. The original flesh-color of its flowers was already broken up into red and white. The gardeners of Italy, France, Germany, Holland and England, with their respective ideals of beauty in this flower, contributed so many varieties that in 1597 Gerard wrote that "to describe each new variety of carnation were to roll Sisyphus' stone or number the sands."



801. A single-flowered Grenadin carnation. (×⅔)

There have been many attempts at classification, but most of them, like the varieties they serve, have disappeared. Two of them are as follows: A French scheme arranges all varieties into three classes: *Grenadins* (Fig. 801), including those with strong perfumes, flowers of medium size, either single or double, petals fringed, and of but one color; *Flamands*, including those with large flowers, round and double, rising in the center to form a convex surface, petals entire, either unicolored or striped with two or more colors; *Fancies*, including those with colors arranged in bands on light grounds, the petals toothed or not. The English classification of these varieties makes four categories: *Selfs*, or those possessing only one color in the petals; *Flakes*, or those having a pure ground of white or yellow and flaked or striped with one color, as scarlet, purple or rose; *Bizarres*, or those having a pure ground marked as in the Flakes, but with two or three colors; and *Picotees* (Fig. 804), or those having a pure ground of white or yellow, and each petal bordered with a band of color at the margin. This last class has been regarded with the distinction of a race.

In the early part of the nineteenth century, English gardeners exercised very great care in the growing of carnations to mature only perfect flowers. Imperfect and superfluous petals were extracted with forceps; petals appearing out of place were arranged in a perfect imbrication; the calyx-tube was cut partly down between the teeth, to prevent excessive splitting at one side and to give more freedom to the expansion of the flower. These and many more tedious details seem to have wrought the depreciation of this flower about the middle of the nineteenth century.



802. Section of normal carnation flower.

All the foregoing has reference to those types of carnations that are little known or grown in America at the present day; the varieties so common in Europe are usually kept in coldframes or coolhouses during the winter, and as spring approaches the plants are brought into their blooming quarters, for no flower is expected to appear until the month of July, when there is a great profusion of blossoms, but for a short season. Therefore, they can all be classed as a summer race. They are also grown permanently in the open.

Development of the perpetual-flowering carnation (Remontant, Monthly, Forcing, or Tree). Figs. 805–807.

The perpetual-flowering race of carnation, which has been brought to its highest state of perfection by American growers, and which is generally regarded as the "American carnation," really originated in France, and was grown in that country from its origin in 1840 until about the year 1856, before it was introduced to America. A French gardener, named M. Dalmais, obtained a constant-blooming carnation by crossing Œillet de Mahon, which bloomed in November, with pollen from Œillet Biohon, crossing again with the Flemish carnation, the first-named sort being disseminated under the name "Atim." By the year 1846 varieties in all colors had been secured and the type permanently fixed. These were taken up and improved upon in quality by other enthusiasts, among whom were M. Schmidt and M. Alphonse Alegatiere, of Lyons, France. The latter succeeded in securing varieties with rigid stems which in 1866 were given the name "tree-carnation." M. Schmidt's most prominent varieties were Arc-en-ciel and Etoile Polaire, which were grown for several years. But the strong rigid-stemmed varieties obtained by Alegatiere, which were termed tree-carnations in 1866, proved of greater value commercially, and became more generally cultivated. About the year 1852, a native of France who had settled near New York City, imported plants of this strain,



803. The anthers are leafy, showing one process in doubling.

and cultivated several varieties for a number of years. About the year 1856 the firm of Dailledouze, Zeller & Gard imported plants of La Purité, a rose-colored variety, also Mont Blanc and Edwardsii, white, and Manteaux Royal, red-and-white variegated. These were used for crossing, and the first variety produced in America, about the year 1858, proved to be a great improvement on existing varieties. It was named "Mrs. Degraw," and with another white variety named "Flatbush," was disseminated about the year 1864. Other varieties followed, and the work was taken up by other growers, among whom were M. Donati, who raised Astoria, a yellow which is conceded to be the ancestor of all the yellow varieties grown today; Rudolph Heintz, who raised Heintz's White in 1876; Chas. T. Starr, whose most famous variety was Buttercup, introduced in 1884; Jos. Tailby, whose Grace Wilder became and remained the standard rose-pink variety until the introduction of Wm. Scott in 1893; John Thorpe and W. P. Simmons, who introduced Portia, Tidal Wave, Silver Spray and Daybreak in the eighties; Sewal Fisher, whose Mrs. Fisher appeared in 1890 and became one of the leading whites; E. G. Hill, whose most notable productions were Flora Hill, the leading white for several years, and America, a scarlet; R. Witterstaetter, who obtained Estelle, Aristocrat, Afterglow and Pres. J. A. Valentine; John Hartje, who raised the scarlet Jubilee; Peter Fisher, whose Mrs. Thos. W. Lawson, Beacon, and Enchantress with its several sports, became leaders in their respective colors; C. W. Ward, who disseminated Governor Roosevelt, Harry Fenn and Mrs. C. W. Ward.



804. Carnation, Picotee.

The late Frederick Dorner conducted the most systematic work in developing the carnation, and succeeded in producing a strain which is recognized as the highest development of the American carnation. His records, which cover a period of 22 years, contain a complete list of the many thousands of crosses made during that time. This strain is distinguished for its easy-growing habit, its freedom and steadiness in producing blooms, the diversity of colors and its adaptability to commercial growing. His labors produced such varieties as Wm. Scott, Mme. Diaz Albertini, White Cloud, Mrs. Geo. M. Bradt, G. H. Crane, Lady Bountiful, White Perfection, Pink Delight, White Wonder and Gloriosa, all leaders in their respective colors.

Through the rapid strides in its development, after being introduced in this country, the carnation established itself as one of the leading flowers for commercial growing and now stands second only to the rose in commercial importance. Not only does it share equally with the rose the bench space in most large growing establishments, but many large ranges are devoted entirely to the carnation. Growing methods have been perfected by the carnation specialists until the practices employed during its early history have been entirely superseded. Since its first arrival in America, over 1,200 varieties have been introduced, and the quality has been improved until the highest developed varieties produce blooms measuring 4½ inches in diameter and are carried on rigid stems 3 feet long.

In 1891 the American Carnation Society was organized to promote the interests of the carnation. By holding exhibitions annually it has assisted materially in popularizing the flower. A system of registering new varieties is in operation, which prevents confusion in nomenclature.

From this country, the improved strain of the perpetual-flowering carnation has returned to European countries, being grown in increased quantities each year and displacing all the older types of carnation for commercial growing.

Culture of outdoor or flower-garden carnations. Fig. 808.

Americans are not sufficiently aware of the excellence of some of the forms of the flower-garden or border carnation. While perennial, like the greenhouse carnation, many of them bloom profusely the first year from seed and are described as annuals. The Marguerite type is one of the most useful. These forms bloom by midsummer from early-sown seeds, and with some protection the plants will pass the winter in the open and bloom again the following spring. The Margaret strain, distinct from the Marguerite, bears double flowers, sulfur-yellow, and also blooms the first season from early-sown seed. The Chabaud strains behave similarly. The Grenadins (Fig. 801) bloom the first year from seed. They pro-



805. The modern florists' carnation. High-centered dark-colored bloom.

806. Modern florists' or forcing carnation.

duce fine singles, of simple form and strong fragrance, although more than half of any sowing from improved seed may produce various degrees of double bloom. Riviera Market and others bloom in autumn from spring-sown seeds. The culture of the hardy or flower-garden carnations is very simple. Their profusion of summer bloom makes them desirable.



807. Carnation, Little Gem. A striped flower.

The Picotee class (Fig. 804) is little known in this country. It is a hardy perennial in England, and the fine strains are often propagated by layers (Fig. 809). They also do well from seeds, blooming freely the second year.

The Malmaison strain, which was the leading carnation in England before the advent of the Perpetual-flowering strain, has been found of little value in this country. On account of its large size it was used to some extent for breeding purposes, but with unsatisfactory results.

The border carnation is a more condensed and bushy plant than the long-stemmed few-flowered plant seen in the American greenhouses, although there are different families or groups of them as there are of phlox or snapdragons. Some forms are dwarf and some tall-growing.

American methods of culture for indoor bloom.

The modern method of propagating the carnation for commercial growing is by means of cuttings which are taken from either the blooming stock or from plants that are grown for cuttings alone. The old method of layering (Fig. 809) would prove too slow in increasing stock for present-day needs. Millions of cuttings are rooted each season for planting the houses for blooming purposes. So much depends on the quality of the cuttings in keeping up the vitality in the stock that expert growers have learned to discriminate in their selection. The best cuttings, if taken from the blooming stock, are those from near the middle of the flower-stems (Fig. 810). These will not only show greater vitality than those taken higher up or lower, but they will prove more floriferous The tip cuttings are likely to give a flower-bud immediately and, if this is pinched out, develop into a weak plant. Those taken from the base develop a large spreading growth known as "grassy." The cuttings are severed by an outward pull and are afterward trimmed of all surplus foliage before being inserted in the propagating sand. Have a sharp knife with which to trim and a pail of fresh water into which to throw the cuttings as they are trimmed. Make a smooth cut at the base, near the joint, so that the lower pair of leaves will peel off readily, leaving a half-inch of clear stem to go into the sand. Shorten those leaves which turn outward, leaving those which stand fairly upright. The removal of part of the foliage is to avoid crowding in the bench and also to prevent flagging while the cutting is giving off more moisture through its leaves than it is taking up through the stem. The cuttings are inserted in the sand about ¾inch deep in rows across the bench, placing the cuttings about ¾inch apart in the row and the rows about 2½ inches apart, according to the size of the cuttings. Use a putty knife for making the cut in the sand. The sand is kept constantly moist and the cuttings are protected from both the sun and drafts by means of muslin curtains. Frequent spraying should be avoided, though it must be resorted to at times to prevent flagging on warm windy days. The most favorable conditions for propagating are usually secured during the months of December, January, February and early March. During that period, ventilation is limited and a fairly even bottom-heat is easily maintained. Keep a bottom temperature of about 60°, while the overhead temperature should be about 52°. Any bench that can be protected from sun and drafts will prove satisfactory.

The bottom of the bench may be of wood or tile, the latter being preferred on account of more perfect drainage and a greater retention of warmth. The sand should be 3 inches deep after being packed down by means of a tool made from a 2-inch plank about 6 inches wide and



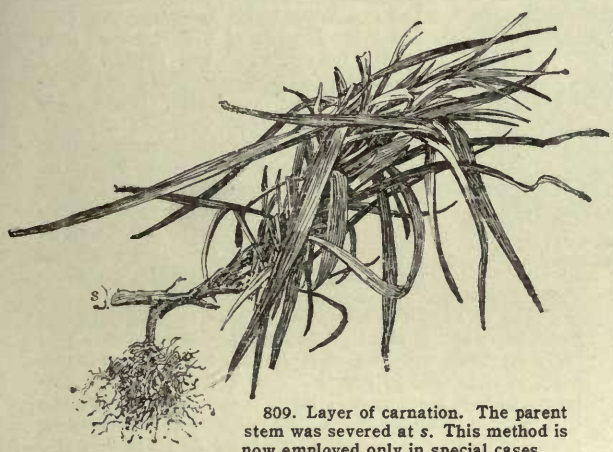
808. Flower-garden or outdoor carnation, showing the condensed bushy habit and short flower-stems.

12 inches long with an inverted V-shaped handle. In about four weeks the cuttings should be ready for potting (Fig. 811). Those that come out of the sand February 15 or earlier should be potted first into 2-inch pots and later on shifted into larger pots as needed. Those potted later may be placed directly into 2½-inch

pots and left until planted out, the object being to keep the young plants growing steadily until they are planted in the field. Stunted, pot-bound plants will be slow in breaking and are likely to develop stem-rot in the field. Use a moderately light soil and only fairly rich.

When the young plants begin to run up to flower, they should be topped back to about four joints above the pot (Fig. 812). A low-branched plant will stand up better and will give less trouble in supporting later on. A second topping may be necessary before planting-out time, on early-propagated stock. A slight hardening-off of the young plants before planting out is beneficial, though not essential. This is usually done by placing the plants in coldframes about two weeks prior to planting them in the field. Late April or early May is the time for planting in the field, according to latitude and climate. A rich loam, inclined to sandiness, produces the finest plants in the shortest time. In a heavy soil the growth will be heavier, but slower and less branching. Set the plants about 8 inches apart in the rows, and if hand-power is to be employed in cultivating, space the rows about 16 inches apart. Space farther if horse-power is to be used.

When a large business is done in young plants or rooted cuttings, a part of the stock is grown especially for cuttings alone. These plants are benched the same as those for blooming, but are not allowed to



809. Layer of carnation. The parent stem was severed at *s*. This method is now employed only in special cases.

bloom. As the shoots begin to run up to flower, they are broken off a few joints higher up than is done when topping in the field. The young shoots which result from these breaks are taken off for cuttings, the very finest cuttings being secured in this way. These are trimmed and handled the same as those taken from the flower-stems.

When packing cuttings for shipping, moist sphagnum moss is used in which to pack the roots. Cut papers (newspapers are used mostly) into sheets about 10 by 18 inches. Lay a strip of moss about 3 inches wide across the middle of the paper lengthwise. Then lay the cuttings side by side with only the roots on the moss. When twenty-five have been laid on, begin to roll from one end until all the cuttings have been taken up. Then turn in the lower part of the paper and continue to roll until the end of the paper has been reached and tie around with any kind of cord. There is little difference in the returns from plants grown for cuttings and those grown for blooms, providing a fair market is found for each.

In shipping plants from the field, the soil is all shaken from the roots. The plants are then set upright in the shipping-cases with moist moss between the roots, a layer of damp moss having first been placed on the bottom.

Cultivate as soon as practicable after each rain, and in the absence of rain at least once each week. Shallow cultivating is recommended, just enough to maintain a loose mulch on the surface. Do not water carnations in the field under any consideration. Cultivation will preserve moisture in the soil without causing soft growth. Keep topping back the young shoots as fast as they begin to run up, thus building up a shapely bushy plant.

If plants are to be placed inside during the summer, the benches should be refilled and made ready for planting as soon after May 1 as possible. It will be a great help to get the plants under way on the benches before hot weather sets in. Fill the benches the same as for field-grown plants and set the plants where they are to bloom. Indoor culture is practicable and profitable only when the benches can be spared by early May. If a good market can be found for the May and June cut, they will more than offset the slight advantage derived in the fall from indoor culture.



810. *a*. Desirable cuttings. *b*. Weak cutting, too high up on stem. *c*. Too low on stem.

If the blooming plants have not made an exceedingly rank growth, they may be cut back sharp early in May, cleaned off, mulched with long manure and grown on for blooming the following year. This should not be attempted, however, unless the plants are free from disease or insects and in good condition to break freely from the lower part of the plant.

Carnations are grown successfully on both raised and solid benches. Perfect drainage is essential, and must be provided for, if solid beds are to be used. There will be no difference in the quality or the quantity if both are properly handled.

By the end of June the old blooming plants will become exhausted, and refilling the benches to receive the new plants from the field will be in order. Clean out the old soil, whitewash the inside of the benches with hot lime and allow to dry before refilling with the new earth. Four inches of soil is enough, and should be of equal depth all over the bench, especially along the edges. The soil should be fairly moist, but not wet when the plants are set, so that the roots may draw moisture from the soil rather than have the soil draw the moisture from the



811. Strong cutting, well rooted.

roots. On the other hand, soil for potting or planting should never be handled while in a wet condition. If too dry at the time of filling the beds, water, and let stand long enough to dry to the proper state before planting.

Apply a light shade of lime or whiting to the glass, to break the fierceness of the summer sun until the plants become established. This shade should not be too heavy, nor intended to darken the house, else a softening and weakening of the growth will result. Lift the plants carefully by means of a spade and leave a ball of soil about the size of the fist on the roots. This ball of soil will greatly assist the plant in re-establishing itself in its new quarters. However, no serious harm will be done should all the soil crumble from the roots without breaking the roots to any considerable extent. Set the plants just about as deep into the soil as they stood in the field and space them about 9 by 12 inches, if plants are of ordinary size. Larger plants may need more, smaller plants less space. It should be borne in mind that the highest quality may be expected only when the plants are not crowded.



812. Showing where to top (*a*) or to head back.

After setting a few hundred plants, water each plant individually, saturating the soil thoroughly around each plant, but do not soak the whole bed until the roots become active and the surface of the soil has been worked over and leveled off, which will be about ten days after planting. Spray the plants overhead several times during each day to prevent wilting. Keeping the walks wet will also help to maintain a humid atmosphere until the roots are able to supply the plants with moisture. This transplanting is an ordeal during which the plants are unable to draw on the roots for support until they have taken a new hold on the soil, and wilting must be prevented by artificial means during this time. To allow severe wilting means loss of foliage and a loss of vitality, which results in inferior qualitv in at least the early part of the season.

As soon as the soil has been leveled off, and most of the weeds gotten rid of, the supports should be put in place. Large growers use one of two styles of supports, or a combination of the two. Wires run lengthwise between the rows, with cotton strings crosswise, placing two or three tiers one above the other to suit the height of the plants is extensively used. Another device is the carnation support, consisting of a wire stake with wire rings to surround each plant.


813. Undeveloped five-petaled carnation.

Yield of bloom.—Plants that were benched in the latter part of July, or early August, which is the time to plant for best results, should begin to yield blooms early in September. If flowers are not desired so early, the stems may be broken off about the time the bud appears, but no general topping should be done after the plants are housed, if a steady cut through the season is desired. Cut the blooms during the early part of the day. They are then fresh and retain their natural colors, much of which would be bleached out of the delicately colored sorts by the sun during a warm day. Place in water at once in a cool room as near 50° as possible. Sort the blooms in separate colors, making two or three grades of quality, tying them into bunches of twenty-five blooms. Cut the stems even at the bottom and replace in water. Avoid crowding the blooms while they are soaking up water, as they will increase 25 per cent in size during the first twenty-four hours in water.

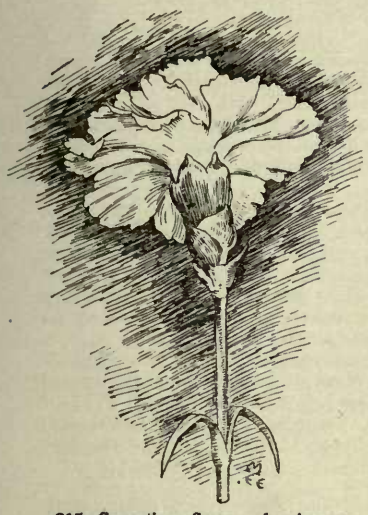
During a season, running from September to the end of the following June, an average cut of twenty blooms per plant may be expected from most varieties. Varieties differ somewhat, according to the size of the blooms, the smaller-flowered sorts usually being the freer bloomers.

The preparation of the soil for growing carnations is of the greatest importance. Choose a piece of land which has not been tilled for some years, if possible. If covered with a heavy sod, all the better. The soil should be a loam of good substance, with an inclination toward sandiness. Break this sod in the fall and leave in a rough state during the winter. In the spring plow again and sow to cowpeas or some other leguminous crop. After plowing this under in the fall, manure heavily and leave until the following spring when it should be plowed again. This soil should be in first-class condition for use the following summer. In working or handling soil, always bear in mind that to handle it while it is wet is to ruin it for immediate use. Only freezing will restore it again. If it will crumble readily, it is safe to handle. Soil which has been prepared in this manner will be rich enough to carry the plants until after the first of the year, when light feeding may be given. Feeding should be done judiciously during the short days of winter, to avoid softening the growth and bloom. Pulverized sheep-manure, dried blood and wood-ashes are used mostly for this purpose. The manure and blood improve the size and quality of the bloom, and the ashes strengthen the stem.

Ventilation and temperature.—The carnation being a cool-temperature plant, abundant fresh air and ventilation should be provided for. A steady temperature is essential to success in growing carnations. Splitting of


814. Carnation flower showing the calyx which has split on account of poor shape.

the calyx may usually be traced to either irregular temperature or to overdoses of feeding. Any point between 48° and 52° will prove a satisfactory night temperature for most varieties, providing it is evenly maintained. The temperature should be 10° higher during the day. Care should also be exercised, when building, in placing the ventilators, so that the atmosphere in the house may be changed without causing cold drafts to strike the plants. By placing the ventilators alternately on both sides of the ridge, this may be accomplished. The side ventilators are used only during mild weather.



815. Carnation flower showing a well-shaped calyx that will seldom burst.

The modern type of carnation house runs east and west, is of even span and is 30 feet or more in width, having ventilators on both sides of the ridge and in the side walls, if houses are detached. Many ranges are connected by gutters 6 feet or more from the ground. When economy in ground is necessary, this is a good plan, but such ranges always contain some benches inferior for growing stock on account of the shade cast by gutters. The single detached house is ideal. See *Greenhouse*.

Varieties.

The leading varieties in cultivation in this country at this time are—*White:* White Perfection, White Enchantress, White Wonder, Shasta, Matchless. *Flesh-Pink:* Enchantress, Pink Delight, Mayday, Pres. Valentine. *Rose-Pink:* Rose-Pink Enchantress, Dorothy Gordon, Gloriosa, Mrs. C. W. Ward, Philadelphia Pink. *Dark Pink:* Rosette, Washington, Peerless Pink, Northport. *Scarlet:* Beacon, Victory, St. Nicholas, Herald, Commodore. *Crimson:* Harry Fenn, Octoroon, Pocahontas. *Yellow:* Yellow Prince, Yellowstone. *White Variegated:* Benora, Mrs. B. P. Cheney. *Any other color:* Gorgeous, Rainbow. New varieties are being registered with the American Carnation Society at the rate of about twenty-five each year. Few varieties remain in cultivation longer than ten years, so that the list changes continually.

Diseases.

Stemrot (*Rhizoctonia*) is the common wet stemrot which does perhaps more damage than all the other diseases combined, and it is also more difficult to control than any of the others. Its presence does not manifest itself until its damage is wrought, and the plant is seen to wilt and die. The cause of the disease is a fungus which exists in the soil, and which will lie dormant in the soil for several years if there are no plants to attack. Hence no carnations should be planted for several years in soil which is known to have this fungus present.

Species of Fusarium cause a slow rot of the heart of the plant; the treatment is same as above.

Carnation-rust (*Uromyces caryophyllinus*) is more common than stemrot, but not nearly so destructive. A slight swelling of the outer tissue of the leaf is the first sign of its presence. Later on this bursts open, releasing a brown-colored powdery substance, comprising the spores by which the fungus is propagated. Keeping the foliage dry and the atmosphere buoyant and bracing will prevent the appearance of this disease. Spraying with bordeaux mixture has been found effective in combating this disease after it has gained a foothold.

Fairy-ring (*Heterosporium echinulatum*) is perhaps the most destructive of the spot diseases. It is brought on by a humid or foul atmosphere, and must be fought with remedies which will produce the opposite in atmospheric condition. Bordeaux is the standard remedy for all spot diseases.

Bench rot may be caused by any one of a number of organisms attacking the ends of the cuttings in the propagating-bench. It is frequently a very serious disease. The fungi most frequently causing the trouble are in the sand and under the ideal conditions of temperature and moisture of the propagating-bench spread very rapidly. The use of clean sand, free from all organic matter, and the securing of new sand for each lot of cuttings and cleanliness in the propagating-house will help to control this trouble.



817. Carnation flower Pink Delight, showing nearly entire-edged petals.

Insect pests.

A green plant-louse (*Myzus persicæ*) is frequently troublesome on carnations. It also attacks a large number of greenhouse and garden plants as well as several fruit trees. Nicotine applied in one of the many forms will destroy it. Spraying and vaporizing are both employed successfully as preventives of the attacks of aphids.

Thrips (*Heliothrips hæmorrhoidalis*) are equally destructive and more difficult to control. The same treatment as for aphis is suggested. Sweetened paris green used as a spray is also effective (three gallons of water; two pounds of brown sugar; two tablespoonfuls paris green).

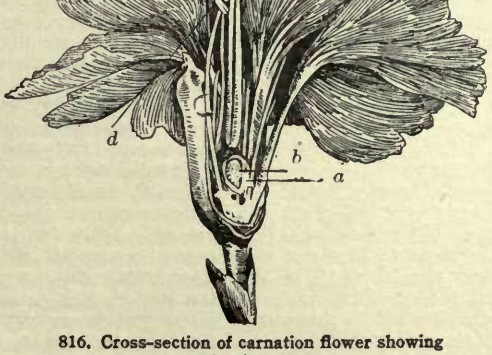
The punctures made by thrips and plant-lice cause yellowish spots on the leaves, a diseased condition known as *stigmanose*.

Red-spider (*Tetranychus bimaculatus*) is found mostly where plants grow near steam-pipes, where ventilation is poor, or in houses kept too dry. Persistent syringing with water will usually destroy them if the spray is applied to the under surface. Use much force and little water to avoid drenching the beds. Sulfur as a dust or in water will also destroy them.

The carnation mite (*Pediculopsis graminum*) injures the buds by transmitting the spores of a fungus (*Sporotrichum poæ*) which causes them to decay. The injured buds are easily recognized and should be promptly gathered and burned to prevent further spread of the trouble.

Raising new varieties.

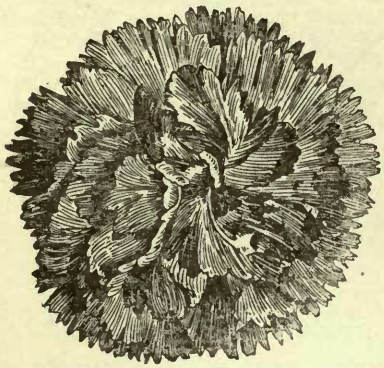
It is a long way from the undeveloped five-petaled carnation (Fig. 813) of early days to the perfectly formed full bloom of today. This filling out of the bloom has evolved gradually, and has been assisted by cross-fertilization and selection by the carnation-breeders through the many years in which the flower has been cultivated. This crossing, which has been the means of perfecting the American strain of the perpetual-flowering carnation, has been prosecuted continuously ever since the arrival of the first plants in this country. Many men have found both pleasure and profit in the work, and those with scientific inclination will find no subject more interesting. Not only have the blooms become larger, but the color has varied widely, the "substance" has been much improved, the calyx has been developed for non-bursting (Figs. 814, 815), the keeping qualities of the flowers have been improved, and the stems have been lengthened.



816. Cross-section of carnation flower showing reproductive organs.

The operation of pollinating the bloom, or transferring the pollen from one flower to the stigma of another, is a simple matter, and is perhaps of less importance than other parts of the work of producing desirable new varieties.

The Fig. 816 is a section of a flower showing the reproductive organs; *a* shows the pod which encases the ovules or forming seeds, *b*. From the tip of the pod rises the style which has usually two, but frequently three curved ends, or stigmas, *c*. When the stigma is in the proper stage to be fertilized, which is indicated by the fuzzy appearance of the upper part, the pollen, which is the powdery substance released by the anthers, *d*, is applied to the fuzzy parts. To prevent self-fertilization, these anthers should be removed from flowers intended to be pollinated, before the pollen is released. Within one to three days, if fertilization has taken place, the bloom will wilt, the ovary will begin to swell and within a week the seed-pod can be seen to increase in size. As soon as the bloom has wilted, the petals should be removed and the calyx slit down the sides to prevent water from standing inside the calyx and causing the pod to decay. In six to eight weeks the seeds will be ripe and should be sown at once. Each seed may prove to be the beginning of a variety which will be one of the milestones of progress in the improvement of the carnation. Not one should be discarded until it has bloomed.



818. Carnation flower Radiance, showing deeply serrated petals.

The seedlings should be potted as soon as the first pair of character-leaves appears. Later on they may be shifted into larger pots and bloomed, or they may be planted in the field and marked as they bloom and only the promising ones housed in the fall. The selecting of the plants for further trial is of the very greatest importance and requires a thorough knowledge of the subject. There are many points in the make-up of a first-class carnation, and a combination of as many of these as is possible to get in one plant is the object sought. No carnation has ever been found which was perfect in every way. The hybridist must be able to judge correctly as to the relative value or loss represented in certain characteristics shown by a seedling plant. This discrimination between the desirable and undesirable calls for the clearest judgment, and a valuable variety might be discarded through the failure of the grower to see its good points.

Among the seedlings will probably appear variety of colors, shapes and sizes of bloom, different types of growth, perfect in some respects and faulty in others. From these the hybridist is to select those which most nearly represent his ideal of the perfect carnation. This ideal should be of a pleasing shade of color, pure in tone, so as to hold when the bloom ages. The form should be symmetrical, resembling as nearly as possible a half sphere with just enough petals to fill the bloom nicely without crowding. The petals may range from the smooth-edged, as seen in Fig. 817, to the deeply-serrated, as seen in Fig. 818. The texture of the petals should be such as will resist bruising. The odor should be strong clove. The size should be as near 4 inches across as possible under ordinary culture. The calyx should be strong and large enough to hold the petals firmly at all stages of development. The stem should be 30 to 36 inches long, and strong enough to hold the bloom erect. The plant should have a free-growing habit, throwing blooming shoots freely after a shoot is topped or a bloom is cut. It should also be healthy and disease-resistant. The American Carnation Society uses the following scale of points for new varieties:

Color	25
Size	20
Calyx	5
Stem	20
Substance	15
Form	10
Fragrance	5
	100

The most uniform results have been secured by confining the breeding to separate colors; as, for example, crossing white with white, red with red or crimson, pink with pink, and so on. This method has been proved to produce the largest percentage of self-colors, which are considered the most valuable commercially in this country.

New varieties are frequently secured by sporting or mutation. A variety of a certain color may produce a bloom of another color, and by propagating the cuttings from the stem which carried the odd bloom a new variety is established. The securing of a new variety in this way is purely a matter of good fortune, as no method for causing the sporting is yet known.

Leading books on the carnation are: "The American Carnation," by C. W. Ward; "Carnations, Picotees and Pinks," by T. W. Sanders; "Carnations and Pinks," by T. H. Cook, Jas. Douglas and J. F. McLeod; "Carnation Culture," by B. C. Ravenscroft. The last three are English. A. F. J. Baur.

CARNÈGIEA (named for Andrew Carnegie, philanthropist). *Cactàceæ*. The giant tree cactus of Arizona, California and Mexico.

Large columnar plants, usually single, strongly ribbed, with numerous spines, those from flowering and sterile areoles quite different: fls. borne from the upper areoles, diurnal, funnelform; petals white: fr. an oblong edible berry; seeds black and shining.

gigantèa, Brit. & Rose (*Cèreus gigantèus*, Engelm.). Suwarro. (Plate III, Fig. 819.) A tree 20–60 ft. high, usually single, but sometimes with one or more branches: ribs in mature plants 18–21: fr. 2–3 in. long. B.M. 7222. A.G. 11:451, 528.—In rocky valleys and on mountain-sides, S. Ariz. and Sonora, with 2 stations in Calif. [reported, but probably not to be found, in Lower Calif.]. This great cactus does not do well in cult., although large plants are often brought into greenhouses and grounds about railroad stations in the S. W. It is not suited for small collections. The fr. is gathered in great quantities by the Indians of Ariz. J. N. Rose.

CAROB: *Ceratonia.*

CAROLÌNEA: *Pachirà.*

CARPENTÈRIA (after Professor Carpenter, of Louisiana). *Saxifragàceæ*. Ornamental shrub cultivated for its large fragrant white flowers.

Evergreen: lvs. opposite, petioled, usually entire: calyx 5-parted; petals 5; stamens numerous; ovary almost superior, 5–7-celled; styles 5–7, connate at the base, with linear-oblong stigmas: fr. a many-seeded dehiscent caps. with numerous oblong seeds.—One species in Calif.

This is a highly ornamental evergreen plant, with rather large opposite leaves and showy white and fragrant flowers in loose and terminal corymbs. Hardy only in warmer temperate regions. It requires a well-drained, light and sandy soil, and sunny, somewhat sheltered position; it especially dislikes moisture during the winter, and its perishing is more often due to an excess of moisture than to the cold. Propagated by greenwood cuttings under glass in



819. Flower of Carnegiea gigantea. (×¼)

summer, and by suckers, which it produces freely; also, by seeds sown in spring.

califórnica, Torr. Shrub, 6–10 ft.: lvs. elliptic-lanceolate, entire or remotely denticulate, bright green above, whitish-tomentose beneath, 2–4 in. long: fls. pure white, 2½–3 in. diam., fragrant; petals orbicular, concave. June, July. B.M. 6911. Gn. 31:100; 34, p. 75; 36, p. 26; 54, p. 248; 76, p. 376. G.C. II. 26:113; III. 40:6, 7; 44:112. R.H. 1884, p. 365. J.H. III. 29:251; 45:107; 59:61. M.D.G. 1913:121. G.M. 31:25; 40:300. G. 29:695. Gn.W. 4:569. ALFRED REHDER.

CARPET-BEDDING: *Bedding.*

CARPÌNUS (ancient Latin name). *Betulàceæ.* HORNBEAM. Trees cultivated for their handsome foliage, assuming bright autumnal tints; also for the light green attractive fruit-clusters.

Deciduous trees or rarely shrubs: winter-buds conspicuous, acute with many imbricate scales: lvs. alternate, petioled, serrate, with deciduous stipules: fls. monœcious; staminate catkins pendulous, each scale bearing 3–13 stamens, 2-forked at the apex; pistillate catkins terminal, slender, each scale bearing 2 ovaries, the bracts and bractlets of which develop into a large, leafy, more or less 3-lobed bract, embracing the small, nut-like fruit at their base.—About 20 species, most of them in Cent. and E. Asia, 5 in Eu. and W. Asia and 1 in N. and Cent. Amer. Monogr. by Winkler in Engler, Pflanzenreich, Betulaceæ, hft. 19, pp. 24–43, quoted below as W. B.

The hornbeams are trees usually with dense round head, rarely shrubby, with medium-sized, bright green ovate to lanceolate leaves and rather insignificant flowers appearing with the leaves and followed by pendulous catkins consisting of large bracts bearing a small nutlet in their axils. The wood is very hard and close-grained, and much used in making tools and other small articles. The handsome foliage is rarely attacked by insects, and assumes a yellow or scarlet color in fall. The most beautiful are *C. cordata,* with large leaves, and *C. japonica,* of graceful habit and with elegant foliage. The European hornbeam bears severe pruning well, and is very valuable for high hedges; it was formerly much used in the old formal gardens for this purpose; it makes, also, an excellent game cover, as it retains its withered foliage almost throughout the winter.

The species are of comparatively slow growth and thrive in almost any soil, and even in dry, rocky situations; most of them are quite hardy North. Propagated by seeds, sown usually in fall, germinating very irregularly; if they do not appear the first spring, the seed-bed should be covered until the following spring with moss or leaf-mold, to keep the soil moist. If intended for hedges, the seedlings should be transplanted after the first year, and allowed sufficient space to prevent them from growing into slender tall plants, unfit for hedges. The varieties of rarer species are grafted in spring under glass, or in the open air on seedlings of one of the common species.

A. *Lvs. with 7–15 secondary veins: mature catkins with spreading narrow bracts.*

caroliniàna, Walt. (*C. americàna,* Michx. *C. virginiàna,* Michx. f.). AMERICAN HORNBEAM. BLUE BEECH. Fig. 820. Bushy tree, rarely 40 ft.: lvs. ovate-oblong, usually rounded at the base, acuminate, sharply and doubly serrate, glabrous at length, except in the axils of the veins beneath, 2–4 in. long: fr.-clusters peduncled, 2–4 in. long: bracts ovate or ovate-lanceolate, ¾–1 in. long, with 2 broad and short unequal lateral lobes, and a much longer middle lobe, usually serrate only on one margin. E. N. Amer., west to Minn. and Texas; also, in Mex. and Cent. Amer. S.S. 9:447. Em. 1:199. Gn. 24, p. 418.—Bushy tree, with dense, but slender and often somewhat pendulous branches, and dark bluish green foliage, changing to scarlet or orange-yellow in fall.

Bétulus, Linn. EUROPEAN HORNBEAM. Tree, to 60 or 70 ft.: lvs. similar to those of the former, cordate or rounded at the base, ovate or oblong-ovate, of somewhat thicker texture, and the veins more impressed above: fr.-clusters 3–5 in. long: bracts over 1½ in. long, with ovate, lateral lobes, and much longer oblong-lanceolate middle lobe, the margins almost entire or remotely denticulate. Eu. to Persia. H.W. 2:17, pp. 31–33. W.B. 29. F.S.R. 3, p. 153. Gn. 24, pp. 418, 419, 420.—The most remarkable of the garden forms are the following: Var. **incìsa,** Ait. (var. *asplenifòlia,* Hort.). Lvs. incised or lobed, smaller. Gn. 24, p. 419. Var. **pyramidàlis,** Dipp. (var. *fastigiàta,* Hort.). Of upright growth. Var. **purpùrea,** Dipp. Lvs. purplish when young, green at length.—It grows into a taller tree than the American species, although the former is of more vigorous growth when young; the foliage turns yellow in fall, and remains on the tree throughout the winter.



820. Carpinus caroliniana. (×⅔)

AA. *Lvs. with 15–25 pairs of veins: mature catkins with loosely appressed ovate and dentate bracts, of cone-like appearance.*

japónica, Blume (*C. Carpinus,* Sarg. *Distegocárpus Carpinus,* Sieb. & Zucc.). Tree, to 50 ft.: young branchlets pubescent: lvs. reddish brown when unfolding, oblong-ovate or oblong-lanceolate, 2–4 in. long, acuminate, rounded or subcordate at the base, unequally serrate, with 20–24 pairs of veins deeply impressed above, bright green and glabrous above, beneath brownish pubescent on the veins at first, finally glabrous or nearly so: mature catkins ovoid-oblong, 2 in. long, slender-peduncled; bracts inflexed at the base inclosing the nutlet. Japan. G.F. 6:365. R.H. 1895, p. 427. S.I.F. 1:24.—A very graceful species and quite hardy; sometimes cult. under the name *C. laxiflora,* which is an entirely different species with the lvs. having only 10–14 pairs of veins.

cordàta, Blume. Tree, to 40 ft.: young branchlets hairy at first, soon glabrous: lvs. ovate or oblong-ovate, acuminate, distinctly cordate at the base, 3–6 in. long, unequally serrate, with 15–20 pairs of veins deeply impressed above, pubescent on the veins beneath or glabrous: mature catkins 2–3 in. long, slender-peduncled; bracts not inflexed at the base, but with an opposite bractlet about as long as the nutlet. Japan, Manchuria, Korea. G.F. 8:295. S.I.F. 1:24.—A very handsome species and quite hardy.

C. americàna, Michx.=C. caroliniana.—*C. duinénsis,* Scop.=C. orientalis.—*C. laxiflòra,* Blume. To 50 ft.: lvs. ovate or elliptic-ovate, long-acuminate, 2–3 in. long, with 10–14 pairs of veins. Japan. S.I.F. 1:25.—Very attractive in fall, with its long and slender catkins. Var. *macrostáchya,* Winkl. Lvs. ovate-oblong: fruiting catkins 2½–3½ in. long. W. China. H.I. 20:1989.—Recently intro.—*C. orientàlis,* Mill. Bushy tree, to 15 ft.: lvs. ovate or oblong-ovate, 1½–2 in. long, with about 10 pairs of veins. S.E. Eu. to Persia. Gn. 24, p. 418.—*C. Páxii,* Winkl.=C. Turczaninowii.—*C. polyneùra,* Franch. (C. Turczaninowii var. polyneura, Winkl.). Small tree: young branchlets pubescent, soon glabrous: lvs. ovate-lanceolate, long-acuminate, usually rounded at the base, 1½–2½ in. long, with 15–20 pairs of veins; fruiting bractlets ovate to lanceolate, serrate. W. China. W.B. 39.—*C. Turczaninòwii,* Hance (C. Paxii,

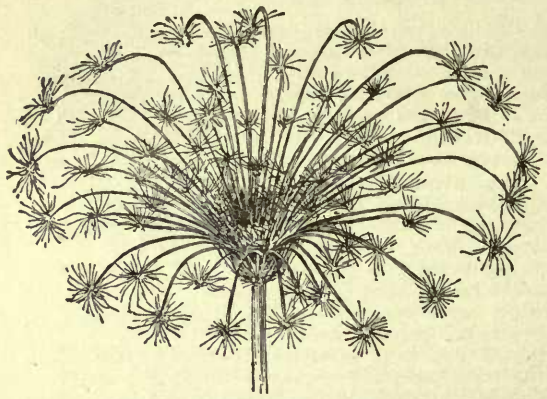
Winkl.) Shrubby tree: lvs. ovate, acute, 1–2 in. long, with 10–12 pairs of veins. N. China.—*C. virginiàna*, Michx. f.=C. caroliniana.—*C. yedoénsis*, Maxim. Small tree: branchlets and lvs. beneath pubescent: lvs. ovate-elliptic or ovate-lanceolate, with about 12 pairs of veins, 2–3 in. long. Japan. S.I.F. 2:11. ALFRED REHDER.

CARRIÈREA (after E. A. Carrière, prominent French horticulturist and botanist, died 1896). *Flacourtiàceæ*. Ornamental tree chiefly cultivated for its handsome bright green foliage.

Deciduous: lvs. alternate, long-petioled, serrate: fls. dicœcious; sepals 5, broadly ovate, pubescent outside; petals wanting; stamens numerous, shorter than the sepals; ovary 1-celled with numerous ovules, rudimentary in the staminate fls.; styles 3–4, 3-lobed, short and spreading: fr. a dehiscent caps.; seeds winged.—One species, or possibly two, in Cent. China.

This is a medium-sized tree very much resembling Idesia in appearance, the apetalous flowers with large white sepals in terminal corymbs or short racemes, the staminate usually many-flowered, the pistillate few-flowered, rarely solitary, and with large capsular long-pointed fruits. It has proved fairly hardy at the Arnold Arboretum. Propagated by seeds; can probably also be propagated like Idesia by greenwood and root-cuttings.

calýcina, Franch. Tree, to 30 ft., with a wide-spreading flat head: lvs. elliptic or ovate to oblong-obovate, 3–6 in. long, short-acuminate, rounded at the base, lustrous on both surfaces, glabrous, crenately-serrate: sepals broadly cordate-ovate about ¾in. long and nearly as broad, white: caps. 2–2½ in. long, pubescent. Cent. China. R.H. 1896, p. 498. ALFRED REHDER.



821. Last year's umbel of wild carrot.

CARROT (*Daùcus Caròta*, Linn.). *Umbellíferæ*. Garden vegetable, grown for its elongated subterranean crown-tuber.

The carrot is native of Europe and Asia, and one of the bad introduced weeds of eastern North America (Fig. 821). The improved succulent-rooted garden varieties are thought to be descended from the same stock, though this has been denied. It seems probable that the horticultural improvement of the species was begun in Holland, and it is said that the cultivated forms were introduced thence into the gardens of England during the reign of Queen Elizabeth. The carrot is now very generally, though not extensively, cultivated everywhere, both for culinary purposes and for stock-feeding. It is sometimes forced under glass, but to no great extent. Carrots are most useful in culinary practice for soups, stews, and salads, and as this class of cookery has never been reasonably popular in America, this vegetable has not received the attention it deserves.

The carrot is hardy and may be planted as soon as the ground is in fit condition to be properly prepared for seeding. When grown as a market-garden or truck crop, this early seeding is essential to maximum returns. The best soil for carrots is a medium to light loam, rich, friable and comparatively free from weeds. As the seed is slow to germinate, it is a good plan to sow some quick-germinating seed with the carrot seed so that the rows may be noticed in time to keep them ahead of weed growth. Lettuce serves well for this purpose. When the carrots are thinned, this lettuce is pulled out. The carrot seed is best sown in rows 12 to 15 inches apart, using enough seed to produce a plant every inch or two along the row. When the carrots are 3 to 5 inches high, they should be thinned to stand 3 inches apart in the row. The only further culture necessary is frequent tillage to conserve soil-moisand to prevent weed growth. The early crop should be ready to pull and bunch for sale seventy-five days after sowing. Early carrots are an important crop on the market-garden and truck-farm. They are pulled as soon as they have attained sufficient size and tied into bunches of three, six or seven roots, according to the size of the roots and the market demands. The earlier the crop and the more active the demand, the smaller the roots which may be salable. A later sowing is made for the main or winter crop or for live-stock. This may be from four to six weeks after the first sowing. The crop is handled in the same manner as the early crop except that it is allowed to continue growth as long as the weather is suitable. It is then pulled, the tops cut from the roots and the roots placed in frost-proof storage for winter sale.

The expense of production of carrots is considerable, but the returns are usually satisfactory. The fall crop should yield 500 to 1,000 bushels to the acre. Truck-growers of the South ship many bunched carrots to the large northern markets in March, April and May, where they meet a ready demand at prices ranging from 35 cents to $1 per dozen bunches.

There are several distinct market types of carrots, the variation being chiefly with respect to size and shape. The smaller varieties, as they mature more quickly, are used to some extent for the early bunching, while the larger kinds are always more popular in the general market.

The varieties of carrots differ chiefly in respect to size and grain, with differences in earliness closely correlated. The following are now favorite varieties:

French Forcing (Earliest Short Horn).—One of the smallest and earliest; root small, almost globular, orange-red.

Oxheart or *Guerande*.—Small to medium in size; root 2 to 4 inches long, growing to a blunt point, of good quality and popular in some sections for an early bunch carrot.

Chantenay.—Large to medium in size; root 3 to 5 inches long, more tapering than Oxheart; of good quality and a better carrot for the bunched crop than the above.

Danvers Half-Long.—Six to 8 inches long, 2 to 3 inches in diameter, at top tapering to a blunt point; the most popular garden carrot grown.

True Danvers.—A long carrot, 8 to 12 inches; tapering to a slender point like a parsnip; grown more for live-stock or exhibition purposes. The Half-Long has largely displaced it as a market sort chiefly because of the greater ease with which the latter strain is harvested.

Half-Long Scarlet.—Top small, roots medium size, cylindrical, pointed; much used for bunching.

Early Scarlet Horn.—Top small, roots half-long, somewhat oval, smooth, fine grain and flavor; a favorite garden sort.

Large White Belgian.—Of much larger size than the above-named varieties, of less delicate flavor and coarser texture; a popular variety for live-stock.

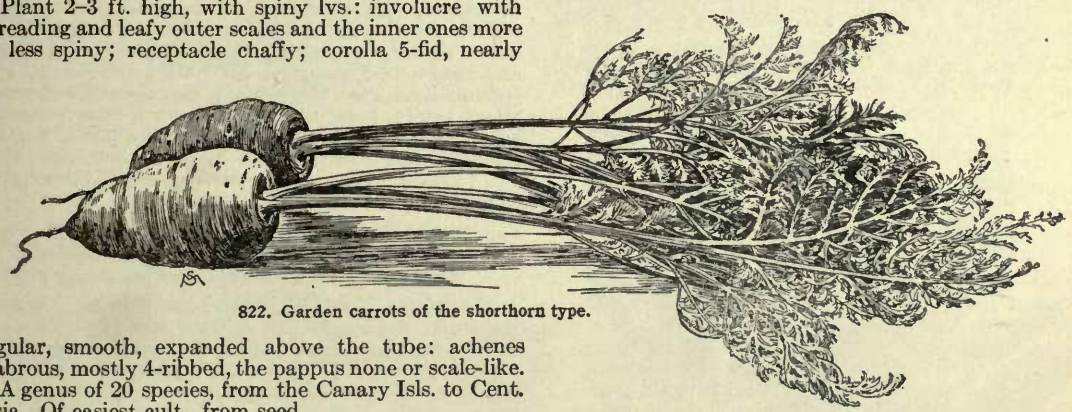
The variation in the different strains of carrot seed is marked and it is important to secure seed from carefully selected roots true to shape and color. Carrot seed may be produced in any location in which the crop of roots is grown successfully.

The carrot may be successfully forced under glass and is grown in this way to a limited extent. The small early varieties are used, such as French Forcing, Early Parisian, Early Scarlet Horn and Golden Ball. These will usually be grown as a catch-crop between tomatoes or cucumbers. When grown in this way, the carrot is one of the most delicious of all vegetables, and deserves much wider popularity. See *Forcing*.

The field cultivation of carrots for live-stock differs little from the garden or horticultural treatment except that earliness is not desired, and the longer-rooted later-maturing kinds are mostly used; and less intensive cultivation is employed. See Vol. II, Cyclo. Amer. Agric., p. 540. F. A. Waugh and H. F. Tompson.

CÁRTHAMUS (Arabic name, alluding to a color yielded by the flowers). *Compósitæ*. Hardy annuals.

Plant 2–3 ft. high, with spiny lvs.: involucre with spreading and leafy outer scales and the inner ones more or less spiny; receptacle chaffy; corolla 5-fid, nearly regular, smooth, expanded above the tube: achenes glabrous, mostly 4-ribbed, the pappus none or scale-like. —A genus of 20 species, from the Canary Isls. to Cent. Asia. Of easiest cult., from seed.



822. Garden carrots of the shorthorn type.

tinctòrius, Linn. (*Cárduus tinctòrius,* Falk.). Safflower. False Saffron. One to 3 ft. high, glabrous, branched: lvs. ovate, spiny-toothed, almost as broad as long: fl.-heads with upward-tapering involucre, and a globular crown of orange florets. Asia.—Florets used like saffron; they have diaphoretic properties and have also been used for dyeing, especially silks; and in making rouge. N. Taylor.†

CARUÈLIA: *Ornithogalum.*

CÀRUM (probably from Caria, in Asia Minor). *Umbelliferæ*. Glabrous annual or perennial herbs, some of which yield aromatic and edible garden products.

Leaves pinnate: fls. white or pinkish, small, in compound umbels with involucres and involucels, the calyx-teeth small: fr. ovate or oblong, more or less ribbed, glabrous, or sometimes hispid: root usually tuberous or filiform.—Twenty or more species, widely distributed in temperate regions. The genus is variously defined and understood. *C. Petroselinum*, the parsley, is here kept under the genus *Petroselinum*.

Cârvi, Linn. Caraway (which see). St. slender but erect, furrowed, 1–2 ft.: lvs. pinnately decompound, with thread-like divisions. Old World.—Sometimes runs wild.

Gàirdneri, Gray. St. solitary, 1–4 ft.: lvs. pinnate or the upper ones simple, with 3–7 linear lfts., the upper lfts. usually entire, but the lower ones often divided: fr. with long style. Dry hills, in Calif. and Nev. and to Brit. Col.—Intro. in 1881, by Gillett, as an ornamental plant. Roots tuberous and fusiform. L. H. B.

CARÚMBIUM: *Homalanthus.*

CÀRYA (*Karya*, Greek name for the walnut tree). Syn., *Hicòria. Juglandàceæ*. Hickory. Trees grown for their handsome foliage and strong habit, and some species for their edible nuts.

Deciduous: branches with solid pith: lvs. alternate, without stipules, with 3–17 serrate lfts.: fls. monœcious, apetalous, appearing with the lvs.; staminate fls. in axillary, slender, pendulous catkins, each fl. with 3–10 stamens, borne in the axil of a 3-lobed bract; pistillate fls. in a terminal, 2–10-fld. cluster or spike, consisting of a 1-celled ovary inclosed by a 4-lobed involucre: fr. globular to oblong, with a husk separating into 4 valves and a bony nut, incompletely 2–4-celled.—About 18 species of hickory, all in E. N. Amer. from Canada to Mex.; the Chinese species recently described by Dode from nuts only is probably not a Carya. See Rep. Mo. Bot. Gard. 7, pp. 28–42, pls. 1–23, and Rep. of U. S. Dept. Agric., Div. Pomol., Nut-Culture (1896), cited below as U. S. N. C. (the first number referring to the plate, the second and third to the figure). By some, Hicoria is considered to have priority, but Carya is retained as one of the "nomina conservanda" of the Vienna code of nomenclature, because of its long-established usage.

The hickories are hardy ornamental, usually tall trees with rather large, deciduous odd-pinnate leaves, small greenish flowers, the staminate ones in conspicuous pendulous racemes, and with rather large green dehiscent fruits inclosing a mostly edible nut. The hickories are among the most beautiful and most useful trees of the American forest, and are all very ornamental park trees, with a straight, sometimes high and slender trunk and a large, graceful, pyramidal or oblong head of usually light green foliage, turning from yellow to orange or orange-brown in fall. They are hardy North except *C. Pecan*, *C. aquatica* and *C. myristicæformis*, but *C. Pecan* thrives rarely in Massachusetts in sheltered positions. Most of the species have heavy hard strong and tough wood, much valued for many purposes, especially for handles of tools, manufacture of carriages and wagons, also for making baskets and for fuel. The nuts of some species, as *C. Pecan* and *C. ovata*, also *C. laciniosa* and some varieties of *C. glabra* and *C. alba*, are edible, and are sold in large quantities, mostly gathered from the woods, though in later years orchards of improved varieties have been planted. A large number of insects prey upon the hickory, attacking the wood, foliage and fruit, for which see the Fifth Ann. Rep. of the U. S. Entom. Com., pp. 285–329. There are also some fungi sometimes causing an early defoliation of the trees.

The hickories generally thrive best in rich moist soil, but some, especially *C. glabra*, *C. alba* and *C. ovata*, grow equally well in drier localities. They are of rather slow growth, and difficult to transplant if taken from the woods; therefore the seeds are often planted where

the trees are to stand, but if grown in the nursery and transplanted several times when young, trees 6–10 ft. high may be transplanted successfully.

Propagation is usually by seeds stratified and sown in spring in rows about 3 inches deep; named varieties may be grafted in spring in the greenhouse, on potted stock of *C. cordiformis*, which seems to be the best species for this purpose, veneer- or splice-grafting being usually employed; sometimes also increased by root-sprouts. For further horticultural advice, see *Hickory-nut* and *Pecan*.

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A. *Scales of buds valvate, 4–6: fr. with winged sutures; nut usually thin-shelled: lfts. 7–15, usually falcate.*

B. *Nut mostly elongated, almost terete; husk thin, splitting to the base; kernel sweet; cotyledons entire or only notched at the apex.*

1. Pecán, Engler & Graebn. (*Júglans Pecán*, Marsh. *Hicòria Pecán*, Brit. *C. illinoénsis*, Koch. *C. olivæfórmis*, Nutt.). PECAN. Fig. 823. To 170 ft., with branches pubescent when young: bark deeply furrowed, grayish brown: winter-buds yellow: lfts. 11–17, short-stalked, oblong-lanceolate, acuminate, serrate or doubly serrate, tomentose and glandular when young, usually glabrous at length, 4–7 in. long: staminate catkins almost sessile: fr. 3–10 in clusters or spikes, oblong, 1½–3½ in. long; nut ovoid or oblong, smooth, brown, irregularly marked with dark brown, 2-celled at the base; kernel sweet. From Iowa and Ind. south to Ala. and Texas; also in Mex. S.S. 7:338–9. A.G. 12:273–275. U.S.N.C.1, 8, 9.—This species is the most important as a fr. tree, and many named varieties are cult. in the southern states, but it is tender N. The wood is less valuable than that of the other species. Hybrids are known of this species with *C. cordiformis*, *C. alba* and *C. laciniosa*, for which see Rep. Mo. Bot. Gard. 7, pls. 20–23 and Gng. 2:226. See *Pecan*.



823. Foliage and pistillate flowers of Carya Pecan.

2. myristicæfórmis, Nutt. (*Hicòria myristicæfórmis*, Brit.). NUTMEG HICKORY. Tree, to 100 ft., with dark brown bark, broken into appressed scales: winter-buds brown: lfts. 5–11, short-stalked or almost sessile, ovate-lanceolate, the uppermost much larger and obovate, serrate, scurfy-pubescent beneath when young and with brown scales above, at length dark green above, silvery and lustrous beneath, 3–5 in. long: staminate catkins peduncled: fr. generally solitary, short-ovoid or obovate, about 1½ in. long; nut ovoid, reddish brown marked with irregular spots and stripes, thick-shelled, 4-celled below; kernel sweet. From S. C. to Ark. and Mex. S.S. 7:342–3.—A very decorative species on account of its handsome foliage, but not hardy N.

BB. *Nut usually so broad as long, compressed, with irregularly angled or reticulate surface, thin-shelled, 4-celled below; kernel bitter; cotyledons deeply 2-lobed.*

3. aquática, Nutt. (*Hicòria aquática*, Brit.). WATER HICKORY. BITTER PECAN. Usually small tree, rarely to 100 ft., with light brown bark separating into long, thin plates: winter-buds dark reddish brown: lfts. 7–13, sessile or short-stalked, lanceolate, long-acuminate, finely serrate, yellowish tomentose when young, glabrous at length: fr. 3–4, ovoid to broadly obovate, 1–1½ in. long; husk thin, splitting to the base; nut obovate, much compressed, irregularly angled and ridged, dull reddish brown; kernel very bitter. From Va. to Ill., south to Fla. and Texas. S.S. 7:344–5. U.S.N.C. 12, 7–8.

4. cordifórmis, Koch (*Hicòria mínima*, Brit. *C. amàra*, Nutt.). BITTERNUT. SWAMP HICKORY. Tree, to 100 ft.: bark grayish brown, broken into thin scales: young branches and petioles glabrous: winter-buds bright yellow: lfts. 5–9, ovate-lanceolate to lanceolate, acuminate, densely serrate, pubescent when young and glandular, almost glabrous at length, 3–6 in. long: fr. 2–3, broadly obovate or subglobose, winged from the apex to the middle, ¾–1½ in. long; husk thin, splitting somewhat below the middle; nut slightly compressed, roundish, abruptly contracted into a short point, smooth, gray; kernel bitter. Que. to Minn., south to Fla. and Texas. S.S. 7:340–1. Em. 226.—A valuable park tree, with handsome rather broad head, growing in cult. more rapidly than other hickories.

AA. *Scales of buds imbricate, more than 6: fr. not or slightly winged at the sutures; nut usually thick-shelled, 4-celled below: lfts. 3–9, not falcate, the uppermost larger and generally obovate.*

B. *Buds small, ¼–½ in. long: husk thin; nut slightly or not angled.*

C. *Lvs. glabrous or only slightly pubescent while young: nut not or only slightly angled, thin-shelled.*

5. glàbra, Sweet (*Hicòria glàbra*, Brit. *C. porcìna*, Nutt.). PIGNUT. Figs. 824, 825. Tree, occasionally to

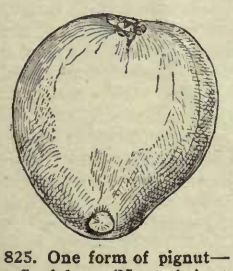
120 ft., with usually dark gray fissured bark and slender, glabrous branchlets: lfts. 3–7, almost sessile, oblong to oblong-lanceolate, long-acuminate, sharply serrate, almost glabrous, 3–6 in. long: fr. usually ovoid or obovate, the sutures usually slightly winged toward the apex and the husk splitting mostly only half way



824. Characteristic growth of the pignut hickory, Carya glabra.

to the base; nut usually brownish, not angled; kernel mostly astringent. Maine to Ont. and south to Fla., Ala. and Miss. S.T.S. 2:179. A.G. 11:386–7. U.S.N. C. 12, 5.—A very handsome park tree, with rather narrow-oblong head, and slender often pendulous branchlets. A very variable tree.

6. **ovàlis,** Sarg. (*Júglans ovàlis,* Wang. *Hicòria microcárpa,* Brit. *H. glàbra* var. *microcárpa,* Trel.). Small Pignut. False Shagbark. Figs. 826–829. Tree, similar to the preceding: bark close and furrowed on young trees, shaggy on old trunks: branches first hairy, soon glabrous: lfts. 5–7, sessile, oval, oblong or ovate, 3–6 in. long, acute or acuminate, rounded or narrowed and unequal at the base, coarsely and shallowly toothed, glabrous; terminal lfts. cuneate at the base, short-stalked: fr. subglobose to short-oblong, ¾–1 in. across, densely scaly and slightly winged, tardily splitting nearly to the base; nut slightly flattened, often broader than high and usually rounded at the apex, sometimes slightly angular, brownish, shell rather thin; kernel small and sweet. Mass. to Wis., south to Ga., Ala., and Miss. A.G. 11:381–388, 1, 2, 5, 8, 10. U.S.N.C. 12, 4, 6. Var. **obcordàta,** Sarg. (*J. obcordàta,* Muhl. *J. porcìna* var. *obcordàta,* Pursh. *C. microcárpa,* Darl.). Fr. nearly globose or ovoid; nut angled, broader than high, sometimes obcordate. S.S. 7: 354, figs. 5, 6, 7, 9. Var. **odoràta,** Sarg. (*Hicòria glàbra* var. *odoràta,* Sarg.). Lfts. generally broader, ovate or oblong-ovate, glandular: fr. subglobose or higher than broad, with distinctly winged sutures, splitting freely to the base; nut gray, very slightly ridged, slightly higher than broad. Conn. to Pa. and Mo. S.S. 7:354, fig. 8. Var. **obovàlis,** Sarg. Fr. obovoid; nut much compressed, pointed or rounded at the apex, and rounded at the base. Mass. to Va. and Mo. Var. **boreàlis,** Sarg. (*Hicòria boreàlis,* Ashe. *C. boreàlis,* Schneid.). Bark scaly: lfts. usually 5, lanceolate: fr. ovoid, flattened, about ¾in. long, very narrowly winged and often incompletely splitting; nut ovoid, ridged, whitish; kernel sweet. Mich., Ont. B.T. 236.



825. One form of pignut—C. glabra. (Natural size.)

cc. *Lvs. hairy beneath: nut angled, thick-shelled.*

7. **villòsa,** Schneid. (*Hicòria villòsa,* Ashe. *H. glàbra* var. *villòsa,* Sarg. *H. pállida,* Ashe). Tree, to 20 or sometimes to 50 ft.: branchlets slender, pubescent mixed with silvery scales, later glabrous: lfts. 5–9, usually 7, sessile or short-stalked, oblong to oblanceolate, 3–5 in. long, acuminate, narrowed at the base, coarsely serrate, when unfolding glandular above, hairy below and with silvery scales; petioles pubescent and with tufts of brownish hairs, finally often glabrous: fr. subglobose to pear-shaped, ¾–1¾ in. long, winged; husk thin, splitting to below the middle or nearly to the base; nut slightly angled, somewhat compressed, thick-shelled, pale or light brown; kernel small and sweet. N. J. to Fla., Miss. and E. Texas. S.S. 7:355. G.F. 10:305.



826. Fruit of C. ovalis, the false shagbark. (Natural size).

bb. *Buds large, ½–1 in. long: nut angled; kernel sweet.*

c. *Bark not shaggy: branches and petioles tomentose: outer bud-scales falling in autumn: husk not separating quite to the base.*

8. **álba,** Koch (*Hicòria álba,* Brit. *C. tomentòsa,* Nutt. Not to be confounded with *C. alba,* Nutt., which is *C. ovata*). Mockernut. Big-bud Hickory. Tree, rarely attaining to 100 ft.: lfts. 7–9, almost sessile, oblong-lanceolate, long-acuminate, usually finely serrate, glandular and tomentose beneath, very fragrant when crushed, 4–8 in. long: fr. globose to pear-shaped,



827. Carya ovalis, the false shagbark.

1½–2 in. long; nut light brown, globular to oblong, slightly compressed, angled, narrowed toward the apex, thick-shelled; kernel small, sweet. Mass. to Ont. and Neb., south to Fla. and Texas. S.S. 7:350–1. U.S.N. C. 12, 1–3. Em. 222.



828. Twig of C. ovalis.

cc. *Bark shaggy, light gray: branches and petioles glabrous or pubescent: husk very thick, separating to the base: outer bud-scales persisting through the winter.*

9. **laciniòsa**, Engler & Graebn. (*Hicòria laciniòsa*, Sarg. *H. acuminàta*, Dipp. *C. sulcàta*, Nutt.). BIG or BOTTOM SHELLBARK HICKORY. KING-NUT. Tall tree, occasionally to 120 ft.: branchlets orange-red: lfts. 7–9, oblong-lanceolate, acuminate, serrate, pubescent when young, usually glabrous at length, 4–8 in. long: fr. generally oblong, 1¾–2½ in. long; nut yellowish white, oblong, but sometimes as broad as long, slightly compressed and obscurely 4-angled, pointed at both ends; kernel sweet. N. Y. to Iowa, south to Tenn. and Okla. S.S. 7:348–9. U.S. N.C. 11.

10. **ovàta**, Koch (*Hicòria ovàta*, Brit. *C. álba*, Nutt.). SHAGBARK HICKORY. Also LITTLE SHELLBARK HICKORY, although the latter name by some is applied to the preceding. Figs. 830, 831. Tree, occasionally to 120 ft.: lfts. generally 5, sessile, oblong or oblong-lanceolate, acuminate, serrate, densely fimbriate, pubescent and glandular when young, glabrous at length, 4–6 in. long: fr. subglobose, about 1½–2½ in. long; nut white, oblong to broadly obovate, 4-angled; kernel sweet. From Que. to Minn., south to Fla. and Texas. S.S. 7:346–7. Em. 217. U.S.N.C. 10. A.G. 11:386, 6, 9; 387, 3; 388, 11. Gng. 7:51. A.F. 14:339.—Next to Pecan the best as a fruit tree, especially for northern states, where the pecan is not quite hardy. Several named varieties are in trade, of which probably var. **Hàlesii**, Hort., with large, thin-shelled nut, is the best known. An ornamental, often very picturesque tree; the stout branches forming a rather broad, usually somewhat open, head. Var. **Nuttàllii**, Sarg. (*C. microcárpa*, Nutt. in part). Fr. smaller; nut rounded, usually obcordate, much compressed and prominently angled, about ½in. across. Mass. to Pa. and Mo. Nuttall, Silv. N. Am. 1:13. Var. **fraxinifòlia**, Sarg. Lfts. lanceolate or nearly oblanceolate, the terminal one 5–6 in. long and 1¾–2 in. wide: fr. generally smaller, ovoid, pointed, 1¼ in. long; nut long-pointed. W. N. Y.

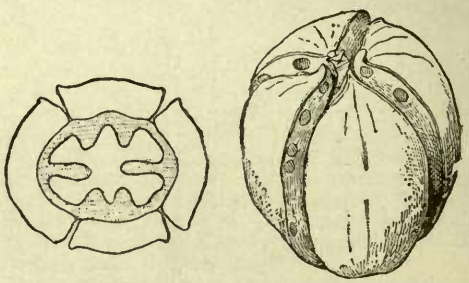


829. Habit of the small-fruited pignut, Carya ovalis.

C. arkansàna, Sarg. Allied to C. glabra. Tree, to 70 ft.: bark dark gray, scaly: branchlets pubescent: lfts. 5–7, lanceolate, densely pubescent when unfolding, glabrous at maturity, 4–7 in. long: fr. ovoid or obovoid; husk usually splitting to the middle; nut slightly obovoid; shell very thick and hard; kernel sweet, small. Ark. and Okla. S.T.S. 2:181.—*C. Búckleyi*, Durand (C. texana, Buckl., not DC.). Allied to C. alba. Tree, to 50 ft., with dark, furrowed bark: lfts. 7, lanceolate or oblanceolate, pubescent on the veins below, 3–6 in. long: fr. subglobose or ovoid, 1½ in. across; husk thin, splitting to the base; nut reddish brown, veined; shell hard; kernel sweet. Texas to Okla. and Ark. S.T.S. 2:182.—*C. carolinæseptentrionàlis*, Engler & Graebn. (Hicoria carolinæ-septentrionalis, Ashe). Allied to C. ovata. Branchlets slender: lfts. 3–5, lanceolate, glabrous: fr. smaller; nut thin-shelled. N. C. to Ga. S.S. 14:720.—*C. floridàna*, Sarg. Allied to C. cordiformis. Buds valvate, brownish yellow: lfts. usually 5, elliptic-oblong to lanceolate, densely scaly beneath, 2–3½ in. long: fr. obovoid, about 1 in. long, husk tardily splitting to the base; nut obovoid or subglobose. Fla. S.T.S. 2:177.—*C. megacárpa*, Sarg. Closely related to C. glabra. Bark close: buds larger:



830. Twig of Carya ovata.



831. Fruit of Carya ovata, the shagbark hickory. The cross-section is to show structure, not to show a good horticultural fruit. (Natural size.)

lfts. to 8 in. long: fr. broadly obovoid, to 1½ in. long; husk thick, tardily dehiscent to the middle; nut obovoid; kernel small, sweet. N.Y. to Mo. and Fla. S.T.S. 2:180.—*C. mexicàna*, Engelm. Tree, with shaggy bark and tomentose-pubescent lvs.: fr. depressed, with rather thick husk and broad, sharply 4-angled, white nut. Mex. The only species not native to the U. S.—*C. texàna*, DC. (Hicoria texana, Le Conte). Similar to C. Pecan, but lfts. broader, less falcate, almost sessile: nut smaller, much darker, with somewhat rough surface; kernel bitter. Texas. S. S. 14:719.—*C. texàna*, Buckl.= C. Buckleyi.

ALFRED REHDER.

CÁRYOCAR (from the Greek word for *nut*). *Caryocaràceæ;* formerly included in *Ternstræmiàceæ*, and by some referred to *Rhizobolàceæ*. Trees, or rarely shrubs, of about 10 species in Trop. Amer., one of which is well known for its large edible nuts. Lvs. opposite, digitately 3–5-foliolate, leathery, often serrate: fls. bractless, in terminal racemes; calyx deeply 5–6-parted, the lobes orbiculate and strongly imbricate; petals 5–6, imbricate; stamens many, somewhat joined at the base; ovary 4–6-celled: fr. drupaceous, with a hard stone or stones and very large seeds. **C. nucíferum**, Linn., produces the souari-nut or butternut of the American tropics. Although native of Guiana, it is cult. in some of the W. Indies isls.: tree, attaining 100 ft. or more, producing durable timber used chiefly in ship-building: lvs. trifoliolate, the lfts. elliptic-lanceolate, glabrous: fls. large, purple, the stamens white and very numerous: fr. several inches in diam., nearly globular or becoming misshapen by abortion of the contents, containing 2–4 hard-shelled nuts the size of a hen's egg, and which are flat-kidney-shaped, warty and reddish brown; kernel or meat white, with a nutty or almond-like flavor, and yielding oil when subjected to pressure. B.M. 2727, 2728. The nuts now and then appear in northern markets. The closely allied *C. villosum*, Pers., of Guiana and Brazil, is reported as a notable timber tree; and the oily pulp surrounding the seed is eaten boiled and the kernel of the seed is eaten raw.

L. H. B.

CARYOPHÝLLUS, the clove tree, is now referred to *Eugenia*.

CARYÓPTERIS (Greek for *nut* and *wing*). *Verbenàceæ*. Ornamental woody plants grown for their lavender-blue flowers profusely produced in autumn.

Deciduous small shrubs: lvs. opposite, short-petioled, serrate: fls. in axillary cymes; calyx campanulate, deeply 5-lobed with lanceolate teeth, spreading and somewhat enlarged in fr.; corolla 5-lobed, with short cylindric tube and spreading limb, 1 segm. larger and fringed; stamens 4, exserted, 2 of them longer; style slender, 2-parted at the apex: fr. separating into 4 somewhat winged nutlets.—About 6 species in E. Asia.

These are glabrous, pubescent or tomentose shrubs with small blue or violet late flowers. Free-flowering and very valuable for their late blooming season; not hardy North; even if well protected they will be killed almost to the ground, but the young shoots, springing up freely, will flower profusely the same season. They require well-drained and sandy soil and sunny position; if grown in pots, a sandy compost of peat and leaf soil or loam will suit them, and they will flower in the greenhouse until midwinter. Propagated readily by cuttings of half-ripened wood in summer or fall under glass, and by seeds sown in spring.

incàna, Miq. (*C. Mastacánthus*, Schauer. *C. sinénsis*, Dipp.). Fig. 832. Suffruticose, 1–5 ft.: lvs. petioled, ovate or oblong, coarsely serrate, pubescent above, grayish tomentose beneath, 2–3 in. long: cymes peduncled, dense-fld.; fls. small, violet-blue or lavender-blue. Aug.–Nov. China, Japan. B.R. 32:2. B.M. 6799. R.H. 1892:324. R.B. 19:273. G.C. II. 21:149; III. 42:409. Mn. 5:5. S.H. 2, p. 89. G.W. 6, p. 197. Gn. 24, p. 523; 76, p. 24. G.M. 43:7.—Known in the nursery trade as "blue spirea." Var. **cândida**, Schneid. has white fls.

C. mongòlica, Bunge. Lvs. lanceolate, almost entire: cymes with fewer but larger fls. R.H. 1872:450.

ALFRED REHDER.

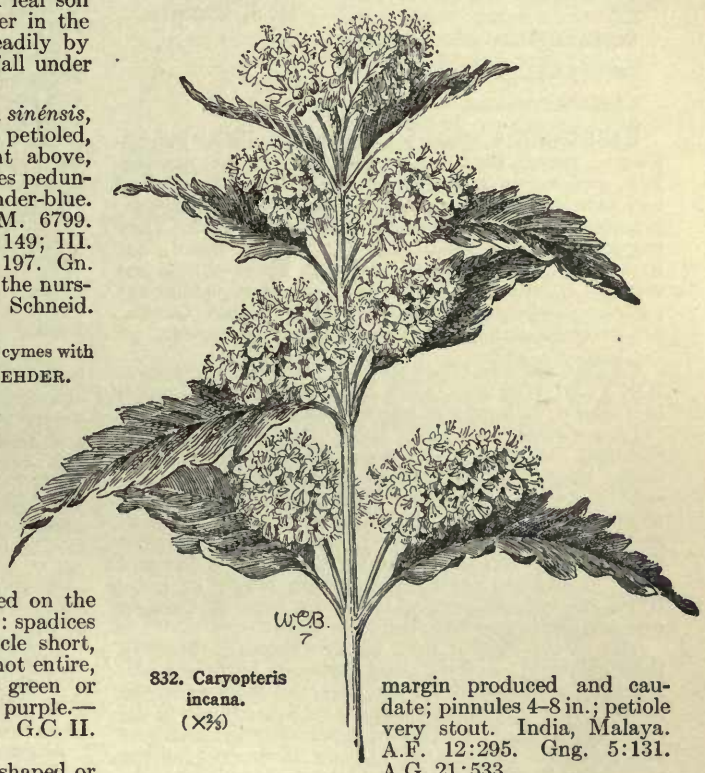
CARYÒTA (old Greek name). *Palmàceæ*, tribe *Arèceæ*. FISH-TAIL PALM. Spineless monocarpic palms, with tall stout ringed trunks, at length bearing suckers.

Leaves disposed in an elongated terminal fringe, ample, twice pinnately divided; segms. dimidiate-flabelliform, or cuneate, entire, or split, irregularly dentate, plicate, folded back in the bud; midnerves and primary nerves flabellate; petiole terete below; sheath keeled on the back, fibrous along the margins: ligule short: spadices usually alternately male and female: peduncle short, thick: branches long, pendent: spathes 3–5, not entire, tubular; bractlets broad: fls. rather large, green or purple: fr. the size of a cherry, globular, purple.—Species, 9. Malaya, New Guinea, Austral. G.C. II. 22:748.

These palms are remarkable for the delta-shaped or fish-tail-shaped leaflets, which make the graceful, spreading fronds very attractive. They are excellent warmhouse palms, very useful for decoration, particularly when young. They are frequently planted out in protected places for the summer. *C. urens*, the wine-palm of India, yields, when full grown, about twenty-four pints of wine in twenty-four hours. The beverage is very wholesome and a valuable article of commerce. There being so many different genera to choose from in selecting plants for moderate-sized conservatories, the members of this genus are not very popular for providing small specimens. In a high, roomy structure, however, they are among the most ornamental of the tribe. They are quick-growing, with large broad leaves, finely cut up, the small divisions resembling the tail of a fish; hence the name "fish-tail palm." After reaching maturity the plant begins flowering at the top, and continues downward until the vitality of the stem is exhausted. Suckers are freely produced by some species, but these, as a rule, do not become so robust as the parent stem, owing probably to the soil becoming exhausted. Seeds are offered by most dealers. The young plants should be grown in a warm, moist atmosphere, the soil consisting of loam with about one-third of its bulk leaf-mold and sand in equal parts. They sometimes lose their roots if kept too cool and wet in winter. Prop. is by seeds and suckers. (G. W. Oliver.)

mìtis, Lour. (*C. soboliféra*, Wall. *C. furfuràcea*, Blume). Caudex 15–25 ft. high, 4–5 in. diam., soboliferous: petioles, lf.-sheaths and spathes scurfy-villous: lvs. 4–9 ft.; pinnæ very obliquely cuneiform, irregularly dentate, upper margins acute; pinnules 4–7 in. long. Burma to Malaya.

ùrens, Linn. WINE-PALM. TODDY-PALM. Caudex stout, even in cult. specimens 60–80 ft. high and 18 in. thick, much higher in the wild, not soboliferous: lvs. 18–20 by 10–12 ft.; pinnæ 5–6 ft., curved and drooping, very obliquely truncate, acutely serrate, the upper margin produced and caudate; pinnules 4–8 in.; petiole very stout. India, Malaya. A.F. 12:295. Gng. 5:131. A.G. 21:533.



832. Caryopteris incana. (×⅓)

Rumphiàna, Mart. Lvs. 2-pinnate, several feet long, the pinnules thick, sessile, 6 in. long or nearly so, oblong. Malaya. Var. **Álbertii**, Hort. (*C. Albertii*, Muell.), is in the trade. It is large and free-growing, the lvs. being 16–18 ft. long and two-thirds as broad; lf.-segms. fan-shaped and oblique, toothed.

C. Blancòi, Hort., from the Philippines, has been listed in the American trade. It is probably a form of C. urens.

JARED G. SMITH.

CASAREEP: *Blighia.*

CASCARILLA: *Croton.*

CASHEW: *Anacardium occidentale.*

CASIMIRÒA (named in honor of Cardinal Casimiro Gomez de Ortega, Spanish botanist of the eighteenth century). *Rutàceæ*. Evergreen trees, one of which is grown for the edible fruits.

Leaves alternate, long-petioled, digitate, 3–7-foliolate; lfts. petiolulate, lanceolate, entire or slightly serrate, smooth or pubescent beneath: fls. regular, poly-

gamo-dicœcious; calyx 5-parted, small; petals 5, oblong, valvate, apex incurved; disk inconspicuous, circular; stamens 5, free; filaments subulate; anthers cordate; ovary sessile, on disk, globose, 5- or occasionally 6–8-lobed, 5-celled; stigma sessile, 5-lobed; ovules solitary in the cells, axillary: fr. a drupe, large, depressed-globose; pulp agreeable to taste, edible; seeds oblong, compressed, exalbuminose.—Four species in Mex. and S.

edûlis, Llav. & Lex. WHITE SAPOTE. COCHIL SAPOTA. Large tree: trunk ashen gray, with warty excrescences: lvs. dark green, glossy: fls. greenish yellow, small: fr. greenish yellow when ripe, with strong, thick epicarp, ½in. thick, about the size of an orange; seeds nearly 1 in. long and half as wide. Mex.—The fr. of this species has a delicious flavor, similar to that of a peach. It is used in Mex. as an aid in inducing sleep, and the lvs. as a remedy for diarrhea. It grows on the coast of Mex. to an altitude of about 7,000 ft. See *Sapote, White.*

H. J. WEBBER.

CASSABANANA: *Sicana.*

CASSANDRA: *Chamædaphne.*

CASSAVA: *Manihot.*

CASSEBEÈRA (from a German botanist). *Polypodiàceæ.* Small Brazilian ferns allied to the maidenhair, but rarely seen in cult. There are 3 species: sori terminal on the veins, oblong or nearly globular; indusium within the margin and distinct from it. They require hothouse conditions. *C. pinnàta,* Kaulf., has fronds 6 in. long, pinnate, the pinnæ linear-oblong and crenate. *C. triphýlla,* Kaulf., has 3–5-parted fronds, the parts linear-oblong and crenate. *C. gleichenioìdes,* Gardn., has twice-pinnate fronds, the pinnules 4-cornered.

CÁSSIA (ancient Greek name). *Leguminòsæ.* SENNA. Herbs, shrubs or trees, a few of which are in cultivation in America, as border plants and under glass.

Leaves even-pinnate: fls. nearly regular (not papilionaceous), with the nearly equal calyx-teeth mostly longer than the tube; corolla of 5 spreading, nearly equal clawed spreading petals; stamens 5–10, frequently unequal and some of the anthers abortive, the good anthers opening at the top: fr. a stalked pod which is either flat or terete, containing numerous seeds and often partitioned crosswise.—Species nearly or quite 400 in the warmer parts of the globe, some of them in cool temperate regions. See page 3566.

The cassias delight in a sunny exposure. Most of those cultivated in the United States are herbs or herb-like shrubs, attractive for the finely cut foliage and the showy flowers. Some of them are cultivated only in the extreme South. *C. corymbosa* is probably the best garden subject. Cassias are summer bloomers, for the most part. Propagation is mostly by divisions and seeds, the annual species always by seeds.

Senna leaves, used in medicine as a cathartic, are derived from various species, chiefly from *C. acutifolia* of Egypt, and *C. angustifolia* of India and other Old World tropics. The "Cassia lignea" of pharmacopœas is the product of a Cinnamomum. Cassia pods of commerce, used in medicine, are the fruits of *C. Fistula.* Many of the species contribute to therapeutics. Some of them provide tanning materials.

A. *Hardy border plants: lfts. 5 or more pairs.*

marylándica, Linn. WILD SENNA. Perennial, glabrous or nearly so, sts. nearly simple: lfts. 5–10 pairs, oblong or lance-oblong and entire, short-acuminate or nearly obtuse: fls. in axillary racemes near the tops of the sts. and often appearing as if panicled, bright yellow, wide open: pods linear, flat. New England, west and south, mostly in wet soil.—Grows 3–4 ft. high, and has attractive light green foliage.

Chamæcrísta, Linn. (*Chamæcrista nictitans,* Moench). PARTRIDGE PEA. Annual, erect or spreading, 2 ft. or less high: lfts. 10–15 pairs, small, narrow-oblong, mucronate, sensitive to the touch: fls. large, 2–5 together in the axils, canary-yellow and 2 of the petals purple-spotted.—Dry soil, Maine, south and west. Sometimes known as Magothy Bay bean and sensitive pea, and formerly recommended as a green-manuring plant. See Cyclo. Amer. Agric., Vol. II, p. 309, for account and picture.

AA. *Tender plants, grown far south, or under glass: lfts. few or many.*

B. *Tree, with woody indehiscent pods.*

Fístula, Linn. PUDDING-PIPE TREE. GOLDEN SHOWER. Lvs. large, the lfts. 4–8 pairs, and ovate-acuminate: fls. in long lax racemes, yellow, the pedicels without bracts: pods cylindrical, black, 3-furrowed, 1–2 ft. long, containing 1-seeded compartments. India, but intro. in W. Indies and other tropical countries. Sparingly cult. S.—Furnishes the cassia pods of commerce.

grándis, Linn. PINK SHOWER. Lfts. 10–20, oblong, abrupt at either end, more or less pubescent beneath and above: fls. in long drooping axillary racemes, rose-colored, without bracts subtending the pedicels: pod 3 in. or less long, compressed-cylindrical, glabrous, transversely rugose. Trop. Amer.; offered in S. Calif., and grown in many tropical countries.

BB. *Shrubs or herbs, with more or less dehiscent pods.*

Sophèra, Linn. (*C. schinifòlia,* DC. *C. Sophòra,* Auth.). Shrub, 6–10 ft.: lfts. 6–10 pairs, lanceolate-acute: fls. yellow on many-fld. axillary and terminal peduncles, which are shorter than the lvs.: pod thin, tardily dehiscent. Oriental tropics. Intro. in S. Calif.

corymbòsa, Lam. (*C. floribùnda,* Hort.). Shrub, half-hardy in middle states, 4–10 ft.: lfts. 3 pairs, oblong-lanceolate and somewhat falcate, obtuse or nearly so: fls. yellow, in long-stalked, small axillary and terminal corymbs. Argentina. B.M. 633. G.C. III. 31:252. Gn. 50, p. 139. J.H. III. 61:139. G. 25:553. H.F. II. 3:252. G.W. 3, p. 421; 6, p. 391.—The best-known garden species, being an excellent conservatory plant for spring, summer and autumn bloom. It is an old favorite, now coming again into prominence (as *C. floribunda* and var. *A. Boehm,* corrupted apparently into *C. Boema*) as a pot-plant, as a tub specimen for lawns, or for plunging in the border; winters readily in a dormant state in a cellar; very free-flowering.

tomentòsa, Linn. Shrub, 10–12 ft.: lfts. 6–8 pairs, oval-oblong and obtuse, white-tomentose beneath: fls. deep yellow. Mex.—Said to be a good winter bloomer in S. Calif., and naturalized in some parts.

artemisoìdes, Gaud. Bushy shrub, soft-canescent and gray all over: lfts. 3–4 pairs, very narrow-linear: racemes axillary, 5–8-fld., the fls. sulfur-yellow: pods flat, shining brown. Austral.—Intro. in S. Calif. Withstands drought.

biflòra, Linn. Shrub, 4–8 ft.: lfts. 6–10 pairs, broad-oblong or obovate-oblong, very obtuse but mucronulate: fls. large, yellow, on 2–4-fld. peduncles, which are shorter than the lvs: pod 3 in. or less long, oblong-linear or narrower, membranaceous. S. Amer. and W. Indies. B.M. 810.—Sparingly cult. in greenhouses.

C. lævigàta, Willd. Shrub, glabrous: lfts. 3–4 pairs, ovate-oblong or ovate-lanceolate, acuminate: fls. yellow in terminal and axillary racemes: pod leathery, 2–3 in. long, nearly cylindrical. Tropics.—*C. occidentàlis,* Linn. HEDIONDA. Annual or subshrubby, widely distributed in the tropics as a weed, the seeds used as a substitute for coffee; it is the "fedegosa" and "negro coffee" of Afr.: lfts. 4–12 pairs, ovate-lanceolate or lanceolate, acuminate, and a gland near the base of the petiole: racemes short and few-fld.: pod glabrous, oblong-linear compressed or nearly cylindrical; the small seeds produced abundantly—*C. splèndida,* Vogel. Shrub, 6–10 ft., much branched: fls. bright yellow, very large. S. Amer. Recently catalogued in S. Calif.—Others of the numerous species of Cassia are likely to appear in cult., particularly some of the native kinds; but as a whole, the genus is not rich in horticultural subjects.

L. H. B.

CASSÌNE (a name said to have been used by the Indians in Fla.; see *Ilex Cassine*). *Celastràceæ*. Some 20 or less erect or climbing glabrous shrubs of the Cape region in Afr., apparently not known in cult. in this country. Lvs. opposite, thick, entire or serrate: fls. small, white, in axillary clusters; calyx 4–5-parted, minute; petals 4–5; stamens 4–5, on the disk, which encircles the ovary: fr. a 1–2-seeded drupe, with a hard pit or stone. *C. Colpoon*, Thunb. (or *C. capensis* var. *Colpoon*) is the ladlewood of the Cape, the wood being used in the making of small articles. *C. Maurocenia*, Linn. (now placed in a separate genus, *Maurocenia capensis*, Sond.) is the Hottentot cherry. H.I. 6:55 2.

CASSÌOPE (Greek mythological name). *Ericàceæ*. Ornamental small shrubs sometimes cultivated for their handsome delicate flowers.

Evergreen: lvs. very small, usually scale-like and opposite, rarely alternate and linear: fls. solitary, axillary, or terminal; calyx small, 5-parted; corolla campanulate, 5-lobed or 5-cleft; stamens 10, the anthers with recurved appendages; style included: fr. a 5-valved caps. with numerous minute seeds.—Ten species in arctic regions and high mountains of N. Amer., N. Eu., N. Asia and Himalayas. Formerly included under Andromeda.

Cassiopes are graceful, delicate plants, adapted for rockeries, flowering in summer. They are of somewhat difficult culture, and require peaty and sandy moist but well-drained soil and partly shaded situation, though *C. hypnoides* grows best in full sun, creeping amongst growing moss. Drought, as well as dry and hot air, is fatal to them. Propagated readily by cuttings from mature wood in August under glass; also by layers and by seeds treated like those of Erica.

C. fastigiàta, Don (Andromeda fastigiata, Wall.). Ascending: lvs. imbricate, in 4 rows, with white-fringed margin: fls. axillary, white. Himalayas. B.M. 4796. G.C. III. 47:379 (habit). Gn. 43, p. 189. G. 15:709.—*C. hypnoìdes*, Don. (Harrimanella hypnoides, Coville). Creeping: lvs. linear, alternate, crowded: fls. terminal, deeply 5-cleft. Arctic regions. B.M. 2936. L.B.C. 20:1946. G.C. III. 39:226 (habit).—*C. Mertensiàna*, Don. Erect or ascending to 1 ft. high: lvs. imbricate in 4 rows, carinate on the back: fls. axillary, white or slightly tinged rosy. Sitka to Calif.—*C. tetragòna*, Don (Andromeda tetragona, Linn.). Similar to the former, but lower, and the lvs. with a deep furrow on the back. Arctic regions. B.M. 3181. M.D.G. 1910:125, 137 (habit).

ALFRED REHDER.

CASSIPOURÈA (a native name in Guiana). *Rhizophoràceæ*. Perhaps a dozen or less species (if the African Dactylopetalum is included in the American Cassipourea) in Trop. Amer. and in Afr., one of which is now offered. Glabrous trees or shrubs: lvs. opposite or whorled, stalked, somewhat leathery, oblong or lanceolate, entire or somewhat crenate: fls. small or medium in size, white, solitary or fascicled in the axils; calyx 4–5-lobed; petals 4–7, fimbriate, linear or spatulate, inserted in the cup-like disk; stamens 10–30; ovary 2–4-celled: caps. ovoid, somewhat fleshy, tardily dehiscent, the cells 1-seeded. C. verticillàta, N. E. Br., Natal, a handsome tree, with very shiny foliage: lvs. about 4 in. long and half as broad, in 3's or 4's, lightly creno-serrate or almost entire; petals 5–7, exserted, very narrow; stamens 10–14.—A rare mangrove-like tree, found at considerable elevations away from the coast. Offered in S. Calif.

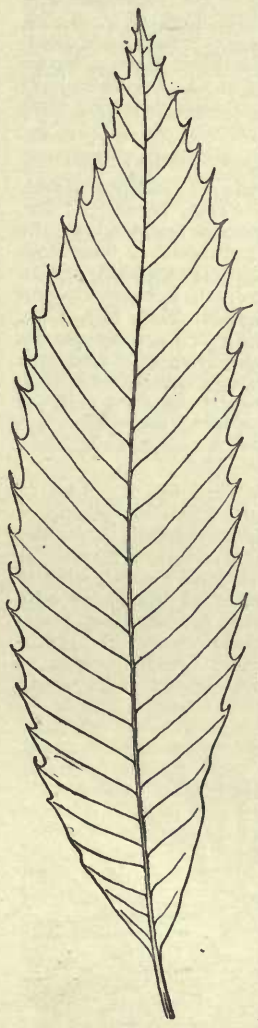
L. H. B.

CASTÀLIA: *Nymphæa*.

CASTÀNEA (ancient Latin name). *Fagàceæ*. CHESTNUT. Fruit and ornamental trees, grown for their edible nuts and also for their handsome foliage and attractive flowers.

Deciduous trees, rarely shrubs: lvs. alternate, serrate, elliptic-oblong to lanceolate: fls. monœcious, the staminate ones with 6-parted calyx and 10–20 stamens, in long, erect, cylindrical catkins; the pistillate ones on the lower part of the upper catkins, usually 3 together in a prickly involucre; ovary 6-celled: fr. a large brown nut, 1–7 together in a prickly involucre or bur: winter-buds with 3–4 scales: branchlets without terminal bud.—About ten species in the temperate regions of N. E. Amer., Eu., N. Afr. and Asia.

The chestnuts are very attractive when in bloom. The handsome foliage is generally not injured by insects or fungi, but the whole tree is attacked by a serious disease known as the chestnut bark disease which has spread rapidly during the last years, chiefly in New York, Pennsylvania and the adjacent states. It was first discovered in 1904. It is caused by a fungus, *Endothia parasitica*, which penetrates the bark, develops its mycelium in bark and sapwood, finally girdles the branch or trunk and causes the death of the portion above the infected place. The presence of reddish pustules on the infected area is a sure sign of the presence of this fungus. The cutting and destroying of the infected parts seems so far the only way of checking the spreading of the disease. This disease was without doubt imported with plants from eastern Asia, as the disease has been discovered recently in China on *C. mollissima*. The latter species and *C. crenata* seem much more resistant than the American and European varieties and there is much hope for a successful selection and breeding of resistant varieties and for keeping this disease under control, as it is done successfully in China.



833. Castanea dentata. (×½)

C. dentata and *C. sativa* are large-sized trees, while *C. pumila* and *C. crenata* usually remain shrubby. The coarse-grained wood is much used for furniture, railway ties and fence-posts, as it is very durable in the soil. The chestnut is extensively cultivated in Europe and eastern Asia and also in this country for its edible fruit. It grows best in well-drained soil on sunny slopes, and even in rather dry and rocky situations, but dislikes limestone soil. The American species is perfectly hardy North, while the European species is somewhat tenderer.

Propagated by seeds, sown in fall where there is no danger of them being eaten by mice or squirrels; otherwise they should be stratified in boxes and buried 1 or 2 feet deep in a warm soil until early spring, when they are sown in rows about 3 inches deep. If growing well, they can be transplanted the following fall or spring 2 or 3 feet apart from each other, and planted after three or four years where they are to stand. They are also increased by layers in moist soil. Varieties are usually worked on seedling stock or on sprouts by whipgrafting above the ground when the stock is just beginning to push into leaf. Crown-grafting, root-grafting and budding are also sometimes practised, but no method gives wholly satisfactory results, and usually only one-half take well. See *Chestnut*.

A. *Nuts 2 or more in one involucre and more or less compressed, usually broader than high.*

B. *Branchlets glabrous or at first with close white tomentum: lvs. usually glabrous at maturity, often with close white tomentum while young.*

C. *Lvs. glabrous or nearly glabrous even while young.*

dentàta, Borkh. (*C. americàna,* Raf.). Fig. 833. Tree, occasionally 100 ft.: lvs. cuneate at the base, oblong-lanceolate, acuminate, coarsely serrate, nearly glabrous when young, 6–10 in. long and somewhat pendulous: fls. of heavy fragrance, in June or July: nuts about ½in. wide. S. Maine to Mich., south to Ala. and Miss. S.S. 9:440–1. Em. 187. G.F. 10:373. F.E. 14, p, 30; 29, p. 895.—The tallest, most vigorous-growing and hardiest species. The nuts, though smaller, have a better flavor than the European varieties. Lvs. said to have sedative properties; used in whooping-cough; bark astringent, tonic, febrifuge.

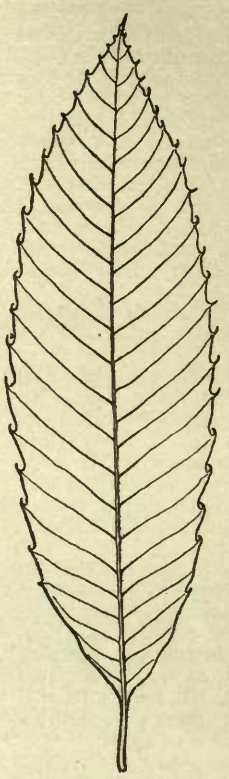
CC. *Lvs. stellate-tomentose beneath while young.*

satìva, Mill. (*C. vésca,* Gaertn. *C. Castànea,* Karst. *C. vulgàris,* Lam.). Fig. 834. Tree, 50–80 ft.: lvs. oblong-lanceolate, often truncate or rounded at the base, coarsely serrate, slightly pubescent or tomentose beneath when young, nearly glabrous at length, 5–9 in. long, erect: nut over 1 in. wide. June. From S. Eu. and N. Afr. to China. Gn. 27, p. 292; 50, p. 389. Gng. 3:209. G.W. 8, p. 350, 385.—There are some garden forms with variegated lvs., and others, of which var. **asplenifòlia,** Lodd., with laciniately cut and divided lvs. is the most remarkable. Of several varieties cult. for their fr., Paragon, a precocious kind, and Numbo, a variety with very large fr., are the most extensively planted in this country. See *Chestnut.*

crenàta, Sieb. & Zucc. (*C. japónica,* Blume. *C. satìva* var. *pubinérvis,* Makino). Fig. 835. Shrub or tree, to 30 ft.: lvs. elliptic or oblong-lanceolate, usually rounded at the base, acuminate, crenately serrate, or the teeth reduced to a long, bristle-like point, slightly pubescent when young, glabrous at length or only pubescent on the veins beneath, 3–7 in. long, erect: nut over 1 in. wide. Japan, China. S. I. F. 1:34.—Shrubby and very precocious; it usually begins to fruit when about six years old. Hardy as far north as Mass.



835. Japanese Chestnut—Castanea crenata. (×⅓)



834. Castanea sativa. (×½)

BB. *Branchlets pubescent, with spreading hairs: lvs. soft-pubescent beneath, at least those toward the end of the shoots.*

mollíssima, Blume. Tree, to 40 ft.: lvs. oval-oblong to oblong-lanceolate, acuminate or short-acuminate, rounded or truncate at the base, 3½–6 in. long, coarsely serrate, glabrous above, white-tomentose or nearly green, but soft-pubescent beneath, at least on the veins; petioles pubescent, with spreading hairs: nut about 1 in. wide; spines of the husk pubescent. N. and W. China.—Has proved perfectly hardy at the Arnold Arboretum and is to be recommended for its hardiness and large nuts.

AA. *Nuts solitary, round, higher than thick.*

pùmila, Mill. CHINQUAPIN. Shrub or small tree, rarely 50 ft.: lvs. cuneate, elliptic-oblong or oblong-obovate, acute, serrate, teeth often reduced to bristle-like points, white-tomentose beneath, 3–5 in. long: fr. ovate, small, about ½in. wide and ¾–1 in. long. May, June. From Pa. to N. Fla. and Texas. S.S. 9: 442–3.—Useful for planting on dry and rocky slopes; attractive when in fl., and again in fall with its abundant light green burs among the dark foliage. The closely allied *C. alnifolia,* Nutt., in the southern states, grows only a few feet high, and has larger lvs. and fr.

Vilmoriniàna, Dode. Tree, to 80 ft.: branchlets glabrous: lvs. oblong-lanceolate to lanceolate, long-acuminate, usually rounded at the base, the teeth mostly reduced to slender bristles, quite glabrous even while young, 4–7 in. long: fr. globose-ovate, about ½in. thick and slightly longer. Cent. China.—A valuable timber tree. Recently intro. by the Arnold Arboretum.

ALFRED REHDER.

CASTANEA of commerce: The nuts of *Bertholletia.*

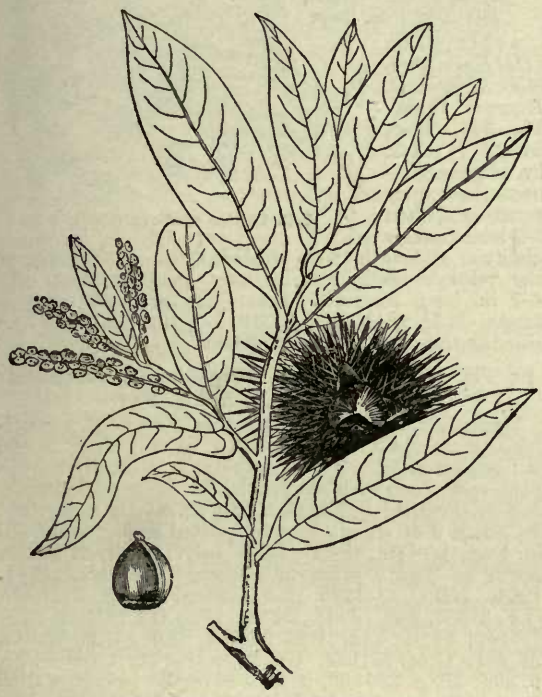
CASTANÓPSIS (*Castanea* and *opsis,* chestnut-like). *Fagàceæ.* Ornamental trees or shrubs sometimes cultivated for their handsome evergreen foliage.

Closely allied to Castanea, but pistillate fls. usually on separate catkins, sometimes solitary; ovary 3-celled: fr. ripening the second year: involucre sometimes tuberculate; winter-buds with many scales; terminal bud present: lvs. evergreen, entire or dentate.—About 25 species, chiefly in the tropical and subtropical mountains of Asia, and 1 in W. N. Amer., which is the hardiest, and is sometimes cult.; also several Chinese species have been recently intro. into cult., but their names have not yet been determined. For prop. see *Castanea.*

chrysophýlla, DC. (*Castànea chrysophýlla,* Hook.). Fig. 836 (adapted from Pacific R. R. Rep.). Tree, to 150 ft., shrubby at high elevations: lvs. ovate-oblong or oblong-lanceolate, narrowed at both ends, entire, dark green above, coated with minute golden yellow scales beneath, 2–6 in. long: nut about ½in. wide, usually solitary in the spiny involucre. Summer. Ore. to Calif. S.S. 9:439. B.M. 4953. G.C. III. 22:411; 36:145. Gn. 76, p. 634. F.S. 12:1184. R.B. 7:240.—A highly

ornamental tree with beautiful foliage, hardy only in the warmer temperate regions, but the shrubby form is much hardier. ALFRED REHDER.

CASTANOSPÉRMUM (*chestnut seed*, because of the taste of the seeds). *Leguminòsæ*. A genus of 2 species, one of which is a tall Australian tree, with odd-pinnate lvs., the lfts. broad, thick, entire: fls. large, yellow-orange, in lateral or axillary loose racemes which are usually about 5 in. long; petals 4; stamens free; ovary long-stipitate, many-ovuled: pod 8–9 in. long with 4–5 seeds larger than Italian chestnuts, globular. **C. austràle,** Cunn., is the species known locally



836. Castanopsis chrysophylla. (×¾)

as "Moreton Bay chestnut." The seeds are roasted and eaten. Intro. in S. Calif., but not common. The other species is New Caledonian, and apparently not in cult.

CASTILLÈJA (a Spanish botanist, D. Castillejo). *Scrophulariàceæ*. PAINTED-CUP. Herbs with showy bracts in a terminal head or spike, sometimes cultivated. Flowers small, solitary, in terminal gaudy-bracted spikes; corolla tubular, sometimes flattened laterally, 2-lipped; lower lip smaller, more or less 3-toothed; stamens 4: lvs. alternate, entire or cut—Upwards of 30 species in U. S. and Mex., and 1 in N. Asia. Castillejas are little known in gardens. They are more or less root-parasitic.

coccínea, Spreng. Biennial or annual, 1–2 ft., hairy: radical lvs. clustered, ovate or oblong, mostly entire; st.-lvs. laciniate or cleft, and the middle lobe of the bright scarlet bracts dilated: corolla pale yellow, about the length of the calyx. Low grounds and grassy places, Canada, south.

indivìsa, Engelm. Annual, 1–2 ft.: lvs. lance-linear and entire (or sometimes 2–3-lobed): bracts not laciniate, bright red and showy. Texas.—Blooms early in spring.

affìnis, Hook & Arn. Perennial, 1–2 ft.: lvs. narrow-lanceolate, entire or the upper ones toothed at apex: fl.-bracts becoming short and broad, red: spike lax below. Calif., in moist soils.—Intro. 1891 by Orcutt.

foliolòsa, Hook. & Arn. White-woolly perennial, 1–2 ft., the base woody: lvs. small (1 in. or less long), narrow-linear, crowded or fascicled: bracts 3-parted; spike dense. Calif., in dry soils.—Intro. 1891 by Orcutt.

íntegra, Gray. Perennial, 1 ft. or less, tomentose: lvs. grayish, linear, 3 in. or less long, entire: bracts of the short spike linear-oblong or obovate-oblong, entire or sometimes incised, red or rose. Texas to Ariz. and Colo. —Has been offered in Germany. L. H. B.

CASTILLÒA (for Castillejo, the Spanish botanist). *Moràceæ*. Laticiferous trees, of which *C. elastica* Cerv., is one of the important rubber-producing plants. There are 2 or 3 species, in Cuba and Cent. Amer. Lvs. alternate, short-petioled, often large, entire or toothed: plant monœcious, the sexes borne in the same cluster; sterile fl. with no perianth, stamens numerous and crowded, with scales intermixed; fertile fls. with 4-lobed perianth, including the short-styled ovary: fr. a crustaceous pericarp containing a pendulous seed. The cult. of *C. elastica* for rubber is described in Cyclo. Amer. Agric., Vol. II, p. 557.

CASTOR BEAN, CASTOR-OIL PLANT: *Ricinus.*

CASUARÌNA (said to be derived from *Casuarius*, the Cassowary, from resemblance of the branches to the feathers). *Casuarinàceæ*. BEEFWOOD. SHE-OAK. Odd slender-branched leafless trees and shrubs grown in warm regions and rarely seen under glass. They are thin-topped trees of striking appearance.

Casuarinas are usually classified near the walnut and hickory tribes, although very unlike them—or other known plants—in botanical characters. They are jointed and leafless plants, somewhat suggesting equisetums in gross appearance. Flowers are unisexual; staminate in cylindrical terminal spikes, each fl. consisting of a stamen inclosed in 4 scales, 2 of the scales being attached to the filament; pistillate fls. in dense heads borne in the axils, and ripening into globular or oblong cones, composed of 1-ovuled ovaries subtended by bracts: fr. a winged nutlet.—About 25 species in Austral., New Caledonia and E. Indies. The species fall into 2 groups, those having cylindrical and verticillate branches, and those having 4-angled and only imperfectly verticillate branches. The species bear small toothed sheaths at the joints.



837. Casuarina equisetifolia. (×½)

Beefwood is planted in the extreme South for its very odd habit, and also to hold sands of the seacoast. The wood burns quickly, and is very hard and durable. The redness of the wood has given the popular name, beefwood.—The species are remarkable for rapid growth. They grow well in brackish and alkaline soils. Propagated by seeds and by cuttings of partly ripened wood.

equisetifòlia, Linn. Fig. 837. Tree, becoming 150 ft. high in favorable climates, and a most rapid grower: branches drooping, pale green, simple, terete or nearly so, the internodes very short (less than ¼in.); sheath-teeth 7 (6–8) lanceolate and appressed: staminate cone nearly terete; pistillate cone short-peduncled, ellipsoidal, about ½-in. diam. Widely distributed in the farther Old World tropics, and the best-known species in this country (in S. Fla. and Calif. and south). Gn. M. 7:21. L.B.C. 7:607.—The wood is valuable for many purposes. The casuarinas are known as "oak" in Austral.

Cunninghamiàna, Miq. Tree with slender branches, much like *C. equisetifolia,* but cones smaller, about ½in. diam., globular and very irregular, with prominent valves. Austral.—Described as a rapid-growing tree in Calif., with strong and dense growth and numerous fine branches with very short internodes.

strícta, Dry. (*C. quadriválvis,* Labill.). Becoming 20–30 ft. high: branches erect, simple, 6–7-angled, scarcely green, internodes short, as in the latter: sheath-teeth usually 7, ovate-lanceolate and appressed: staminate cone slender; pistillate cone nearly sessile, oblong (sometimes staminate above), about 14-sided, 1 in. diam. Austral. Gn.M. 7:21.

torulòsa, Dry. (*C. tenuíssima,* Sieber). Reaches 70 or 80 ft.: branches erect, capillary, mostly terete, internodes short: sheath-teeth 4, very short, triangular appressed: staminate cones filiform; pistillate cones ellipsoidal, 8–10-sided. Austral.

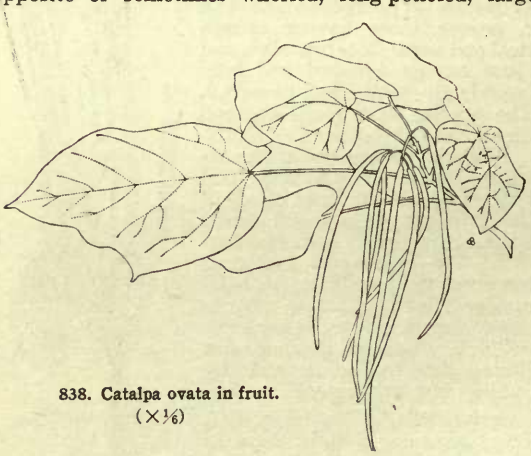
sumatràna, Jungh. Shrub with dense very slender branches which are sharply angled, the internodes often very short, the sheath-teeth short: cone large, elliptical or globose, the valves thick and concave-truncate at apex. Sumatra.—Offered in England, and the branches said to be useful for bouquets; very much branched.

L. H. B.

CATÁLPA (the Indian name of *C. bignonioides*). *Bignoniàceæ.* Ornamental trees, often cultivated for their handsome flowers appearing in large and showy panicles in summer, and for their heavy foliage.

Leaves usually deciduous, opposite, long-petioled, entire or coarsely lobed: fls. in terminal panicles; calyx splitting irregularly or 2-lipped; corolla campanulate, 2-lipped, with 2 smaller upper and 3 larger lower lobes; fertile stamens 2, curved, with diverging anther-sacs, not exceeding the tube of the corolla; style 2-lobed at the apex, slightly longer than the stamens: fr. a very long cylindrical caps., separating into 2 valves, with numerous small oblong compressed seeds bearing a tuft of white hairs on each end.—About 10 species in N. Amer., W. India and E. Asia, of which 6 are hardy in the northern temperate regions.

Catalpas are deciduous or rarely evergreen trees with opposite or sometimes whorled, long-petioled, large



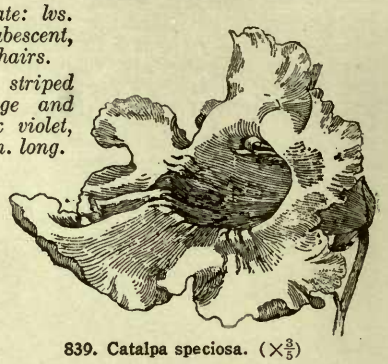
838. Catalpa ovata in fruit. (×⅙)

and simple leaves emitting in most species a disagreeable odor when bruised, and with white, pinkish or yellowish flowers in large and showy panicles followed by very long and narrow cylindric pods.

The coarse-grained and soft wood is very durable in the ground, and, therefore, much valued for fence-psts and railway ties. *Catalpa bignonioides* and particularly *C. speciosa* are sometimes planted as avenue trees. For formal gardens, if low round-headed trees are desired, *C. bignonioides* var. *nana* is to be recommended. They grow in almost any somewhat moist soil, and are hardy as far north as New England. Propagated by seeds sown in spring, in the North, best with slight bottom heat, or by cuttings from ripe wood, the varieties often by softwood cuttings in early summer or by grafting on seedlings or on roots under glass in spring; also increased sometimes by layers and root cuttings.

A. *Infl. paniculate: lvs. usually pubescent, with simple hairs.*

B. *Fls. yellow, striped inside orange and spotted dark violet, less than 1 in. long.*



839. Catalpa speciosa. (×⅖)

ovàta, Don (*C. Kæmpferi,* Sieb. & Zucc. *C. Hénryi,* Dode). Fig. 838. Tree, to 20 ft.: lvs. broadly cordate-ovate, abruptly acuminate, often 3-5-lobed, nearly glabrous at length, with reddish spots in the axils of the veins beneath, 5–8 in. long: panicles many-fld., 4–7 in. long, fragrant. June. China, much cult. in Japan. B.M. 6611. I.H. 9:319. L.I. 10. S.I.F. 2:71.—Hardier than the American species.

BB. *Fls. white, with 2 yellow stripes inside, and spotted purplish brown, 1½–2 in. long.*

bignonioìdes, Walt. (*C. Catálpa,* Karst. *C. syringifòlia,* Sims). Catalpa. Indian Bean. Tree, 20–50 ft.: lvs. often whorled, cordate-ovate, abruptly acuminate, sometimes with 2 lateral lobes, pubescent beneath, 5–8 in. long, of unpleasant odor: panicles many-fld.; fls. about 2 in. diam., thickly spotted inside: pod 6–20 in. long, ¼–½in. thick. June, July. Southern states, north to Tenn., often naturalized elsewhere. B.M. 1094. L.B.C. 13:1285. S.S. 6:288–9. Gng. 6:118–9. G.F. 3:537, 539. J. H. III. 32:121. G.C. III. 21:298; 29:167; 44:10, 312. F.E. 23:479. G.W. 7, p. 88. G. 23:481. G.M. 37:627. Gn. 22, p. 74; 26, p. 164–5; 33, p. 393; 36, p. 239; 66, p. 205.—Usually low tree, with very wide-spreading branches. Not much used medicinally, but pods and seeds said to possess antispasmodic, cardiac, and sedative properties: bark anthelmintic, alterative. There are some garden forms. Var. **aûrea,** Lav. Lvs. yellow. G.M. 53:709. Var. **nàna,** Bur. (*C. Búngei,* Hort., not C. A. Mey.). Forms a dense, round bush, often grafted high. Gng. 3:195. M.D.G. 1903:616. F.E. 14, p. 31.

speciòsa, Warder. Figs. 839, 840. (*C. cordifòlia,* Jaume, partly). Western Catalpa. Tree, to 100 ft.: lvs. cordate-ovate, long-acuminate, pubescent beneath, 8–12 in. long: panicles comparatively few-fld.; fls. about 2½ in. diam., inconspicuously spotted inside: pod ½–¾in. thick. June. From S. Ill. and Ind. to La. and Miss. S.S. 6:290–1. R.H. 1895:136. M.D.G. 1903:229–30 (habit).—A very desirable ornamental tree, closely allied to the former, but taller and hardier. Properties similar to *C. bignonioides.* Var. **pulverulénta,** Paul & Son. Lvs. freely dotted with white or cream color. G.M. 53:30. G. 30:289. F.E. 31:319.

hýbrida, Spaeth (*C. Teàsii,* Penhall. *C. Teasiàna,* Dode). Hybrid Catalpa. Hybrid between *C. bignonioides* and *C. ovata.* Large tree, intermediate between the parents: the lvs. resemble more those of *C. ovata,* and are purplish when unfolding, but much larger and slightly pubescent beneath, while the fls. are more like *B. bignoniodes,* but smaller and with the infl. often twice as long. Originated at J. C. Teas' nursery at Baysville, Ind. G.F. 2:305. Gt. 47:1454. G.W. 3, p. 569.—A very valuable tree, flow-

ering profusely; of rapid growth and hardy. Seedlings usually resemble *C. ovata*. Var. **japónica,** Rehd. (*C. japónica,* Dode). Lvs. broader and more abruptly acuminate, nearly glabrous beneath. Var. **purpùrea,** Rehd. (*C. hýbrida* var. *atropurpùrea,* Spaeth. *C. bignonioides* var. *purpùrea,* Hort.). Lvs. dark purple when young, green at length.

AA. *Infl. racemose; pedicels very slender, 1–1½ in. long, occasionally the lower ones with 2 or 3 fls.*

B. *Lvs. pubescent or tomentose beneath, with branched hairs.*

Fárgesii, Bur. Tree, to 60 ft.: lvs. ovate, acuminate, rounded at the base, entire, slightly pubescent above, densely beneath, 3–6 in. long: racemes pubescent, 7–10-fld.; fls. about 1½ in. long, rosy pink with purplish brown dots in throat: pod to 2 ft. long, ¼–⅓in. thick. W. China. Nouv. Arch. Mus. Paris III. 6:3.

BB. *Lvs. quite glabrous.*

Ducloùxii, Dode (*C. sutchuenénsis,* Dode). Tree, to 80 ft.: lvs. ovate, acuminate, usually rounded or subcordate at the base, with purple spots in the axils of the veins beneath, 5–8 in. long and often 4 or 5 in. broad: racemes 5–15-fld., the lower branches sometimes with 2 or 3 fls.; fls. rosy pink with orange markings in throat, 1½–1¾ in. long: pod about 2 ft. long and ¼–⅓in. thick. Cent. China.

Búngei, C. A. Mey. Small tree: lvs. narrowly triangular-ovate, entire or with 1 or few pointed teeth near the base, long-acuminate, truncate or sometimes broadly cuneate at the base, with purple spots in the axils beneath, 3–6 in. long and not over 3 in. wide: racemes 3–12-fld.; fls. white with purple spot, 1–1½ in. long: pod 12–15 in. long. N. China. Nouv. Arch. Mus. Paris III. 6:4.—Has proved perfectly hardy at the Arnold Arboretum. Var. **heterophýlla,** C. A. Mey. (*C. heterophýlla,* Dode). Lvs. with several pointed teeth near the base: racemes 3–5-fld.

C. longíssima, Sims. Tree to 50 ft.: lvs. oblong-ovate, coriaceous: fls. small, white. W. Indies; often planted as shade tree in Cuba.

ALFRED REHDER.

CATANÁNCHE (Greek name, referring to ancient custom of using the plant in making love-philters). *Compósitæ.* Annual or perennial garden herbs, grown for the bloom.

Leaves crowded at the base of the st., and linear or lanceolate: head long-peduncled, blue or yellow: achene oblong, ribbed and usually villose or setose: pappus of 5–7 lanceolate long-acuminate scales.—A half dozen species in the Medit. region. Of easiest cult. in any garden soil, particularly if light. Prop. by seeds and division. Useful for cutting.

cærùlea, Linn. Perennial, 2 ft.: lvs. tomentose, lanceolate and few-toothed, 3-nerved: fl.-heads 2 in. across, with wide flat-toothed blue rays, on long slender sts. Blooms in June, July and Aug. S. Eu. B.M. 293. R.H. 1890, p. 523. G. 28:541. Gn. 42, p. 25; 55: 368. Var. **álba,** Hort., has white fls. Gn. 55:368. Var. **bícolor,** Hort., has white margin and blue center. Often used as everlastings.

L. H. B.

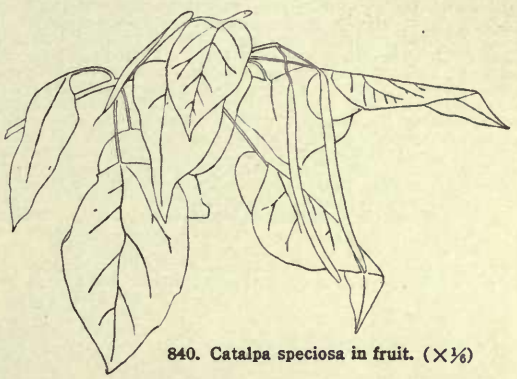
CATASÈTUM (Greek for *downward* or *backward,* and *bristle*). *Orchidàceæ.* Epiphytic or terrestrial orchids, requiring hothouse conditions.

Stems short fusiform: lvs. plaited, membranaceous: scapes basal; fls. in racemes, globose or expanded; labellum fleshy; column erect, provided with sensitive appendages which, when touched, cause the pollen-masses to fly out; pollinia 2. The genus includes Monachanthus and Myanthus.—There are about 50 or 60 species in the American tropics.

The flowers are in racemes or spikes, firm in texture, and white or in shades of green, yellow, brown or purple. Catasetums are not much cultivated, since most of the species are not showy, but they are interesting to the botanist and amateur because of the striking ejection of the pollen-masses. Gardeners often have trouble with catasetums, but they are not difficult to grow if given good care. They need a high temperature, long period of rest, and free supply of water during the growing season. They are grown in both pots and baskets. Readily propagated by dividing the plants at the base; also from very ripe pseudobulbs cut in pieces and put in sand. For culture, see *Orchids.*

A. *Fls. white.*

Bungeròthii, N. E. Br. Sts. 8–9 in. tall: sepals larger than the petals, nearly 2 in. long; labellum tending toward concave, roundish; appendages thickish. Ecuador. B.M. 6998. G.C. III. 1:142. I.H. 37:117; 34:10. Gn. 33:388. A.F. 6:633.—A striking plant.



840. Catalpa speciosa in fruit. (×⅙)

AA. *Fls. yellowish, more or less marked with brown or red.*

macrocárpum, Rich. (*C. Cláveringi,* Lindl. *C. tridentàtum,* Hook.). Fls. large, nearly 3½ in. across; petals and sepals yellow, verging on green, spotted with reddish brown; labellum yellow. Guiana. B.M. 2559, 3329. I.H. 33:619. Var. **rùbrum,** Hort. A red-fld. form.

fimbriàtum, Lindl. & Paxt. Pseudobulbs 2–3 in. long: raceme pendulous, 8- or more-fld.; fls. 2½ in. across; sepals whitish or pale yellow, closely barred with red. Brazil. B.M. 7158. A.F. 6:609. Var. **aûreum,** Hort. Fls. pale green, slightly marked with rose, center of lip deep golden yellow.

longifòlium, Lindl. Pseudobulbs deflexed: lvs. narrow and glaucous, reaching 3 ft.: fls. on drooping, compact spikes; sepals and petals greenish yellow tipped with dull red; lip helmet-like, orange-yellow. Guiana. —Epiphyte.

AAA. *Fls. essentially red or brownish.*

decípiens, Reichb. f. Fls. 1½ in. across; sepals and petals lanceolate; red-brown and spotted; lip saccate, yellowish outside and red-brown inside. Venezuela. A.F. 6:609.

AAAA. *Fls. many-colored, grotesque.*

Gnòmus, André. Pseudobulb oblong-ovate and alternate, articulated: fls. in a long loose raceme on slender pedicels; sepals greenish and purple-barred; 2 lateral petals spreading, concave, purple; lip bluntly conical, olive-green spotted outside, ivory-white within, fringed above. S. Amer. I.H. 24:270. A.F. 12:293.

C. barbàtum, Lindl. Fls. green, blotched with purple. Guiana. —*C. callòsum,* Lindl. Odd: fls. with chocolate-brown, narrow-lanceolate sepals and petals; lip greenish, speckled with red. Venezuela. B.M. 4219, 6648.—*C. Christyànum,* Reichb. f. Sepals and petals usually chocolate; lip greenish yellow, purple fringed. S. Amer.(?). G.C. III. 18:617. B.M. 8007.—*C. Claesiànum,* Lind. & Cogn. Fls. greenish yellow; lip fringed along sides. Brazil. G.C. III. 44:211.—*C. Clíftonii,* Hort. Probably a form of C. Bungerothii. G.M. 54:593 (desc.).—*C. Còlmaniæ,* Hort. Fine yellow fl. with 3-lobed lip stained with deep crimson.—*C. discolor,* Lindl. Fls. purple. An old sort, now rarely seen. Brazil.—*C. ebúrneum,* Rolfe.

Fls. ivory-white; sac of lip deep yellow. Colombia.—*C. Garnettiànum*, Rolfe. Allied to C. barbatum. Fls. small; sepals and petals very narrow, green, with large bars of red-brown; lip white, fringed. Amazon. B.M. 7069.—*C. imperiàle*, Lind. & Cogn. Sepals and petals ovate-acute, white, purple-spotted; lip orbicular-cordate, purple in center and white-margined. G.C. III. 17:329. S.H. 1, p. 369. J.H. III. 30:25.—*C. labiàtum*, Rodr. Scapes 1½ ft. long, the male 10-fid., female 2-fid. Organ Mts. *C. Lìndeni*, Cogn. Fls. large (as of C. Bungerothii); sepals and petals yellow, with purplish spots and bars; lip yellow, spotted at base. G.C. III. 17: 329. S.H. I, p. 369.—*C. maculàtum*, Kunth. Sepals acuminate, spotted with claret; petals broader, red-blotched; lip yellowish green outside, dark brown within. Colombia and Nicaragua.—*C. mirábile*, Cogn. Fls. very large, the sepals and petals oblong-lanceolate, and yellowish, with purple spots and bars; lip kidney-shaped, bright yellow with 2 purple spots, toothed. G.C. III. 17: 329. S.H. 1, p. 369.—*C. mónodon*, Kränzl. Spike long with 6–8 greenish fls.; lip flat, with fringes along border. Brazil. G.C. III. 35:354 (desc.).—*C. pileàtum*, Reichb., var. *aùrèum*, Hort. Fls. creamy white, shaded with greenish yellow. G.M. 47:829, 831.—*C. quádridens*, Rolfe. Fls. with pair of short, acute teeth situated at lower angles of abortive stigma.—*C. Rhamphástos*, Hort. Raceme few-fld., up to 10 in. long; fls. pale green. Andes of Colombia.—*C. Scúrra*, Reichb. f. Compact: fls. fragrant, yellowish white, green-veined; lip 3-lobed. Guiana. G.C. II. 7:304–5.—*C. spinòsum*, Lindl. (Myanthus spinosus, Hook.). Lip spreading, with succulent hairs, bearing on upper side at base an erect 3-partite spine and a much larger one below the acumen. Brazil. B.M. 3802. —*C. spléndens*, Cogn. Intermediate between C. Bungerothii and C. macrocarpum. Sepals greenish white with purplish center; petals white with many purple spots; lip cream-color, purple-marked. Runs into many forms: var. *álbum*, Lind. & Cogn., white or nearly so. Var. *Alicíæ*, Lind. & Cogn. Fls. large; sepals and petals purplish; lip white, toothed. Var. *aùreo-maculàtum*. Bossch. Yellow. I.H. 43:54. Var. *atropurpùreum*. Hort. Blackish purple.—*C. tenebròsum*, Kränzl. Fls. almost black, very spreading. Peru. G.C. III. 48:229 (desc.).—*A. Tracyànum*, Hort. A provisional name for a distinct species with whitish green fls.—*C. víridi-flàvum*, Hook. Fls. green, the lip conic, yellow inside. Cent. Amer. B.M.4017.—*C. Warscewiczii*, Lindl. & Paxt. From Panama. Now rarely seen.

OAKES AMES.
L. H. B.†

CATCHFLY: *Silene.*

CATECHU: *Acacia Catechu; Areca Catechu.*

CATERPILLARS. The worm-like pods of *Scorpiùrus vermiculàta*, Linn., *S. subvillòsa*, Linn., and others (*Leguminòsæ*), are sometimes used as surprises in salads and soups; and for that purpose they are cultivated in parts of Europe, and seeds are sold in this country. They are sometimes catalogued as Worms. They are annuals of the easiest culture. The pods of *Medicàgo scutellàta*, Mill., and others are known as Snails. The pods are not edible. European plants. A.G. 13:681.
L. H. B.

CATESBÆA (Mark Catesby, 1679–1749, author of natural histories of parts of N. Amer.). *Rubiàceæ.* Spiny shrubs of the W. Indies and one (*B. parviflora*) reaching the coast of Fla., of 6 species, one of which is offered in the trade: lvs. small, opposite or fasciculate, mostly ovate or oblong: fls. axillary and solitary, white, sometimes showy, 4-merous; corolla funnel-shaped, with short lobes; stamens 4, inserted deep in the tube: fr. a globular berry. **C. spinòsa**, Linn., offered in Fla., is a slow-growing evergreen shrub from the W. Indies: lvs. ovate to obovate, nearly as long as the straight spines: fls. yellow, large and conspicuous, the corolla-tube tapering down to the middle and then very narrow or filiform, the segms. much shorter than the tube: berry ovoid, yellow, edible.—Recommended for hedges.
L. H. B.

CÀTHA (Arabian name). *Celastràceæ.* One evergreen spineless shrub of Arabia and Afr., and cult. in warm countries for the lvs., which are said to possess sustaining and recuperative properties and which are eaten by the Arabs or used in the preparation of a beverage. **C. edùlis**, Forsk. (*Celástrus edùlis*, Vahl). KHAT. CAFTA. Glabrous, to 10 ft.: lvs. opposite, or on the leafy shoots alternate, thick, narrowly elliptic or oval-oblanceolate, serrate, narrowed to the short petiole, 4 in. or less long: fls. small, white, in short axillary clusters; calyx 5-lobed; petals 5; stamens 5, borne on a disk: fr. an oblong or clavate caps., 3-valved, 1–3-seeded, ⅓in. long.—Recently offered in this country. The twigs and lvs. are an object of commerce in Arabia.
L. H. B.

CATMINT or CATNIP: *Nepeta.*

CATÓPSIS (Greek compound, of obscure application). *Bromeliàceæ.* Fifteen or more species in Trop. Amer., with strap-shaped or lanceolate mostly rosulate lvs. and spikes or racemes of white or yellow fls. terminating a scape, very little known in cult.: sepals and petals separate to base; stamens shorter than the calyx; stigma subsessile. They require the cultural conditions of the erect tillandsias. *C. nítida*, Griseb. (*Tillándsia nítida*, Hook.), from W. Indies and S., is 6–18 in. tall, with oblong-mucronate shining green lvs. in rosettes, and white fls. in slender spikes. *C. penduliflòra*, Wright. from Peru, is recently intro., with oblong-elliptic lvs. (6 in. long) in a rosette and with thin denticulate margins, and white pendulous short-stalked fls. on a racemosely branched scape 1½ ft. high.

CAT-TAIL: *Typha.*

CÁTTLEYA (William Cattley, an early English horticulturist and naturalist). *Orchidàceæ.* Epiphytic orchids, requiring intermediate temperatures.

Pseudobulbs ovoid, clavate, fusiform or cylindric, short or elongated, smooth or furrowed, bearing 1–3 lvs.: lvs. coriaceous: fls. single or in clusters, borne usually at the apex of the pseudobulb, rarely on a leafy st. arising from the base of the pseudobulb, showy; sepals and petals similar or the petals much broader, membranous or fleshy; lip usually 3-lobed; lateral lobes commonly forming a tube inclosing the column, rarely the lateral lobes small; column clavate, fleshy; pollinia 4.—A genus of about 40 species, natives of continental Trop. Amer., especially numerous in Brazil and in the Andean region. Innumerable hybrids and horticultural forms have been named, those of the labiata group alone running into hundreds. Showiest of all orchids, and of great commercial value.

The growing of cattleyas.

The cattleyas are indigenous to the western hemisphere only, Central and South America being the regions in which they abound, particularly in the latter, from the different countries of which large quantities are imported yearly. During the last few years the collecting and importing of cattleyas into the United States has assumed large proportions, owing to a continually and steadily increased demand, not only by amateurs but also by the trade in general. There are two particular reasons for this increased demand: first, the exquisitely beautiful flowers, combined with size and marvelous colors adapted for decorations at all sorts of functions, are never out of place; second, their easy culture. Florists and amateurs alike are beginning to realize that, after all, orchids are plants, and if only treated in a commonsense way they are by far easier to grow than a good many other plants, and especially so the cattleyas, provided some attention is paid to their requirements.

Cattleyas, as a whole, delight in a genial atmosphere, with all the air possible when the outside temperature will permit. In summer, from May on to the end of October, air should be admitted day and night; thus there are no temperatures to be prescribed for these months. Later, when artificial heat has to be depended on, 50° to 55° at night is the best, bearing in mind that the earliest species to flower may be kept at the warmer end, and the later summer-blooming species, such as *C. Mossiæ* and *C. gigas*, may be wintered at the cooler end of the structure; thus beginning in autumn with *C. labiata, C. Percivaliana, C. Trianæ, C. Schrœderæ, C. Mossiæ, C. Mendelii;* and, last of all, *C. gigas*, in their regular order of bloom, these may be treated according to their season of flowering. One cannot change the



XXIII. Cattleya Lawrenceana.

time of blooming of a cattleya, that is to say force it as other plants may be forced, without injury to the plants and a poor quality of bloom, but they are often retarded by systematic cooler treatment.

The best potting material is the soft brown osmundine, used alone with no sphagnum moss unless it is possible to make this moss live, and even then it is of no value to the plants except as an index to the presence of moisture. Moss that is dead and inert is a detriment in the potting material of all orchids. The one imperative thing in the potting of cattleyas is that they be made perfectly firm in their receptacles; if loose potting is practised, the young roots are injured each time the plant is handled, and the material is like a sponge, holding too much moisture in suspension for the plants to do well, and, given a time when the roots do not dry out quickly, all will soon die.

Newly imported cattleyas, as they arrive from South America, are usually much dried up, due to the treatment given before shipment to avoid loss by decay or fermentation on the way. If the plants are washed well with soap and water, placed in an airy shaded house for a few weeks and allowed to plump up again, roots will soon be seen starting. At this time, pot each piece in a receptacle suitable to the size of the plant (never let it be too large, but always err on the minimum when in doubt), fill the pots half full of drainage if common flower-pots are used, and fill up with osmundine to the top, pressing this material in with a blunt-pointed stick so that the plant will be firm. Moisture from this time on for weeks may be applied by spraying overhead during bright days. If the pieces are large, baskets are preferable to pots, as there is more aëration through the material and the plants may be suspended and space economized. Newly established plants often bloom the first year, and one may get an idea of the infinite variety found among the plants, as no two are alike. Some districts known to collectors produce better forms than others, in fact, in certain localties, the plants found produce flowers of very inferior quality. It is becoming more difficult to collect orchids, especially cattleyas from their native habitats, transportation not having improved and the distance to travel being greater each time. In consequence of this, hybridizers are now turning their attention to the reproduction of fine forms true to themselves, with considerable success, and should the supply of wild plants fail, there cannot now, in view of the well-understood and successful methods of raising cattleyas, be a time when the plants will be unobtainable. Considering the variation found among the wild plants, it is to be expected that home-raised seedlings will vary; but if the best-known forms are used, and these only are worth the trial, one may expect a large measure of success.

In our climate there is no period when the cattleyas should be kept dry at the roots. The plants are either getting ready to bloom, in crop, or recuperating therefrom, and these three periods cover the year. One does not have to resort to drying to attain ripening as do the European cultivators, and failure here is often traceable to foreign training or text-books.

Established plants should be repotted at least every second year. This is as long as the osmundine will remain suitable for the roots to ramify in, and if the plants are grown in pots, immerse the same a day before if the roots are dry, or most of them will remain attached to the pots. Remove all decayed portions of material and roots, wash with clean water, and repot as with newly imported plants, remembering always that a size too large often proves fatal to success. Plants that have been newly potted must not be placed among others that have not received attention, but all should be put in a situation in which they can be treated to little water at the roots for several weeks until the weather is such that there is no danger of their becoming overwatered. Cattleyas should be attended to in this respect in the winter months, taking first *C. labiata*, as it is the first to start growing, then *C. Trianæ;* the later kinds may be potted before flowering with less injury than afterwards, if done with care.

In hot weather, cattleyas should always be watered in the evening or latter part of the day. A generous spraying overhead will supply the moisture at a time when the roots get most of it, as may be seen by an examination in early morning. There is no danger of injury if an abundance of air is supplied. One has only to be careful during such times as the atmosphere outside is surcharged with moisture, then it is wise not to use any moisture inside even for a week at a time. This is when the dreaded "black spot" disease is often seen. It usually begins at the union of leaf and bulb, and when first seen, amputation must be practised to a point below infection, and dry sulfur and powdered charcoal applied at once as an absorbent. A small can of this ought always to be ready to hand, for if the disease gets down to the rhizome, several bulbs will be affected at once, and it is often difficult to save the plant. The disease is also highly infectious and may easily be transmitted to a healthy plant by means of a knife used to cut off diseased parts of another.



841. Cattleya Mendelii.

Apart from seeds, the propagation of cattleyas is a slow process to be accomplished only by the cutting of the rhizome between the bulbs, leaving at least three of the leading ones and separating the older ones according to their strength or the dormant buds at the base that are visible. A clean cut or notch that almost severs the rhizome is the best, leaving the parts where they are until new growth and roots are made, then potting in small receptacles, wiring or staking the little pieces firmly. Apart from the three last-made bulbs on the rhizome, the older ones are a source of weakness to the plants and are better removed, and in the case of valuable forms utilized as above. This is the way all duplicates of the many albino varieties have been obtained. There are many white cattleyas bearing the same name, as *C. Trianæ alba* or *C. Mossiæ Wagneri*, for many have appeared among importations, but these differ in each individual and unless a plant is increased by division one cannot be sure of the same thing.

Opinions are divided as to the "feeding" of orchids. It is certain that when rain-water is saved in cisterns for the plants, and these happen to be in the vicinity of cities where soot collects on the roofs of the houses, the

plants show unusual vigor and in consequence of this, many have practised the use of fertilizers in exceedingly dilute proportions in all the water used on the plants, and some have had surprising results. The temptation, however, is always present to feel that if a little is good, more would be better, and herein lies the danger. When plant-foods are used in solution, they should be considered only as sufficient to make the difference between rain-water and that which comes out of a pipe.

The best twelve varieties of cattleyas for commercial purposes, and, indeed, for amateurs also, are the following: *C. Trianæ*, fls. Jan.–March; *C. Schroederæ*, fls. March, Apr.; *C. Mossiæ*, fls. April, May; *C. Mendelii*, fls. Apr., May; *C. Warneri*, fls. May, June; *C. gigas*, fls. June, July; *C. aurea*, fls. June, July; *C. Gaskelliana*, fls. Aug., Sept.; *C. Harrisoniana*, fls. Sept., Oct.; *C. labiata*, fls. Oct., Nov.; *C. Bowringeana*, fls. Oct., Nov.; *C. Percivaliana*, fls. Dec.

With a number of plants of each of the above kinds, it will be seen that it is possible to have a succession of flowers from one end of the year to the other.

E. O. Orpet and John E. Lager.

The following American trade names belong to Lælia: *C. crispa*, *C. lobata*, *C. marginata*, *C. pumila*. See, also, the list of hybrids at the close of *Cattleya*. For *C. aurantiaca*, see *Epidendrum*.

The cattleyas enter into various generic hybrids: consult, for example, *Brassocattlælia*, *Brassocattleya*, *Brasso-Lælia-Cattleya*, *Epicattleya*, *Læliocattleya*.

Of several of the following species, there are named varieties in the American trade, varying in stature, habit and particularly in the color of the flowers.

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KEY TO THE SPECIES.

A. *Infl. terminal.*
- B. *Lateral lobes of lip small or wanting, the column exposed.*
  - C. *Peduncles 1-2-fld., from a very short spathe or naked: pseudobulb fusiform, short*..... 1. **Aclandiæ**
  - CC. *Peduncles many-fld., from a large spathe: pseudobulbs long*..... 2. **bicolor**
- BB. *Lateral lobes of lip large.*
  - C. *Corners recurved, exposing column.* 3. **dolosa**
  - CC. *Corners not recurved, concealing column.*
    - D. *Pseudobulbs 1-lvd.*
      - E. *Plants large: pseudobulbs fusiform or clavate: fls. large.*
        - F. *Sepals and petals yellow; lip ample, rich purple, beautifully veined and reticulated with gold*..... 4. **Dowiana**
        - FF. *Sepals and petals not yellow.*
          - G. *Petals about twice as broad as the sepals which are markedly undulate.*
            - H. *Tube narrowly cylindric, the limb not striped*..... 5. **Lawrenceana**
            - HH. *Tube cylindric-funnelform, the limb bordered with white and streaked with darker color, with a median yellow line*..... 6. **maxima**
          - GG. *Petals 3 times or more as broad as the sepals which are not undulate or but slightly so.*
            - H. *Lip with a large orange blotch in the center, surrounded by circles of white and purple in order*..... 7. **Eldorado**
            - HH. *Lip with other color arrangement.*
              - I. *The lip about as wide as or wider than the petals.*
                - J. *Tube of lip yellow; sepals and petals white*..... 8. **Rex**
                - JJ. *Tube white or colored other than yellow.*
                  - K. *Border of limb white, the center bright purple variegated with violet*..... 9. **Mossiæ**
                  - KK. *Limb without white border.*
                    - L. *Throat with a yellow or white eye on each side*..... 10. **Luddemaniana**
                    - LL. *Throat without eye.*
                      - M. *Color of tube white, or the same as petals; limb purple-crimson*..... 11. **Mendelii**
                      - MM. *Color of tube and limb bright purple; throat with 2 yellow spots*..... 12. **Warscewiczii**
              - II. *The lip narrower than petals.*
                - J. *Limb much shorter than the tube, the margin relatively but little crisped*..... 13. **Trianæ**
                - JJ. *Limb about as long as the tube, the margin much crisped.*
                  - K. *Throat with a golden eye on each side*..... 14. **labiata**
                  - KK. *Throat without eye.*
                    - L. *Margin of limb different in color from the center.*
                      - M. *Petals longer than the sepals and lip; fls. 4½–5 in. across*..... 15. **Percivaliana**

KEY TO THE SPECIES, continued

MM. *Petals about as long as sepals and lip; fls. 6–7 in. across*.....16. **Gaskelliana**
LL. *Limb not margined*..17. **Warneri**
EE. *Plants small: pseudobulbs ovate or oblong: fls. small, yellow*...18. **luteola**
DD. *Pseudobulbs 2–3-lvd.*
E. *Peduncle pendent, bearing usually a single yellow fl.; lip entire*.....19. **citrina**
EE. *Peduncle erect, bearing 2–10 fls. or more; lip usually 3-lobed.*
F. *Ground-color of sepals and petals not green nor brown.*
G. *With large purple spots*....20. **amethysto-**
GG. *Not spotted* **[glossa**
H. *Fls. 5–10; sepals and petals not fleshy.*
I. *Lip emarginate; blooms in fall*.....21. **Bowringiana**
II. *Lip acute; blooms in spring*.....22. **Skinneri**
HH. *Fls. 2–5; sepals and petals fleshy.*
I. *Middle lobe of lip much broader than tube*.....23. **Victoria-**
II. *Middle lobe of lip not broader than tube.* **[regina**
J. *Color of sepals and petals pale or white; petals the same width as dorsal sepal*.....24. **intermedia**
JJ. *Color of sepals and petals marked; petals broader than dorsal sepal.*
K. *Lateral lobes of lip and petals acute*....25. **violacea**
KK. *Lateral lobes of lip and petals obtuse.*
L. *Lip distinctly 3-lobed, the nerves of the disk smooth*....26. **Loddigesii**
LL. *Lip indistinctly 3-lobed, the nerves of the disk rugose-thickened*.....27. **Harrisoniana**
FF. *Ground-color of sepals and petals brown*.....28. **Leopoldii**
FFF. *Ground-color of sepals and petals green.*
G. *Lip warty or papillate.*
H. *Claw long*.....29. **granulosa**
HH. *Claw short or wanting*....30. **guttata**
GG. *Lip not warty nor papillate.*
H. *Middle lobe much broader than the tube; sepals and petals spotted*.....31. **Schilleriana**
HH. *Middle lobe not broader than the tube; sepals and petals not spotted*.....32. **Forbesii**
AA. *Infl. from the base of the pseudobulb.*
B. *Pseudobulbs 1-lvd.: lateral lobes of lip separated, exposing column*...33. **Walkeriana**
BB. *Pseudobulbs 2-lvd.: lateral lobes of lip forming a tube, concealing column*.....34. **nobilior**

1. **Aclándiæ,** Lindl. Sts. 4–5 in. tall, bearing 2 or 3 lvs. 2–3 in. long: peduncle with 1 or 2 fls. 3–4 in. across; sepals and petals similar, obtuse, greenish yellow, marked with spots of black-brown; lip fleshy in the middle, somewhat fiddle-shaped, the lateral lobes small, curved over the column, the middle lobe large, broadly reniform, undulate, rose-purple with darker veins. Brazil. B.M. 5039. C.O. 23. There is a var. **nigréscens.**

2. **bícolor,** Lindl. Pseudobulbs cylindric, deeply striate, 1–3 ft. tall, 2-lvd.: lvs. 4–6 in. long, oblong-lanceolate: peduncle with 2–6 fragrant fls. 3–4 in. across; sepals oblong, acute, usually olive or bronze-green, the lateral falcate; petals like the sepals but undulate; lip crimson-purple, sometimes white-margined, the lateral lobes wanting, the middle lobe recurved, oblong-cuneate, bilobed, channeled in the center. Brazil. B.M. 4909. C.O. 10. O.R. 10:305.

3. **dolòsa,** Reichb. (*C. Walkeriàna* var. *dolòsa,* Veitch). Pseudobulbs 4–6 in. long, usually 2-lvd., the lvs. oblong: peduncle 1- or 2-fld.; sepals and petals acute, rose-purple to lilac, the sepals oblong-lanceolate, the petals cuneate-ovate; lip 3-lobed, the lateral lobes erect, the middle lobe reniform, emarginate, amethyst-purple. Brazil. G.C. II. 5:430–1. V.O. 2:49. A.G. 11:159.

4. **Dowiàna,** Batem. (*C. labiàta* var. *Dowiàna,* Veitch). Pseudobulbs up to 1 ft. tall, furrowed, 1-lvd.: lvs. up to 1 ft. long: peduncle 2–6-fld.; fls. 6–7 in. across; sepals and petals nankeen-yellow, the sepals lanceolate, acute, less than half as wide as the undulate petals; lip ample, about as long as the petals, the tube yellow, striped with purple, the limb crisped, velvety, dark purple, finely and beautifully veined with golden lines which radiate from the median lines. R.H. 1869:30. A.F. 25:593; 21:838; 30:1078. C.L.A. 11:45; 19:343. Costa Rica, where it was discovered by Warscewicz.— It was rediscovered in 1864 by Mr. Arce, who sent plants to Eu., where they were purchased by Messrs. Veitch & Son, in whose establishment they flowered for the first time. Var. **aùrea,** Williams & Moore (var. *chrysotóxa,* Hort.), has the sepals and petals of a deeper yellow and the golden veins on the lip more copious and anastomosing. Colombia. A.F. 6:563; 12:10. F.R. 1:76. C.O. 2*a*. O.R. 19:17. Var. **jenseniàna,** Hort. A large and handsome form. Var. **rósita,** Hort. Sepals creamy white, tinged with purple; petals rose-purple, tinged with yellow.

5. **Lawrenceàna,** Reichb. Pseudobulbs 12–15 in. tall, fusiform-clavate, compressed, furrowed, 1-lvd.: lvs. oblong, 6–9 in. long: peduncle 5–8-fld.; fls. 4–5 in. across; sepals and petals pale rosy purple to almost white, the sepals linear-oblong, the petals elliptic-oblong, undulate, about twice as wide as the sepals; lip with a narrowly cylindric tube, colored externally like the sepals and petals, the limb purple with a maroon blotch. Brit. Guiana. B.M. 7133. R. 1:12.

6. **máxima,** Lindl. Pseudobulbs about 1 ft. tall, claviform, furrowed, compressed, 1-lvd.: lvs. oblong, 5–10 in. long: peduncle 3–6-fld.; fls. 4–5 in. across; sepals and petals lilac or pale rose, acute, the sepals lanceolate-ligulate, the petals about twice as broad as the sepals, undulate or crisped; lip as long as petals, the limb crisped, pale rose or crimson-purple with a median yellow stripe, from which radiate darker lines, the border white. Ecuador and Peru. B.M. 4902. F.S. 20:2136. F.R. 1:298. C.O. 13.

7. **Eldoràdo,** Lind. (*C. labiàta* var. *Eldoràdo,* Veitch)· Pseudobulbs 6–8 in. tall, stout, 1-lvd.: lvs. oblong, 8–12 in. long: peduncle with 1–3 fragrant fls. 5–6 in. across; sepals and petals pale rosy lilac passing to white, the sepals lanceolate, acute, the petals oval-rhomboid, obtuse, undulate; lip longer than lateral sepals, externally the same color as petals, the limb crisped, emarginate, a large central orange blotch surrounded by zones of white and purple. Brazil. F.S. 18:1826. C.O. 26. Var. **crocàta,** Hort. Sepals and petals white or pale rose, the orange spot of lip extended in a broad line to the base. Var. **Wállisii,** Rand. (*C. Wállisii,* Lind.). Fls. pure white except golden spot on lip. C.O. 26*a*.

8. **Réx,** O'Brien. Pseudobulbs 8–14 in. tall, claviform or fusiform, furrowed, 1-lvd.: lvs. up to 1 ft. long, oblong: peduncle with 3–6 fls. 6–7 in. across; sepals and petals cream-white, the sepals acutish, linear-oblong, the petals obtuse, as long as sepals but 3 times their width, oval-rhomboid, undulate; lip about as long as lateral sepals, the tube yellow, veined with purple, the limb crisped, the front part margined white surround-

ing a crimson center veined with a lighter shade. Peruvian Andes. B.M. 8377. R.H. 1894:228. C.O. 22.

9. **Mŏssiæ,** Hook. (*C. Carrièri,* Houll. *C. labiàta* var. *Mŏssiæ,* Lindl. *C. Peètersii,* André). Pseudobulbs fusiform, compressed, furrowed, 12–15 in. tall, 1-lvd.: lvs. 6–8 in. long, oblong: peduncle with 3–5 fls. 6–7 in. across; sepals and petals rose, of equal length, the sepals lanceolate, the petals oval-elliptic, crisped, especially on upper margin; lip with the tube colored like petals, the limb ample, emarginate, strongly undulate-crisped, the center purple, variegated with violet, the margin white, the throat yellow lined with purple-crimson. La Guayra. B.M. 3669. R.H. 1857, p. 322. S.H. 1:149. O.R. 18:241. C.O. 9. A.G. 14:70. A.F. 6:563. Var. **cærùlea,** Cogn., has the sepals and petals and spot on the limb a pale blue-violet. C.O. 9*e*. Var. **Reineckiàna,** O'Brien (*C. Reineckiàna,* Reichb.), has the sepals, petals and external of tube white, the limb a mauve-lilac, bordered white, the throat yellow, veined purple-violet. C.O. 9*b*. Var. **Wâgeneri,** Veitch (*C. Wâgeneri,* Reichb.), has fls. white except the small yellow spot on lip. O.R. p. 24. Var. **rouseleàna,** Hort., has rosy fls. Var. **coundoniénsis,** Hort. Fls. large and richly colored. Var. **dúlcis,** Hort. Fls. rose-tinted; lip orange in center, rich rose-crimson in front, finely crimped. Var. **boelénsis,** Hort. Dark-colored form. Var. **cœléstis,** Hort. Fls. lavender-tinted. Var. **fúlgens,** Hort. Fine fls. in shape and color. Var. **Alexándræ,** Hort. Fls. pure white with tinge of rose-pink on lip. Var. **álba,** Hort. Fls. white. Var. **Goosensiàna,** Hort. Lip deep reddish violet, with white crimped margin; sepals and petals white. Var. **aureòla,** Hort. Fls. large, white. Var. **Flòryæ,** Hort. Fls. pure white.—A variable group.

10. **Luddemanniàna,** Reichb. f. (*C. labiàta* var. *Luddemanniàna,* Reichb. f. *C. Dáwsonii,* Warner. *C. speciosíssima,* Hort. *C. Roèzlii,* Reichb. f. *C. Malouàna,* Lind. *C. Bássettii,* Hort.). Pseudobulbs clavate, 8–12 in. tall, 1-lvd.: lvs. oblong, 6–10 in. long: peduncle 2–5 fld.; fls. 5–6 in. across; sepals and petals rose-purple, suffused with white, the sepals oblong, acute, the petals elliptic, undulate; lip with the tube of same color as petals, the front lobe crisped, emarginate, amethyst-purple, the throat with 2 yellow or white blotches, separated by lines of amethyst-purple. Venezuela. C.O. 21. Var. **álba,** Hort. Fls. white. O.R. 16:201. Var. **Stánleyi,** Hort. Fls. white, disk of lip yellow, front lobe lined with purple.



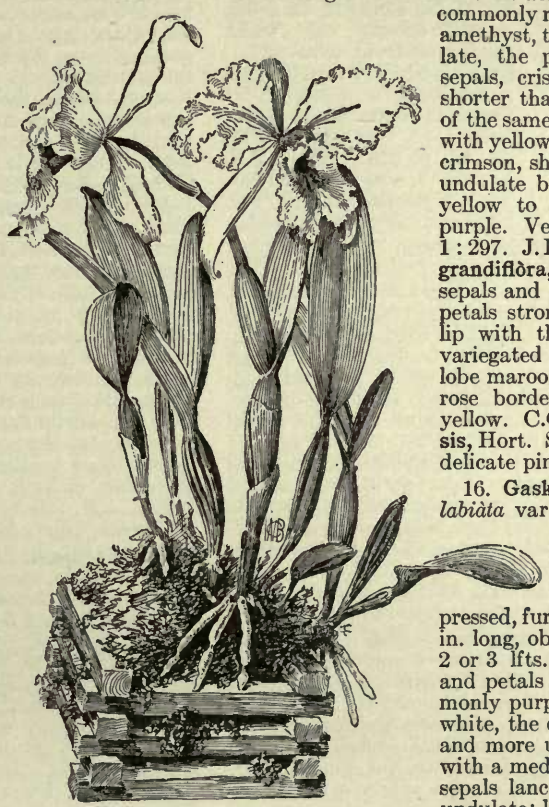
842. Cattleya Warscewiczii var. gigas (×⅓).

11. **Méndelii,** Backh. (*C. labiàta* var. *Méndelii,* Reichb. f. *C. Mórganiæ,* Williams). Fig. 841. Pseudobulbs 12–16 in. tall, compressed, furrowed, 1-lvd.: lvs. oblong, 6–10 in. long: peduncle with 2 or 3 fls. 7–8 in. across; sepals and petals white, or often tinted pale rosy mauve, the sepals oblong-lanceolate, the petals obliquely oval, obtuse, crisped; lip with the tube white or colored like petals, the front lobe much crisped, rich crimson-purple abruptly passing into the yellow throat which is reddish streaked. Colombia. O.R. 1:273; 10:233. S.H. 2:413. C.O. 19. Var. **Blúntii,** Hort., has the fls. white, except a small yellow spot on lip. Var. **Maùdeæ,** Hort. White with rose markings on the lip. Var. **gigantèa,** Hort., has a very large lip. Var. **hackbridgénsis,** Hort. Petals blotched with crimson. Var. **Bértii,** Hort. Fls. white tinted with rose. Var. **leucoglóssa,** Hort. Sepals bluish tinted. Var. **Lòwiæ,** Hort. Lip white, pale purple at apex. Var. **wisetonénsis,** Hort. Lip rich rose-purple, delicately veined; throat yellow veined with reddish purple. Var. **macroziàna,** Hort. Fls. very large. R.H. 1903, p. 253 (desc.). Var. **Láchneri,** Hort. Lip curiously colored, front lobe having a broad marginal band of dark purple sparingly blotched with white and an inner band of lighter purple. Var. **Piètiæ,** Hort. Fls. nearly white; lip marked with pink. Var. **majéstica,** Hort. Fls. large, white. Var. **Díxonæ,** Hort. Attractive blush-pink form. Var. **Lambeanàna,** Hort. Fls. white.

12. **Warscewíczii,** Reichb. f. (*C. labiàta* var. *Warscewíczii,* Reichb. f. *C. gloriòsa,* Carr. *C. imperiàlis,* Wallis). Pseudobulbs 1 ft. or more tall, stout, compressed, furrowed, 1-lvd.: lvs. oblong, 8–10 in. long: peduncle with 2 or 3 fls. 7–9 in. across; sepals and petals rosy mauve, the sepals lanceolate, acute, the petals oval, obtuse, undulate; lip entirely bright purple except 2 yellow spots and lines of the same color in the throat, crisped, the front lobe ample. Colombia. O.R. 12:241. G.C. III. 22:163; 42:312. Gn. 33, p. 18. C.O. 1. Var. **gìgas,** Hort. (var. *Sanderiàna,* Hort. *C. gìgas,* Lind. & André. *C. Sanderiàna,* Hort. *C. labiàta* var. *Sanderiàna,* Hort.). Fig. 842. A noble form, the sepals and petals dark rose, with a deep purple-magenta lip, the fls. larger than those of any other form of the labiata group. Colombia. I.H. 21:178. Gn. 45, p. 445. G.F. 1:437. A.G. 19: July 23, suppl. F.R. 1:77, 674. F.E. 10:892. C.L.A. 11:42, 44. The following forms of this variety occur: *álba,* fls. pure white, the rarest of all cattleyas (O.R. 18:232); var. *albéscens,* sepals and petals white, with faint blush, the lip rose-purple, fringed; var. *atropurpùrea,* of deeper color; var. *rochelléns*is, sepals and petals white, the lip with the faintest trace of color. Var. **saturàta,** Hort. Fls. bright rose, with ruby-crimson lip.

13. **Triànæ,** Lind. & Reichb. f. (*C. labiàta* var. *Triànæ,* Duch. *C. Leeàna,* Sander. *C. Rollissoniàna,* Moore. *C. quadrícolor,* Batem. *C. Massangeàna,* Reichb. f. *C. bogoténsis,* Lind.). Fig. 843. Pseudobulbs about 1 ft. tall, clavate, 1-lvd.: lvs. oblong, 6–8 in. long: peduncle bearing 2 or 3 fls. about 6 in. across; sepals and petals a delicate rose to white, the sepals oblong-lanceolate, the petals much broader than sepals, obtuse, oval-rhomboid, crisped; lip narrower than in the other related forms, the tube rose, the front lobe purple, less crisped than in most of the related species, emarginate, the throat yellow, often streaked with deeper color. Colombia. O.R. 6:145. B.M. 5504. R.H. 1860, pp. 406–7. A.G. 17:177. Gng. 3:151. A.F. 6:607; 13:715. F.E. 9:325. F.R. 1:672–3. C.O. 5.

S.H. 1:11, 27; 2:403, 405. Var. **álba,** Hort. Fls. white, except yellow blotch in throat. C.O. 5*a*. Var. **atropurpùrea,** Hort. Fls. crimson-purple. Var. **Backhousiàna,** Hort. Sepals and petals rose-purple, the petals strongly marked with amethyst-purple at the apex, the tube of lip rose-purple, the front lobe purple-magenta. C.O. 5*e*. Var. **chocoénsis,** Hort. Fls. very fragrant, not fully expanding, the sepals and petals white, sometimes flushed pale lilac. I.H. 20:120. A.F. 6: 563. Var. **delicàta,** Hort. Sepals and petals white, faintly flushed pale amethyst-purple, the deeper lip with a pale yellow spot. F.M. 1:8. Var. **Schròederæ,** Hort. (*C. Schròederæ*, Reichb. f.). Fls. fragrant, the sepals and petals a delicate blush, faintly suffused with white, the petals and broader lip much more crisped than in other forms of this species. G.C. III. 20:73. A.G. 15:211. O.R. 11:177. C.L.A. 11:45. F.E. 9:331. The following forms of this variety occur: *álba*, the fls. pure white; *álbescens*, the fls. nearly white; *cærùlea*, the lip a blùish color; *Mèta*, sepals and petals pink, the throat bright yellow; *lilacìna*, lilac; *refúlgens*. Var. **grataxiàna,** Hort. A large and richly colored form. Var. **cândida,** Hort. Fls. snow-white; lip with faint violet spot. Var. **coundoniénsis,** Hort. Purple-rose sepals and petals. Var. **Mâriæ,** Hort. Silvery white sepals and petals veined with pink; front of lip deep magenta-crimson, with 2 yellow blotches on throat. Var. **triúmphans,** Hort. Sepals and petals rose-colored; lip rich purple with an orange-yellow tube. Var. **enfieldiénsis,** Hort. Fls. white; tip of lip blush-pink. Var. **boetzelæriénsis,** Hort. Rose-colored form. Var. **tessellàta,** Hort. Large rose-colored form curiously marked. Var. **Brandneriàna,** Hort. Anterior part of lip dark purple-violet. Var. **Hòltzeii,** Hort. Lip dark. Var. **Wéllesleyæ,** Hort. A pretty white form. Var. **Mooreàna,** Hort. Sepals and petals light rosy lilac; lip ruby-claret color, orange at base. Var. **Hòlmesii,** Hort. Broad petals and rich rose-purple lip. Var. **brunoyénsis,** Hort. Sepals and petals mauve. Var. **Goodsònii,** Hort. Richly colored; petals flushed with deep rose.



843. Cattleya Trianæ (×⅓)

14. **labiàta,** Lindl. (*C. Lemòinei*, Lindl. *C. Naldereàna*, Reichb. f. *C. Pérrinii*, Endl. *C. labiàta vèra*, Veitch. *C. labiàta autumnàlis*, L. Lind. *C. labiàta* var. *Warocqueàna*, Rolfe. *C. Warocqueàna*, L. Lind.). Pseudobulbs claviform, compressed, furrowed, 4–8 in. tall, 1-lvd.: lvs. 5–7 in. long, ovate or oblong: peduncle, from a double spathe, bearing 3–5 fls. about 6 in. across; sepals and petals usually rose-lilac, the sepals lanceolate, the petals undulate; lip with the tube colored usually like the petals, the front lobe deeply emarginate, undulate-crisped, commonly a violet-purple with deeper veins, the color running in streaks to the yellow throat which has an orange spot each side. The color-variations of this species are numerous. Brazil. B.R. 32:35; 1859. O.R. 16:281. B.M. 3998. Gt. 5:146. F.S. 1893–4. P.M. 4:121. A.G. 17:65; 19:811. G.C. III. 19:13. A.F. 6:607. F.R. 1:8; 2:531.—Intro. from the Organ Mts. in S. Brazil in 1818. Var. **álba,** Hort. Fls. white, except yellow throat. C.O. 3. Var. **Amesiàna,** Hort. Sepals and petals white, the lip lilac. Gn. 62, p. 401. Var. **Cooksòniæ,** Hort. Fls. white, except the crimson-purple lip with a narrow white margin. Var. **supérba,** Hort. Sepals and petals deep rose, with a deep crimson-purple lip.

15. **Percivaliàna,** O'Brien (*C. labiàta* var. *Percivaliàna*, Reichb. f.). Pseudobulbs up to 1 ft. tall, clavate, strongly furrowed when old, 1-lvd.: lvs. oblong: peduncle bearing 2 or 3 fls. 4–5 in. across; sepals and petals commonly rose-lilac, tinted purple-amethyst, the sepals linear-lanceolate, the petals longer than the sepals, crisped; lip rather small, shorter than the petals, the tube of the same color as petals, tinged with yellow, the front lobe purple-crimson, shaded with maroon, the undulate border lilac, the throat yellow to orange, streaked with purple. Venezuela. C.O.7. F.R. 1:297. J.H. III. 32:179. Var. **grandiflòra,** Hort. Fls. larger, the sepals and petals bright rose, the petals strongly crisped above, the lip with the tube yellow-orange variegated with rose, the front lobe maroon-purple with a bright rose border, the throat orange-yellow. C.O. 7*a*. Var. **summiténsis,** Hort. Sepals and petals a pale delicate pink.

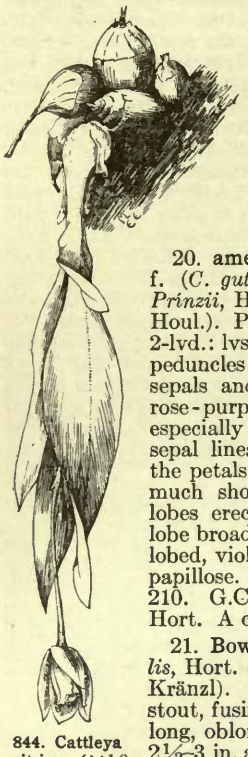
16. **Gaskelliàna,** Reichb. f. (*C. labiàta* var. *pállida*, Williams. *C. labiàta* var. *Gaskelliàna*, Sander.). Pseudobulbs 8–12 in. tall, oblong-fusiform, compressed, furrowed, 1-lvd.: lvs. 8–12 in. long, oblong: peduncle bearing 2 or 3 lfts. 6–7 in. across; sepals and petals of equal length, commonly purple-violet, suffused with white, the color sometimes deeper and more uniform, rarely marked with a median band of white, the sepals lanceolate, the petals oval, undulate; lip as long as the petals, the tube of same color as petals, the front lobe emarginate, undulate, purple-violet, with a pale border, the throat yellow streaked with darker yellow, bordered on each side with a zone of yellowish white. Brazil and Venezuela. I.H. 33:613. A.F. 6:185; 30:662. Var. **álba,** Williams. Sepals and petals pure white, the lip cream-white, the throat a pale yellow streaked with darker yellow. C.O. 20*a*. Var. **cærùlea,** Hort. Fls. pure white with bluish spot on base of lip. Var. **Hôdgkinsonii,** Hort. Sepals and petals white; front of lip crimson.

17. **Wârneri,** Moore (*C. trilabiàta*, Rodr. *C. labiàta* var. *Wárneri*, Veitch). Pseudobulbs 4–8 in. tall, cylindric or fusiform, furrowed, 1-lvd.: lvs. oblong, 6–7 in. long: peduncle with 3–5 fls. 6–8 in. across; sepals and petals rosy mauve, the sepals lanceolate, the petals oval; lip shorter than lateral sepals, the tube the color of the petals, the front lobe strongly crisped, emarginate, bright purple-violet, the throat yellow-orange, streaked with white or pale lilac. Brazil. C.O. 12. A.F. 6:563.—Very like *C. labiata*, but flowering in late spring and early summer. Var. **álba,** Hort. Fls. white, except the pale yellow throat, streaked with orange-yellow. C.O. 12*a*.

18. **lutèola,** Lindl. (*C. Hólfordii*, Hort. *C. flávida*, Klotzsch. *C. Mèyeri*, Regel. *C. modésta*, Mey.). Dwarf: pseudobulbs 2–3 in. long, ovoid, 1-lvd.: lvs. 3–4 in. long, elliptic-oblong: peduncles bearing 2–5 fls. about 2 in. across; sepals and petals similar, yellow, oblong-lanceolate; lip nearly orbicular when spread

out, yellow, the middle lobe crisped, whitish on margin, the side lobes sometimes streaked purple inside. Brazil. B.M. 5032. F.S. 23:2479.

19. **citrìna,** Lindl. (*C. Karwínskii,* Mart.). Fig. 844. Pseudobulbs 2–3 in. long, ovoid, 2–3-lvd.: lvs. 4–7 in. long, ligulate, acute, glaucous: peduncle pendent, bearing usually a single fragrant fl., rarely 2 or 3 fls., yellow except the white border of front lobe of lip; sepals oblong, acute, the petals cuneiform-oblong; lip longer than the petals. Mex. B.M. 3742. J.H. III. 30:399. Gn. 33, p. 535. C.O. 6. F.S. 16:1689. Gt. 27:931. R.1:20. Var. **gigantèa,** Hort. Fls. large and intensely colored.



844. Cattleya citrina. (×¼)

20. **amethystoglóssa,** Lind. & Reichb. f. (*C. guttàta* var. *Prinzii,* Reichb. *C. Prinzii,* Hort. *C. guttàta* var. *Keteleèrii,* Houl.). Pseudobulbs 1½–3 ft., cylindric, 2-lvd.: lvs. 6–12 in. long, elliptic-oblong: peduncles 5–8-fld.; fls. 3½–4½ in. across; sepals and petals white, suffused with rose-purple, spotted amethyst-purple, especially on the upper half, the dorsal sepal linear-oblong, the lateral falcate, the petals obovate, rounded at apex; lip much shorter than petals, the lateral lobes erect, purple at apex, the middle lobe broader than long, emarginate or 2-lobed, violet-purple, the radiating ridges papillose. Brazil. B.M. 5683. R.H. 1869: 210. G.C. III. 38:105. Var. **Sánderæ,** Hort. A creamy white form.

21. **Bowringiàna** Veitch (*C. autumnàlis,* Hort. *C. Skinneri* var. *Bowringiàna,* Kränzl). Pseudobulbs 10–20 in. tall, stout, fusiform above, 2-lvd.: lvs. 6–8 in. long, oblong: peduncle bearing 5–12 fls. 2½–3 in. across; sepals, petals, and tube of the lip rose-purple, the sepals acute, oblong, somewhat undulate, the petals oval-oblong, obtuse, undulate; lip shorter than the lateral sepals, the front lobe emarginate, the throat with a large white spot, surrounded by a zone of bright maroon and bordered with deep purple. Honduras. R.B. 21:37. R.H. 1890:300. G.C. III. 39:114. A.F. 19:651; 34:804. C.O. 24. O.R. 12:361; 16:337. Var. **triúmphans,** Hort. Fls. rich purple.

22. **Skínneri,** Lindl. (*Epidéndrum Hügeliànum,* Reichb.). Flower of St. Sebastian. Pseudobulbs 5–10 in. tall, 2-lvd.: lvs. 6–8 in. long, oblong-oval: peduncle bearing 5–10 fls. 3½–5 in. across, rose-purple except the white throat of the lip, the sepals elliptic-lanceolate, acutish, the petals oval-oblong, broader than the sepals; lip with the front lobe acute. Guatemala to Costa Rica. B.M. 4270. P.M. 11:193. R.B. 22:201. G.C. III. 20:6. G.F. 3:201. C.O. 30. Var. **álba,** Hort. Fls. white.

23. **Victòria-regìna,** O'Brien. Pseudobulbs 1–1½ ft. tall, somewhat compressed and clavate, 1–2-lvd.: lvs. 3–6 in. long, oblong or elliptic-oblong: peduncle bearing 2–5 fls., rarely more, 5–6 in. across; sepals purple a little tinged with yellow, striated with darker purple, oblong-lanceolate, obtuse, the petals purple tinged with violet, obliquely striated with darker purple, elliptic-oblong, obtuse, undulate; lip distinctly 3-lobed, the lateral lobes exteriorly white or flushed with rose, violet-purple at the obtuse apex and inside, the front lobe reniform, bright rose-violet, crisped, the disk yellow streaked purple. Pernambuco. G.C. III. 11:808. O.R. 3:17; 8:361. R. 2:85. C.O. 3.—Said to grow wild in company with *C. labiata* and *C. Leopoldii* var. *pernambucensis,* and considered by some a natural hybrid between the two. The variability of 1 or 2 lvs. on a pseudobulb points in this direction.

24. **intermèdia,** Graham (*C. amethýstina,* Morr. *C. ovàta,* Lindl. *C. marítima,* Lindl. *C. Lóddigesii* var. *amethýstina,* Lem. *C. Aquínii,* Rodr.). Pseudobulbs up to 1½ ft. tall, cylindric, somewhat furrowed, 2-lvd.: lvs. 5–6 in. long, oblong: peduncle bearing 3–5 fls. 4–5 in. across; sepals and petals equal, pale rose or white, acute, oblong, the lateral deflected, the petals somewhat falcate; lip a little shorter than the lateral sepals, distinctly 3-lobed, the tube the same color as the petals, the lateral lobes rounded, the front lobe bright rose-purple, orbicular, strongly crisped. S. Brazil. B.M. 2851. O.R. 8:73; 15:156. P.M. 1:151. J.F. 4:379. C.O. 8. B.R. 1919. V.O. 2:39. Var. **Parthènia,** Reichb. f. Fls. pure white. C.O. 8*a*. Var. **punctatíssima,** Sander. Sepals and petals spotted and dotted with deep rose. C.O. 8*b*.

25. **violàcea,** Rolfe (*C. supérba,* Schomb. *C. Schombúrgkii,* Lindl. *C. odoratíssima,* P. N. Don). Pseudobulbs 8–12 in. tall, clavate, somewhat compressed, 2-lvd.: lvs. 3–5 in. long, oval or oval-oblong: peduncle bearing 3–5 fragrant fls. 4–5 in. across; sepals and petals bright rose-purple, the sepals oblong-lanceolate, acute, the petals oblong-rhomboid, acutish, undulate, broader than sepals; lip fleshy, distinctly 3-lobed, deep purple-violet except the yellow disk streaked with purple, the lateral lobes triangular, acutish, the front lobe nearly orbicular, crisped. N. S. Amer. B.M. 4083. P.M. 9:265. J.H. III. 31:321. A.F. 11:1351. C.O. 28. Var. **spléndens,** Hort., has paler fls.

26. **Lóddigesii,** Lindl. (*C. Arembérgii,* Scheidw. *C. intermèdia* var. *variegàta,* Hook.). Pseudobulbs 8–12 in. tall, cylindric, 2-lvd.: lvs. 4–5 in. long, oblong-elliptic: peduncle bearing 2–5 fls. 3–4½ in. across; sepals and petals rose-lilac, oblong-elliptic, the lateral sepals somewhat falcate, the petals a little broader than the sepals, undulate; lip shorter than the lateral sepals, distinctly 3-lobed, the tube externally colored like petals, internally whitish, the lateral lobes rounded, undulate, the front lobe nearly orbicular, pale amethyst, strongly crisped, the disk whitish passing into yellow at the base. Brazil. C.O. 18. O.R. 15:145.—There is a white form. Var. **álba,** Hort. Var. **delicàta,** Hort. Fls. bluish white. Var. **ínnocéns,** Hort. Fls. milky white. Var. **spléndens,** Hort. Fls. with bright purplish rose sepals; lip white inside, pale lilac outside; disk and side lobes pale yellow.

27. **Harrisoniàna,** Batem. (*C. Hárrisoniæ,* Paxt. *C. Papeiansiàna,* Morr. *C. Hárrisonii,* Beer. *C. Lóddigesii* var. *Hárrisoniæ,* Veitch. *C. Lóddigesii* var. *Harrisoniàna,* Rolfe). Pseudobulbs 8–16 in. tall, cylindric, 2-lvd.: lvs. 4–6 in. long, oblong-lanceolate: peduncle bearing 2–5 fls. 4–4½ in. across; sepals and petals similar, oblong, bright rose-lilac, the lateral sepals falcate, the petals undulate, a little broader than sepals; lip shorter than lateral sepals, 3-lobed, the tube the same color as the petals, the front lobe crisped, rose-purple, the disk yellow-orange. Brazil. P.M. 4:247. C.O. 17. Gn. 48:380. Var. **àlba,** Beer. Fls. white, or sometimes faintly tinged with rose or yellow. C.O. 17*a*. Var. **cándida,** Hort. Fls. white except yellow disk of lip. Var. **gigantèa,** Hort. A large form. Var. **maculáta,** Hort. Fls. purple-dotted. Var. **superbíssima,** Hort. Fls. large, the sepals and petals dark rose, the lip creamy white. Var. **violàcea,** Hort. Fls. deeper colored.

28. **Lèopoldii,** Versch. (*C. guttàta* var. *Lèopoldii,* Lind. & Reichb. f.). Pseudobulbs 15–30 in. tall, fusiform, 2–3-lvd.: lvs. 6–8 in. long, oblong-elliptic: peduncle bearing 10–25 fls. 3–4 in. across; sepals and petals brown, oblong-cuneate, purple-spotted, the lateral sepals somewhat falcate, the petals undulate and a little broader than the sepals; lip strongly 3-lobed, the

lateral lobes acute, the front lobe broadly cuncate-obcordate, undulate, bright amethyst-purple, the tube paler, the disk covered with small tubercles and elevated papillate lines. S. Brazil. C.O. 15. F.S. 14:1471–2.

29. **granulòsa,** Lindl. Pseudobulbs 1–2 ft. tall, rather stout, cylindric, 2–lvd.: lvs. 5–6 in. long, lanceolate-oblong: peduncle bearing 5–9 fls. 3–4 in. across; sepals and petals obtuse, olive-green, red-spotted, the lateral sepals strongly falcate and deflected, the petals obovate-oblong, a little wider than sepals, undulate; lip deeply 3-lobed, the tube white externally, internally yellowish or rose, the lateral lobes acute, the terminal lobe white, crimson-papillate, undulate, round-reniform, emarginate, the long claw yellow, marked with crimson. Guatemala. B.R. 28:1. Gn.M. 9:30. C.O. 14. Var. **Du Buysoniàna,** Hort. (*C. Dubuysoniàna,* Hort.). Sepals and petals yellow, often spotted with rose. Var. **Russelliàna,** Lindl. Lvs. broader: fls. larger with broader sepals and petals, the lateral lobes of lip orange-yellow internally, the front lobe spotted with small crimson-purple papillæ. Brazil. B.R. 31:59. B.M. 5048. Var. **Schofieldiàna,** Veitch. (*C. Schofieldiàna,* Reichb. f.). Sepals and petals yellow-brown, densely spotted with crimson-purple, the lateral lobes of lip cream-white externally, yellow, purple-marked internally, the front lobe with numerous purple-magenta papillæ, and a broad white border. Brazil. C.O. 14*a*.

30. **guttàta,** Lindl. (*C. elàtior,* Lindl.). Pseudobulbs 18–30 in. tall, cylindric, 2-lvd.: lvs. 5–9 in. long, oblong-elliptic: peduncle bearing 5–10 fls. 3–4 in. across; sepals and petals yellowish green, spotted deep purple, the sepals obtuse, the lateral somewhat falcate, the petals undulate, broader than sepals; lip 3-lobed, the lateral lobes white externally, acute, the front lobe amethyst-purple, obcordate, papillate. S. Brazil. B.R. 1406.

31. **Schilleriàna,** Reichb. f. (*C. Regnéllii,* Warner. *C. Aclándiæ* var. *Schilleriàna,* Jenn.). Pseudobulbs 5–6 in. tall, clavate, furrowed, 2-lvd.: lvs. 2½–6 in. long, oblong-elliptic: peduncle bearing 1–3 fls. 4–5 in. across; sepals and petals olive-green tinted with brown and spotted with black-purple, oblong-ligulate, undulate, especially in the petals; lip a little shorter than the lateral sepals, deeply 3-lobed, the lateral lobes whitish outside, pale yellow marked with purple inside, the front lobe reniform, sessile, crimson, lined and margined with white, undulate, the disk yellow with 5 sunken lines. Brazil. B.M. 5150. F.S. 22:2286. A.F. 6:563. C.O. 16.

32. **Fórbesii,** Lindl. (*C. vestàlis,* Hoffm.). Pseudobulbs 8–12 in. tall, cylindric, 2-lvd.: lvs. 4–5 in. long, oblong: peduncle bearing 2–5 fls. 3–4 in. across; sepals and petals a pale yellowish green, obtuse, undulate, sepals oblong-ligulate, the petals oblong-lanceolate; lip distinctly 3-lobed, the tube pale yellow outside, inside a bright yellow streaked with red, the terminal lobe small, sessile, orbicular, undulate, pale yellow, with a bright yellow center marked with purple. S. Brazil. B.M. 3265. C.O. 11. B.R. 953.

33. **Walkeriàna,** Gardner (*C. bulbòsa,* Lindl. *C. Gardneriàna,* Reichb. f. *C. prìnceps,* Rodr.). Pseudobulbs 2–5 in. tall, oval-fusiform, furrowed, 1-lvd.: lvs. 2–5 in. long, oblong-elliptic: fls. 1–3, very fragrant, 3–5 in. across, on a scaly st. arising from the base of the pseudobulb; sepals and petals pale rose-lilac or a deep purple-rose, the sepals oblong-lanceolate, acute, the petals about twice as wide, oval-rhomboid, undulate; lip a little shorter than sepals, fleshy, 3-lobed, the lateral lobes rose, separated, exposing the column, the front lobe nearly orbicular, emarginate, crisped, violet-purple, the disk yellow, streaked with bright purple. Brazil. B.R. 33:42.

34. **nobílior,** Reichb. f. (*C. Walkeriàna* var. *nobílior,* Veitch). Pseudobulbs 3–5 in. tall, ovate-fusiform or nearly clavate, furrowed, 2-lvd.: lvs. 2–4 in. long, elliptic-ovate: fls. 1 or 2, on a scaly st. arising from the base of the pseudobulb, very fragrant, 3–4½ in. across; sepals and petals purple-lilac, acute, the sepals oblong, the petals ovate-rhomboid, about twice the width of the sepals; lip fleshy, about as long as lateral sepals, deeply 3-lobed, the tube the same color as the petals, the front lobe broadly reniform, emarginate, scarcely undulate, the disk yellow, many-costate. Brazil. G.C. II. 19:729. I.H. 30:485.

The following are some of the many hybrid forms: *C. Ádula*=C. bicolor×C. Hardyana; *C. Albertii*=*C.* intermedia×C. violacea; *C. atalánta*=C. Leopoldii×C. Warscewiczii gigas; *C. Ballantiàna*=C. Trianæ×C. Warscewiczii; *C. blesénsis*=Lælio-cattleya; C. *Brabántiæ*=C. Aclandiæ×C. Loddigesii; *C. Brymeriàna*=supposed natural hybrid between C. violacea×C. Eldorado (C. O. 1); *C. Cassándra*=Laelio-cattleya; *C. Chamberlainiàna*=C. Leopoldii×C. Dowiana; *C. Dietrichiàna*=C. Schilleriana×C. Trianæ; *C. Dormanoàna*=Lælio-cattleya; *C. Dùchesnei*=C. bicolor×C. Harrisoniana (R.B. 30:3); *C. Düsseldorffii* var. *Undine*=C. intermedia×C. Mossiæ alba (O.R. 18:369); *C. exoniénsis*=Lælio-cattleya; *C. fàusta*=Lælio-cattleya; *C. Fówleri*=C. Leopoldii×C. Hardyana (C. O. 5); *C. germánia*=C. granulosa×C. Hardyana; *C. Hardyàna*=C. Dowiana×C. Warscewiczii (C.O. 2). O. R. 4:241; 5:363; 8:248; 11:336, 337); *C. Hárrisii*=C. Leopoldii × C. Mendelii; *C. Heldsiæ*=C. Forbesii×C. Mossiæ; *C. hýbrida pícta*=C. guttata×C. Loddigesii; *C. interglòssa*=C. amethystoglossa×C. intermedia; *C. Krameriàna*=C. Forbesii×C. intermedia; *C. Louryàna*=C. Forbesii ×C. intermedia; *C. Mánglesii*=C. Loddigesii×C. Luddemanniana; *C. Mántinii*=C. Bowringiana×C. Dowiana (C.O. 7. O.R. 10:337); *C. Márdellii*=Lælio-cattleya; *C. Márstersoniæ*=C. labiata×C. Loddigesii; *C. Medsuresiæ*=C. Luddemanniana×C. velutina; *C. Mínùcia*=C. Loddigesii×C. Warscewiczii gigas; *C. móllis*=C. Gaskelliana×C. violacea; *C. O'Brieniàna*=considered by some a natural hybrid between C. Loddigesii×C. dolosa (C.O. 8); *C. Pittiæ*=C. Dowiana×C. Harrisoniana; *C. Pittiàna*=C. Dowiana×C. granulosa (C.O. 28); *C. Pórtia*=C. Bowringiana×C. labiata; *C. Thayeriàna*=C. intermedia×C. Schroederæ (O.R. 12:49); *C. weedoniénsis*=C. granulosa×C. Mendelii; *C. Whitei*=C. Schilleriana×C. Warneri (B.M. 7727); *C. Zenobia*=Lælio-cattleya.

C. Abeliàna, Hort. Fls. creamy yellow, speckled with purple on the lip. Peru.—*C. Forgetiàna,* Rolfe. Somewhat resembling C. Lawrenceana. Scape bearing 2 fls.; sepals and petals rose-purple. Brazil.—*C. Gròssii,* Hort., var. *pállida.* A nearly white form; sepals slightly tinged with green; lip pale rose.—*C. Hardyàna,* Hort., var. *aùrea.* Lip deep yellow.—*C. Jénmanii,* Rolfe. Allied to C. Gaskelliana, but lvs. broader and fls. smaller. British Guiana.—*C. marginàta,* Paxt.=Lælia pumila.—*C. velùtina,* Reichb. Sts. slender, the fragrant fls. with the sepals and petals orange, spotted purple, the lip orange and white, veined violet. Brazil. G.C. III. 24:333. C.O. 29*a*.

GEORGE V. NASH.

CAULIFLOWER (*Brássica oleràcea,* Linn., var. *botrỳtis,* DC.). A form of the common cabbage species, producing an edible head of malformed and condensed flowers and flower-stems (the word cauliflower means stem-flower); it will hybridize with the cabbage and form some very interesting freaks. See *Forcing.*

A perfect "curd" or head of cauliflower is one in which the parts are so adjusted to one another that it looks almost homogeneous. This condition is most often found in the young or partly developed heads. As soon as segmentation begins to take place, the curd has reached full development and maturity from the market-gardeners' standpoint. The breaking-up of the curd is an indication of the formation of floral parts. The value of the curd depends upon its symmetry and form; and the length of time that it will hold without beginning to break up into distinct parts.

Not all plants produce perfect curds. Growers recognize a peculiar form which is known as the "ricy" curd illustrated at *a* in Fig. 845. Another form, which is equally undesirable is a segmented curd between the segments of which leaves appear, known as a "leafy" curd shown at *b*. A head in perfect condition is shown at *c*. Segments are apparent in *c*, but the development of the curd is almost ideal and the head as a whole is very nearly perfect. It is the aim of the seed-grower as well as of the gardener to produce plants which will return curds of the type shown at *c*.

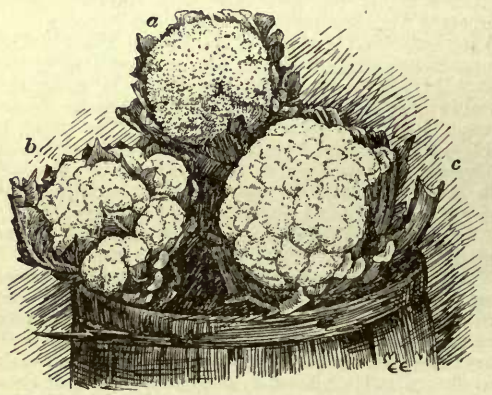
Cauliflower is the most fastidious and exacting member of the cabbage family. It is less tolerant of adverse soil and climatic conditions than any of its near relatives. This accounts, in a great measure, for its limited cultivation and the fact that it is grown only in certain localities. When well grown, however, it is one of the most profitable market-garden crops. Because of its

intolerance to heat, it is grown in the open so as to take advantage of the cool seasons of early spring and autumn. It is one of those crops, therefore, which is less adaptable than those having a greater range of heat-endurance. If the season happens to be favorable the amateur may have good luck, but if the season proves severe the most expert grower may fail.

A rich loamy soil, thoroughly charged with available plant-food is suited to this plant. Light thin sandy soils or those extremely heavy and retentive are, as a rule, not well suited for this crop. The soil should be one which does not dry out quickly but which will furnish the plants a constant supply of moisture. High-grade cauliflower is quite as dependent upon careful handling of the plants and a constantly available supply of moisture as high-grade celery. Among the fertilizers, none is better than well-decomposed manure from the horse-stable, thoroughly incorporated with the soil at the time of preparing it for the crop.

If commercial fertilizers are necessary, quick-acting ones are most desirable, except it is thought that sulfate of potash is preferable to muriate. The nitrogen-content of the fertilizer, however, should be in the form of nitrate of soda or sulfate of ammonia rather than in a slow-acting form. If a fertilizer is to be used, a portion of it should be scattered over the field before the plants are set. An application of 500 pounds to the acre at this time, applied broadcast, and a side dressing about the time "buttons" begin to form, will prove an advantage. The side dressing may be at the rate of 500 pounds, making a total application of 1,000 pounds to the acre. A good fertilizer is one carrying 3 to 4 per cent of nitrogen, 6 to 8 per cent of phosphoric acid and about 10 per cent of potash.

Cauliflower plants in northern latitudes are handled so as to prepare them either for an early or a late crop. The early crop should be started at the same time as early cabbage, or a few days later. Cauliflower plants cannot, however, be started in the autumn and successfully wintered in coldframes, as can early cabbage plants. Plants so handled are less likely to give a desirable product. The best early-crop plants are produced from hotbed or greenhouse propagated stock started in a mild temperature and grown so as to produce a sturdy broad-leaved plant to be set in the field a few



845. Types of cauliflower heads: *a*, ricy; *b*, leafy; *c*, perfect.

days later than the early crop of cabbage. Young cauliflower plants are less hardy than young cabbage plants and, for this reason, planting in the open must be somewhat delayed.

For the late cauliflower crop in the North, seed-beds are prepared on the shady side of a building or in a partially shaded situation and handled in same manner as seed-beds for late cabbage, the late crop in the Long Island region being placed in the open the last days of June or early in July.

The early crop is usually grown on a smaller scale than the autumn crop. Plants grown in the hotbed are usually transplanted and the transplanted plants carried and set in the field by hand. The distance between the rows should be sufficient to permit of cultivation with horse-power implements, but the plants need not be set more than 18 inches apart in the row.

The late crop, however, is frequently transplanted during the drier parts of the season and, largely on this account, growers prefer to use a transplanting machine so as to water the plants at the same time they are set. A convenient distance between the rows is 3 feet, with the plants 20 to 24 inches apart in the row, depending upon the variety grown.

The old adage that "cabbage should be hoed every day" applies with equal force to cauliflower. Cultivation should be of such character as to prevent the formation of a crust and to discourage the development of weeds. The maintenance of a soil-mulch by shallow cultivation which shall not disturb or severely prune the roots of the plants is desirable.

Cauliflower is subject to the same enemies and diseases as cabbage. Clubroot and mildew are two of the most annoying diseases. The aphis, root-maggot and both the green cabbage-worm and the cabbage-looper are annoying pests. The delicacy of the curd requires that the plants be kept perfectly free from insects which devour any portion of the plant.

Cauliflower requires more careful field attention than that required by any other garden crop except those that are blanched either by tying or banking. The young curd of the cauliflower, as soon as it has reached the size of a hen's egg, should be carefully protected from the elements by adjusting the leaves in such a manner as to prevent discoloration by the action of sun or rain. The expert growers accomplish this and at the same time indicate the stage of maturity of the plants by different methods of folding the leaves together over the curd or by tying them with different tying materials, a different method being used each time the field is gone over. To illustrate: the earliest developed curds may be protected by tying the leaves together with rye straw, the next later size may be indicated by folding the leaves together over the plant, while the third may be indicated by tying the leaves with raffia. Usually three operations will be sufficient to care for the entire season's crop. As soon as the curds have reached the desired market size, which varies greatly with different producers and somewhat also with different varieties and is to a degree dependent upon the season and fertility of the land, the plants are harvested by cutting the heads with at least two or three whorls of leaves attached.

After the heads have been cut and a sufficient number assembled in one place to justify packing, they are trimmed by using a large knife to sever the leaves just above the edge of the curd so as to form a border or "ruche" of leafstalks with a part of the blade attached about the curd. This border of stiff green leafstalks about the white curd gives it a very attractive appearance.

After the curds have been properly trimmed, which varies somewhat with different operators, they are protected by the use of tea paper, either white or brown, placed over the head in such a manner as to protect it from dirt and contact with its neighbors. The curds are then packed in crates or barrels, the California and Florida product being largely packed in crates holding one dozen heads in a single layer. If the heads are to be packed in barrels, a layer of excelsior is first placed in the barrel and the wrapped heads, curd down, are carefully placed so as to form a layer resting upon the excelsior over the bottom of the barrel. The next row of curds is placed stem end down and curds up; on top is placed another cushion of excelsior and the operation repeated until the barrel is filled in such a manner as to

leave the last row with the stem end upward, over which a cushion of excelsior and a burlap cover are placed. Ventilated barrels are ordinarily used for this purpose, but for long-distance shipment the smaller crates holding a single layer of heads have proved most advantageous.

During late years, the marketing of this crop has been very greatly facilitated and the returns to the growers considerably enhanced by a coöperative method of sale which has taken into consideration a more extended distribution of the crop than formerly. In this the Long Island Cauliflower-Growers' Association and the California Vegetable-Growers' Union have both been very helpful.

One of the handicaps in the cultivation of cauliflower has been the entire dependence of the American growers on foreign seed, little or no cauliflower seed having been produced in this country and that in the open only in the Puget Sound region. The seed has been expensive and not always to be depended upon. The greatest care should be given to securing a perfectly reliable stock of seed.

Broccoli.

Broccoli, which is a long-season cauliflower, is in all respects like cauliflower except that its vegetative parts are somewhat coarser, the heads somewhat smaller, and it does not form an edible curd early in its life as does cauliflower.

Broccoli is cultivated only in climates having a mild winter, when it can be planted the summer before and carried through the winter to form heads early the following spring. It is a popular plant in all parts of France and particularly in England. It is undoubtedly the parent type of the cauliflower, the cultivated varieties of cauliflower being short-season forms.

For best results, the seed should be sown at the same time as that of autumn cabbage and the plants transplanted to the field about the same time, so that they will make their vegetative growth during the late summer and autumn. Where winters are mild, the plants can be left in the open, but in more rigorous climates at the approach of cold weather, a small number of plants can be lifted with earth adhering to the roots, stored in a suitable root-cellar, and the following spring transferred to the open to form heads.

L. C. Corbett.

CAULOPHÝLLUM (Greek, *stem-leaf*). *Berberidàceæ*. Blue Cohosh. Two species of perennial herbs (sometimes combined with Leontice), one in E. Amer. and the other in Asia, the former sometimes removed from the woods to cult. grounds. Rhizomatous: sts. erect, very smooth: lf. 1, large, triternately compound and sessile: fls. small, yellow-green, panicled; sepals 6, subtended by 3 or 4 bracts; petals 6, much smaller than the sepals and appearing like glands or scales; stamens 6; ovary soon bursting, freeing the 2 ovules which develop into depressed-globular berry-like seeds (without pericarp). **C. thalictroìdes**, Michx., Fig. 846, is the American species, a smooth or glaucous plant of rich woods from Canada south, 2–2½ ft. high. The plant is always attractive because of its trim growth and interesting habit; in Sept. and later, when the foliage is dead, the drupe-like seeds stand erect on the dry stalks and afford one of the richest and best of deep blues.

L. H. B.

CAUTLÈA (Sir P. Cautley, 1802–1871, British naturalist). *Zingiberàceæ*. About a half-dozen Himalayan species closely allied to Roscoea, differing in the spherical rather than narrow fr., and the spicate infl. Probably not in cult. in this country. *C. lùtea*, Royle (*Roscòea lùtea*, Royle. *R. grácilis*, Smith). Erect or leafy perennial herb, 1½ ft. or less: lvs. narrow-lanceolate, slender-tipped, reddish underneath: fls. 2 in. or less long; corolla yellow; calyx reddish purple, the linear segms. prominent, the lateral ones spreading or reflexed and the dorsal one erect and with an incurved erect staminode under it.—Treatment of Alpinia and Roscoea.

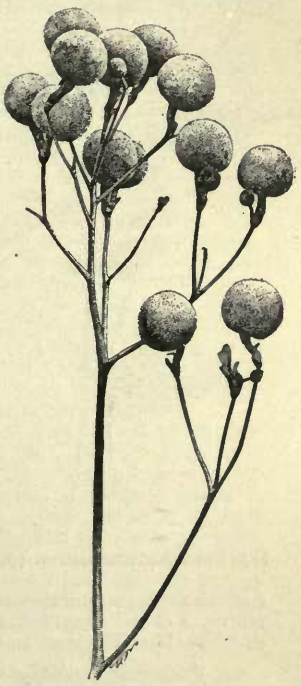
CAVAN: *Acacia Cavenia.*

CAYENNE PEPPER: *Capsicum.*

CAYRÁTIA JAPÓNICA: *Cissus japonica.*

CEANÒTHUS (ancient Greek name). *Rhamnàceæ*. Ornamental woody plants grown for their profusely produced white, blue or pink flower-clusters.

Deciduous or evergreen shrubs or trees: lvs. alternate or sometimes opposite, short-petioled, serrate or entire, usually 3-nerved, with small stipules: fls. perfect, small, 5-merous, in small umbels forming panicles or racemes; sepals often incurved, colored; petals clawed, spreading or recurved; filaments slender; disk annular; ovary partly adnate to the calyx-tube, 3-celled; style 3-cleft: fr. a 3-celled drupe, dry at length and separating into 3 one-seeded dehiscent nutlets.—Nearly 50 species in N. Amer., chiefly in the Pacific coast region.



846. Seed-berries of blue cohosh, Caulophyllum thalictroides. (×½)

These are free-flowering shrubs, some especially valuable for their late flowering period. Many of them are hardy only in the warmer temperate regions, but *C. americanus*, *C. ovatus*, and *C. Fendleri* are hardy North, while the numerous hybrids of *C. americanus* are only half hardy, and even if protected they are killed to the ground in the North, but the young shoots will usually flower the same season. The safest way, however, to have good free-flowering plants of these beautiful hybrids will be, in the North, to dig them up in fall, store them away in a frost-proof pit or cellar, and plant them out again in spring. Pruning of the late-flowering species will be of advantage; about one-half of last year's growth may be taken away. They grow in almost any soil, but best in a light and well-drained one, and most of the Californian species prefer a sunny position. Propagated by seeds sown in spring and by cuttings of mature wood in autumn, inserted in a cold-frame or greenhouse; softwood cuttings also grow readily if taken in early spring from forced plants. Sometimes increased by layers, and the varieties and hybrids by grafting on roots of *C. americanus* under glass in early spring; the cions must be fresh and with leaves, taken from plants kept in the greenhouse during the winter.

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A. *Lvs. alternate.* (*Nos. 1–13.*)

B. *Margin of lvs. serrate or crenate.*

C. *Foliage glabrous beneath or slightly pubescent.*

D. *Fls. white: lvs. thin, deciduous.*

E. *Peduncles slender, at the end of the new growth.*

1. **americànus,** Linn. Fig. 847. Low, erect shrub, to 3 ft.: lvs. ovate, usually acute, finely and irregularly serrate, bright green and dull above, paler and pubescent or nearly glabrous beneath, 1½–3 in. long: fls. in terminal and axillary panicles on slender peduncles, forming large, corymbose panicles. July–Sept. From Canada to S. C. and Texas. B.M. 1479. Gt. 61, p. 92. Gn. 56, p. 137.—Common in dry woods and making a profusion of bloom, which, however, is short-lived. Many hybrids have been raised from this species in Eu. (see *C. hybridus*). Var. **intermèdius,** Trel. (*C. intermèdius,* Pursh), has smaller, ovate or ovate-lanceolate lvs. and the fls. in small, very slender-peduncled, short racemes or panicles. Tenn. to S. C.



847. Ceanothus americanus. (×⅓)

2. **ovàtus,** Desf. (*C. ovàlis,* Bigel.). Low shrub: lvs. elliptic to elliptic-lanceolate, obtuse or acute, crenulate-serrate, nearly glabrous, glossy above, 1–2 in. long: infl. like the former, but usually smaller. New England to Colo. and Ala.

EE. *Peduncles usually stout, from lateral buds of the old wood.*

3. **sanguíneus,** Pursh (*C. oregànus,* Nutt.). Tall shrub, with purple or reddish glabrous branches: lvs. orbicular to ovate or obovate, obtuse, serrate, nearly glabrous, 1–3 in. long: fls. in rather long, narrow panicles, on stout, leafless peduncles, axillary, from branches of the previous year. May, June. Brit. Col. to Calif. B.M. 5177.

DD. *Fls. blue or pink, rarely white: lvs. usually half-evergreen.*

4. **hýbridus,** Hort. Hybrids of garden origin, chiefly between *C. americanus* and *C. thyrsiflorus,* between *C. ovatus* and *C. thyrsiflorus* and between *C. americanus* and *C. azureus;* the hybrids of the first group may be classed under *C. roseus,* Koehne, of the second under *C. pallidus,* Lindl., and those of the third group under *C. Arnouldii,* Hort. Some of the most distinct are: *álboplènus,* with double white fls.; *atrocærùleus purpùreus,* fl. blue, foliage purple when young; *Árnouldii,* fls. sky-blue, in large panicles; *Gloire de Versailles,* with bright blue, large panicles (M.D.G. 1903:485); *Gloire de Plantières,* fls. dark blue, in large panicles; *Victor Jouin,* fls. deep blue, darker than in the preceding, one of the hardiest hybrids; *Cièl de Provence,* fls. deep blue, profusely produced (R.H. 1903:332); *Marie Simon,* fls. flesh-colored; *ròseus,* fls. pink (R.H. 1875:30); *pállidus,* fls. pale blue, lvs. green and pubescent below (B.R. 26:20).

5. **thyrsiflòrus,** Esch. Shrub or small tree: lvs. oblong, obtuse, crenate-serrate, nearly glabrous, 1–1½ in. long: fls. blue, rarely white, in narrow panicles, about 3 in. long. May–July. Ore. to Calif. B.R. 30:38. S.S. 2:64. G.C. III. 20:363; 37:179; 41:221. Gn. 74, p. 303. G.M. 50:430.—A very fine, free-flowering species of beautiful blue color. Probably natural hybrids of this species are: *C. Veitchiànus,* Hook. (*C. thyrsiflorus* × *C. rigidus*), with deep blue fls. in dense panicled clusters (B.M. 5127; F.S. 13:1383), and *C. Lobbiànus,* Hook. (*C. thyrsiflorus* × *C. dentatus*), with deep blue fls., in oval, peduncled, solitary clusters. B. M. 4810 (4811 by error). F.S. 10:1016.

CC. *Foliage tomentose or densely pubescent beneath: half-evergreen or evergreen (see also C. hybridus).*

D. *Branchlets and the veins beneath nearly glabrous: lvs. very obtuse: fls. white.*

6. **velùtinus,** Douglas. Tall shrub: lvs. persistent, broadly elliptic, mostly subcordate, obtuse, serrate, dark green and glabrous above, canescent beneath, but the veins glabrescent, 2–3 in. long: fls. in large, compound panicles at the ends of the branches. June, July. Brit. Col. to Colo. and Calif. B.M. 5165.

DD. *Branchlets and the veins tomentose or pubescent: lvs. mostly acute: fls. usually blue.*

E. *The lvs. glabrous or puberulous above, whitish or tawny tomentose beneath.*

7. **arbòreus,** Greene (*C. velùtinus* var. *arbòreus,* Sarg.). Small tree, with whitish bark: branchlets at first angled and pubescent, later glabrescent and glossy: lvs. elliptic-ovate, obtusish or acutish, rounded or subcordate at the base, closely serrate, with close white tomentum beneath, 1½–3 in. long: fls. pale blue to white in panicles 2–3 in. long. Spring. Isls. off the Calif. coast. S.S. 2:65.

8. **azùreus,** Desf. (*C. bícolor,* HBK. *C. cærùleus,* Lag.). Tall shrub: branchlets terete, densely tomentose: lvs. oblong-ovate or oblong, acute or obtuse, rounded at base, serrate, with villous tawny tomentum beneath, 1–3 in. long: fls. deep blue, in slender panicles 2–4 in. long. Spring. Mex. L.B.C. 2:110. B.R. 4:291. P.M. 2:74. Gn. 61, p. 223.—Under this name, a hybrid species with *C. americanus* is often cult.

EE. *The lvs. villous or hirsute on both sides, usually green beneath.*

9. **hirsùtus,** Nutt. Shrub or small tree, with villous branches: lvs. broadly elliptic or ovate, rounded or cordate at the base, obtuse or acute, with glandular teeth, ½–2 in. long: fls. deep blue to purplish, in narrow panicles 1–2 in. long. April, May. Calif.—Called "wild lilac" in Calif. Var. **Órcuttii,** Trel. (*C. Órcuttii,* Torr.). Fls. blue, paler: fr. loosely villous.

BB. *Margin of lvs. entire or nearly so (sometimes serrate on vigorous shoots).*

C. *Shrub prostrate: fls. white.*

10. **Féndleri,** Gray. Low, prostrate and spiny shrub: lvs. oval, rounded or nearly acute at both ends, entire, rarely finely serrulate, grayish green, minutely tomentose beneath, ½–1 in. long: fls. white, in short racemes, terminal, on short, lateral branchlets. June, July. From S. D. to New Mex. and Ariz. R.H. 1901, p. 423. M.D.G. 1908:208; 1912:499.—A very graceful and free-flowering shrub of almost creeping habit, well adapted for covering dry, sandy banks; half evergreen and hardy N.

CC. *Shrubs tall, upright.*

D. *Branchlets terete or slightly angled, rarely spiny.*

11. **integérrimus,** Hook. & Arn. Tall, erect shrub, with glabrescent branches: lvs. broadly elliptic or ovate, obtuse, sparingly hairy or glabrous, bright green beneath, 1–3 in. long: fls. blue, sometimes white, fragrant, in 3–6 in. long, narrow panicles. April–June. Wash. to Calif. and S. E. Ariz. B.M. 7640.

12. **divaricàtus,** Nutt. Tall, erect shrub, with usually glaucous branches and often spiny: lvs. ovate, obtuse or nearly acute, glaucous and glabrous or grayish tomentose below, ⅓–1 in. long: fls. pale blue, sometimes whitish, in 2–3 in. long, narrow panicles. April–June. Calif. Gn. 74, p. 425 (habit).

DD. *Branchlets angled, spiny.*

13. **spinòsus,** Nutt. Tall shrub, sometimes arborescent: branchlets glabrous: lvs. elliptic to oblong, thinly coriaceous, rounded or broadly cuneate at the base, very obtuse or emarginate, scarcely 3-nerved, glabrous, ½–1½ in. long: fls. light blue to almost white in large terminal panicles 4–6 in. long. Spring. Cent. and S. Calif., Coast Range and down to sea-level. S.S. 13:621.

AA. *Lvs. opposite, persistent.*

14. **cuneàtus,** Nutt. Tall, much-branched shrub: lvs. spatulate or cuneate-obovate, mostly obtuse, entire, minutely tomentose beneath, ¼–1 in. long: fls. white, in small clusters along the branches. March–May. Ore. to Calif. B.H. 8:170.

15. **prostràtus,** Benth. Procumbent shrub: lvs. cuneate, obovate or spatulate, coarsely and pungently toothed, sometimes only 3-pointed at the apex, often minutely silky when young, ½–1 in. long: fls. blue, in clusters, terminal on short branchlets. Spring. Wash. to Calif.

C. africànus, Linn.=Noltea africana.—*C. dentàtus,* Torr. & Gray. Low shrub: lvs. oblong, penninerved, dentate, glandular-papillate above, loosely hairy: fls. blue, in peduncled clusters. Calif. F.S. 6:567, 2. B.H. 3:101.—*C. dentàtus* var. *floribúndus,* Trel. (C. floribundus, Hook.). Fl.-clusters numerous, nearly sessile: lvs. smaller. B.M. 4806. F.S. 10:977. I.H. 7:238. B.H. 5:129.—*C. foliòsus,* Parry. Low shrub: lvs. small, broadly elliptic, glandular-toothed, slightly hairy, pale or glaucous beneath: fls. deep blue, in numerous small clusters. Calif.—*C lævigàtus,* Douglas. Tall shrub: lvs. broadly elliptic, serrate, glabrous, glaucous beneath: fls. yellowish white, in large panicles. Calif.—*C. microphýllus,* Michx. Low shrub: lvs. very small, obovate or elliptic, nearly glabrous: fls. white, in small, short-peduncled clusters.—*C. papillòsus,* Torr. & Gray. Low shrub: lvs. narrow-oblong, dentate, glandular-papillate above, villous beneath: fls. deep blue, in peduncled, axillary oblong clusters. Calif. B.M. 4815. F.S. 6:567, 1. P.F.G. 1, p. 74 R.H. 1850:321.—*C. Párryi,* Trel. Large shrub: lvs. elliptic or ovate, denticulate, cobwebby beneath: fls. deep blue, in peduncled, narrow panicles. Calif.—*C. rígidus,* Nutt. Rigid, much-branched shrub: lvs. opposite, cuneate-obovate, denticulate, usually glabrous, small: fls. blue, in small, nearly sessile, axillary clusters. Calif. B.M. 4660 (as C. verrucosus) and 4664. J.F. 3:316; 4:348.—*C. verrucòsus,* Nutt. Low shrub: lvs. mostly alternate, roundish obovate, emarginate, denticulate, nearly glabrous, small: fls. white, in small, axillary clusters along the branches. Calif.—*C. verrucòsus,* Hook.= C. rigidus.

ALFRED REHDER.

CEARA RUBBER: *Manihot.*

CÉBATHA: *Cocculus.*

CECRÒPIA (from Greek word referring to use of the wood of some species in making wind instruments). *Moràceæ.* Milky-juiced trees, with peltate leaves, sometimes planted in grounds in tropics and warm countries.

Leaves large, alternate, long-petioled, the blade circular in outline; segms. or lfts. 7–11: dicœcious; fls. very small, sessile in cylindrical heads or receptacles, which are arranged in umbels; calyx tubular and petals 0; sterile fls. with 2 stamens; fertile fls. with free ovary and divided stigma: frs. small 1-seeded nuts combined into short spikes.—Species about 40, from Mex. to Brazil. *C. peltata,* Linn., is the trumpet-tree of the W. Indies and S. It is a middle-sized tree with lvs. 1 ft. across; hollow branches used for the making of wind instruments. The juice of some species yields rubber. The hollow stems are often perforated by ants, which nest and rear their young in them.

palmàta, Willd. Fig. 848. A characteristic tree of the farther W. Indies (and planted somewhat in S. Fla.), with a single long weak thin trunk and at the top a few horizontal or deflexed awkward branches bearing at their ends large palmate lvs. with divisions like thumbs, the trunk and branches partitioned at the nodes: lvs. 7–11-lobed to the middle, white-tomentose beneath, the lobes oblong-obovate and blunt.—The tree attains a height of 50 ft.; wood soft; branches more or less hollow; grows rapidly, like an herb; often covering areas that have recently been burned over.

L. H. B.

CEDAR: *Cedrus, Juniperus.*

CEDAR, WHITE: *Thuya, Chamæcyparis.*

CEDAR, WEST INDIAN: *Cedrela.*

CÉDRELA (from *Cedrus,* the wood resembling that of Cedrus). *Meliàceæ.* Including *Toòna.* Ornamental trees, grown for their handsome foliage; some are valuable timber trees.

Trees with alternate, usually abruptly pinnate lvs., without stipules: lfts. petioled, entire or slightly serrate: fls. inconspicuous, whitish, usually perfect, 4–5-merous, in large, pendulous, terminal panicles; calyx short, 4–5-parted, the petals forming a tube with spreading limb, below partly adnate to the disk; stamens shorter than petals; ovary 5-celled; style simple, with capitate stigma, somewhat longer than the stamens: fr. a caps., dehiscent, with 5 valves not splitting to the base, with many flat, winged seeds.—Nine species in Trop. Amer. and 8, forming the subgenus Toona, in E. India and Austral. Toona is often considered a distinct genus, distinguished from Cedrela by the disk being much longer than the ovary and by the seeds being winged above or at both ends, while in Cedrela the disk is as long or shorter than the ovary and the seeds are winged below. The first 3 species below belong to the subgenus Toona, the others are true cedrelas.

Cedrelas are tall ornamental trees with large pinnate foliage, well adapted for avenues: *C. sinensis* is hardy as far north as Massachusetts; the others are hardy only in southern California and in the Gulf states except *C. odorata,* which is tender even there. The wood of some species, particularly of *C. odorata,* is known as cedar wood, and much valued for making furniture and boxes. They thrive best in rich loam, and are propagated by seeds or by cuttings of mature wood, and, also, by root-cuttings, all with bottom heat.



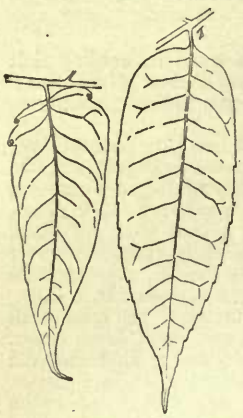
848. Cecropia palmata.

A. *Lfts. 10–25.*

B. *Lvs. quite glabrous.*

C. *Margin of lvs. more or less serrate: panicles very long, pendulous: seeds winged above.*

sinénsis, Juss. (*Toòna sinénsis,* Roem. *Ailánthus flavéscens,* Carr.). Tree to 50 ft.: lvs. long-petioled, 10–20 in. long; lfts. 10–22, oblong or oblong-lanceolate, acuminate, slightly and remotely serrate, light green beneath, 4–8 in. long: fls. white, in very long, pendulous panicles; ovary glabrous; 5 subulate staminodes alternating with the stamens: fr. oblong or obovate, about 1 in. long. June. China. R.H. 1891, p. 574–5; 1875, p. 87. Gng. 4:1. M.D.G. 1902:495. F. 1876, p. 175. F.E. 13, p. 1.—Ornamental tree, with large feathery foliage; very valuable for avenues; similar to ailanthus, and nearly of the same hardiness, but of more regular and dense growth, and without the disagreeable odor when flowering. Ailanthus can be easily distinguished by the few coarse teeth near the base of the lfts., each bearing a large gland beneath (Fig. 849).



849. Leaflets of Cedrela and Ailanthus. Cedrela on the right. (×⅓)

serràta, Royle (*Toòna serràta,* Roem.). Tree, to 70 ft.: lvs. usually odd-pinnate, 15–20 in. long; lfts. 15–25, ovate-lanceolate or ovate-acuminate, irregularly serrate, glaucous beneath: panicles longer than the lvs., pendulous; fls. fragrant, often 6-merous; ovary glabrous. Himalayas, to 8,000 ft. altitude. Royle, Ill. 25. Collett, Flor. Siml. 82.—This is probably the hardiest of the tropical species. Sometimes united with *C. Toona.*

CC. *Margin of lvs. entire: panicles shorter than the lvs.*

Toòna, Roxbg. (*Toòna ciliàta,* Roem.). Tree, to 70 ft., nearly evergreen: lvs. abruptly pinnate; lfts. 10–20, usually opposite, lanceolate or ovate-lanceolate, sometimes undulate, 3–6 in. long: fls. white, honey-scented, 5-merous; ovary hairy; seeds winged at both ends. Himalayas. Wight., Icon. 161. Brandis, Forest Fl. 14.

odoràta, Linn. West Indian Cedar. Tree, to 100 ft.: lvs. 10–20 in. long; lfts. 12–20, ovate-lanceolate, acuminate, entire, bright green on both sides, 4–6 in. long: panicles shorter than the lvs.: fr. oblong, 1½ in. long; seeds winged below. W. Indies.—The cedar wood comes mostly from this species. Wood brown, fragrant, the source of the cigar-box wood of commerce. It is a very durable wood, and is much prized in the W. Indies in the manufacture of cabinets, furniture, canoes, and other articles. In the W. Indies known as "cedar."



850. Cedrus atlantica.

BB. *Lvs. densely pubescent beneath.*

físsilis, Vell. Tree: lvs. 10–15 in. long, abruptly pinnate; lfts. 18–24, opposite, nearly sessile, oblong-lanceolate, acuminate: panicles pubescent, longer than the lvs.; calyx pubescent outside; petals fulvous tomentose; ovary glabrous. Brazil, Paraguay. St. Hilaire, Fl. Brazil. 2:101.—According to Franceschi it does better at Santa Barbara than any other species of this genus.

AA. *Lfts. 6–10, finely ciliate.*

Dugèsii, Wats. Tree: lvs. 10–15 in. long; lfts. cuneate, ovate-lanceolate, long and slender acuminate, nearly entire, shining above, pale green and glabrous or nearly so beneath, 4–6 in. long: panicles rather compact, much shorter than the lvs. Mex. Alfred Rehder.

CEDRONÉLLA (*a little cedar,* from the odor of *C. triphylla,* a species from the Canary Islands sometimes called "Balm of Gilead"). *Labiàtæ.* Herbs or shrubs, sometimes planted in borders in the middle and southern parts of the United States.

Four species allied to Dracocephalum, to which the first 2 belong according to Bentham. Engler and Prantl consider the genus monotypic, containing only the third species below. The 2 native kinds described below are compact, free-flowering border perennials, with aromatic lvs. and numerous showy purplish pink fls. with blue stamens, and borne in dense whorls on long racemes or spikes: calyx a trifle oblique, 5-toothed; corolla-tube exserted, the limb 2-lipped; stamens 4, the anthers 2-celled.—They are not quite hardy N., and should have a sheltered sunny position, or some winter protection. The first 2 prop. by division of the root, the last by cuttings.

càna, Hook. Height 2½–3 ft.: sts. hard, square, subshrubby: branches numerous, especially at the base, opposite, hoary with a minute pubescence: upper lvs. small, ½–1½ in. long, entire, hoary, numerous near the fls., ovate; lower lvs. larger, cordate-ovate, dentate-serrate: spikes numerous; whorls dense, 15- or more-fld.; corolla 1 in. long, limb 5-cleft, the lowest lobe largest, crenate, revolute. June–Oct. Mex. and New Mex. B.M. 4618.

mexicàna, Benth. (*Gardòquia betonicoìdes,* Lindl.). Height 1–3 ft.: root creeping: lvs. 1½–2½ in. long, ovate-lanceolate (the lower ones cordate), crenate-dentate, becoming purplish below, petioled: fls. very like the above, bright pink. Mex., Mts. S. Ariz. B.M. 3860.—Rarer in cult. than above; lvs. larger, longer and fewer. Intro. into cult. in 1839.

triphýlla, Moench (*Dracocéphalum canariénse,* Linn.). Balm of Gilead. Shrubby, 3 to 4 ft.: lfts. 3, oblong or lanceolate: fls. purple or

white, in loose spicate whorls. Aromatic plant from Canary Isls.

C. pállida, Lindl. Similar to C. mexicana, but differing in having shorter, pale red fls. B.R. 1846:29. It is sometimes confused with C. mexicana.

N. Taylor.†

CÉDRUS (*Kedros*, ancient Greek name). *Pinàceæ.* Cedar. Trees grown for their persisting foliage and striking habit; they are also valuable timber trees.

Large evergreen trees, with quadrangular, stiff, fasciculate lvs.: fls. monœcious, the staminate forming cylindrical catkins: cones ovate or ovate-oblong, thick, 3–5 in. long, with broad, closely imbricate, bracts, attaining maturity in 2 or 3 years; seeds winged.—Three closely allied species in N. Afr., Asia Minor and Himalayas.

The cedars are large ornamental conifers, with wide-spreading branches, very distinct in habit from most other conifers. They are usually considered tender, but a hardy race of *Cedrus Libani* has been recently introduced by the Arnold Arboretum from the highest elevation where the species occurs in Asia Minor; the plants have stood all the winters since 1902 unprotected at the Arnold Arboretum and have proved perfectly hardy. It is very gratifying that one is now able to grow so far north the famous cedar of Lebanon which, aside from its beauty, is of peculiar interest for its historic and religious associations. The race of *Cedrus Libani* commonly cultivated is rather tender, more tender than *C. atlantica* which may be grown as far north as New York in sheltered positions, while *C. Deodara* can be grown safely only in California and southern states. The very durable and fragrant wood of all species is highly valued.

The cedars prefer well-drained, loamy soil, and will also grow in sandy clay, if there is no stagnant moisture. Propagated by seeds sown in spring; the varieties by veneer grafting, in late summer or in fall, on seedlings of *C. atlantica;* or, in warmer regions, on *C. Deodara;* they grow also from cuttings, if the small shoots are selected which spring occasionally from the old wood. Plants of this genus are the true cedars; but trees of other genera are often called cedar. See *Chamæcyparis*, *Juniperus*, and *Thuya;* also *Cedrela.*



851. Cedars on Mt. Lebanon, Cedrus Libani.

A. *Branches stiff, not drooping: cones truncate, and often concave at the apex.*

atlántica, Manetti. Fig. 850. Large, pyramidal tree, to 120 ft., with upright leading shoots: lvs. mostly less than 1 in. long, usually thicker than broad, rigid, glaucous green: cones 2–3 in. long, light brown. N. Afr. Gng. 2:163. G. F. 9:417. R.H. 1890, p. 32. G. W. 6, p. 498. Gn. 37, p. 195. Gt. 61, p. 449. Var. **glaùca,** Carr. Foliage glaucous, with silvery hue; a very desirable and vigorous form. Gng. 8: 275. Var. **fastigiàta,** Carr. Of upright columnar habit. R.H. 1890, p. 32.

Líbani, Loud. Fig. 851. Large tree, with wide-spreading, horizontal branches, forming a broad head when older, leading shoot nodding: lvs. 1 in. or longer, broader than thick, dark or bright green, sometimes bluish or silvery: cones 3–4 in. long, brown. Lebanon, Taurus, S. Anatolia and N. Afr. Gng. 5:65. Mn. 1:39. G.F. 8:335; 2:149 (adapted in Fig. 851). Gn. 48, p. 237; 66, pp. 124–5, 178. G.C. III. 34:265. F.S.R. 2, pp. 291–4. Var. **brevifòlia,** Hook. With shorter lvs. and smaller cones. Cyprus. Var. **glaùca,** Carr. (var. *argéntea*, Veitch). Foliage of blue or silvery hue. Var. **nàna,** Loud. Dwarf form.

AA. *Branches and leading shoot pendulous: cones obtuse.*

Deodàra, Loud. Tall tree, of pyramidal habit, to 150 ft.: lvs. 1–2 in. long, dark bluish green, rigid, as thick as broad: cones 3½–5 in. long, reddish brown. Himalayas. Gng. 2:8. G.C. III. 25:139; 34:400. F. 1876, p. 103. Gn. 28, p. 223. V. 20:185. Var. **robústa,** Carr. Lvs. about 2 in. long, rigid. Var. **péndula,** Beissn. (var. *recurvàta péndula*, Hort.). With long pendulous branches

or prostrate if not supported. G.W. 14, p. 413. Var. **fastigiàta,** Carr. Of columnar habit. Var. **verticillàta,** Rehd. (var. *verticillàta glaùca,* Tutenberg). A compact form with the lvs. whorled at the base of the shoots: foliage bluish white: the hardiest form of the species. G.W. 11, p. 89. Var. **víridis,** Knight. Lvs. bright green. Var. **argéntea,** Carr. Foliage of silvery hue. Var. **nívea,** Annesley. Young growth white. G.C. III. 25:399. Var. **álbo-spîca,** Annesley (var. *álbo-spicàta,* Beissn.). Young growth green, becoming later white at the tips. G.W. 11, p. 89. Var. **aùrea,** Beissn. Foliage golden yellow. G.W. 11, p. 87.

ALFRED REHDER.



852. Ceiba Casearia, the great silk-cotton tree at Nassau.

CÈIBA (aboriginal name). *Bombacàceæ.* SILK-COTTON. KAPOK. CEIBA. Trees, one of which is widely known in the tropics for its great size as a shade tree, and for the "cotton" of its seed-pods. Eriodendron is a more recent name.

Leaves digitate, with 5–7 entire lfts.: fls. medium to large, rose or white, on 1-fld. peduncles, solitary or fascicled; calyx cup-shaped, truncate or irregularly 3–5-lobed; petals oblong, pubescent or woolly; staminal tube divided at the apex into 5 or 10 parts, each part bearing a stamen; ovary 5-celled: fr. a coriaceous caps., pubescent within and bearing obovoid seeds embedded in a wool-like or cotton-like fiber.—Allied to Bombax and Adansonia, from which it differs in having 5 parts in the staminal body or column, rather than a much more divided column bearing many stamens on each division. Ten or more species, mostly in Trop. Amer., extending to Asia and Afr.

Caseària, Medic. (*C. pentándra,* Gaertn. *Bómbax pentándrum,* Linn. *B. guineénse,* Schum. & Thoun. *Eriodéndron anfractuòsum,* DC. *E. occidentàle,* Don. *E. orientàle,* Kostel. *Xylon pentándrum,* O. Kunze.). SILK-COTTON TREE. CEIBA. POCHOTE. Figs. 852, 853. Great tree, reaching 100 ft. and more, and having immense horizontal far-spreading branches and wide-flung thin buttresses or flanges: trunk spiny when young; branches verticillate: lfts. 7, arising from a nearly circular plate or disk at the top of the petiole, lanceolate-acuminate, undulate, smooth, each 4–6 in. long: fls. white or rose, the corolla 2–3 in. long; petals oblong-obtuse, hairy outside: caps. 4–8 in. long, 5-valved, bearing many woolly seeds. Tropics of Asia, Afr., and Amer. B.M. 3360.—One of the characteristic and well-known trees of tropical countries. The wings of some of the old trees run far in all directions, sometimes being prominent 30 ft. or more; note the picture (Fig. 852) of the well-known tree at Nassau on the island of New Providence. The wood is used to some extent in interior construction, but is soft, white and brittle. The cotton-like material in the pods is used in beds and pillows and for stuffing life-buoys, but it cannot be spun into threads; it is the "kapok" of commerce. Offered in S. Calif. and Fla., as a tree of rapid growth.

grandiflòra, Rose. Tree, 15–20 ft., 8–12 in. diam., the branches with short prickles: petioles 2–4 in. long; lfts. 3–5, glabrous, oblong, cuneate at base, entire or slightly serrulate, 2–3½ in. long: petals white, silky, 4–5 in. long, strap-shaped; stamens 5, the filaments 3½ in. long and each with 2 anthers: caps. oblong, 4½ in. long. Trop. W. Mex.—The fls. are fleshy; they change to brown. Listed in S. Calif.

L. H. B.

CELÁSTRUS (*Kelastros,* ancient Greek name). *Celastràceæ.* Woody plants grown chiefly for their brightly colored fruit; some also for their handsome foliage.

Shrubs, usually climbing, with alternate, petioled, usually deciduous and serrate glabrous lvs.: fls. polygamous, 5-merous, inconspicuous, greenish white, in axillary or terminal panicles or racemes; calyx 5-parted; petals small, oblong-ovate; disk entire or crenate; stamens short; ovary superior; style short with 3-lobed



853. Leaves and fruits of Ceiba Casearia, the silk-cotton tree. (×¼)

stigma: fr. a caps. dehiscent into 3 valves, each containing 1 or 2 seeds, inclosed in a fleshy crimson aril. —More than 30 species in S. and E. Asia, Austral. and Amer. The species with perfect fls. in axillary cymes and with evergreen lvs., being rigid and often spiny shrubs, are now included under *Gymnosporia*, which see.

These shrubs are hardy and ornamental, very effective with their bright-colored fruit remaining usually throughout the winter; *C. angulatus* is also worth growing for its large handsome foliage. They are very valuable for covering trelliswork, trees or rocks and walls: they grow in almost any soil and situation, and as well in shaded as in sunny positions. Propagated by seeds, sown in fall or stratified, and by root-cuttings or layers; suckers are freely produced, and become sometimes a nuisance in nurseries; they also can be increased by cuttings of mature and of soft wood.

A. *Under side of lvs. green.*

B. *Lvs. 2–4 in. long: branchlets terete.*

C. *Fls. and fr. in axillary few-fld. cymes along the branches.*

orbiculàtus, Thunb. (*C. articulàtus,* Thunb.). Fig. 854. High-climbing shrub: lvs. cuneate, suborbicular to oblong or obovate, acute or acuminate, crenate-serrate, 2–3 in. long: fr. globular, orange-yellow, with crimson seeds. Japan, China. B.M. 7599. G.F. 3:550 (adapted in Fig. 854). A.F. 9:534. G.C. III. 23:29; 43:242. Gng. 5:119. M.D.G. 1902:306. Var. **punctàtus,** Rehd. (*C. punctàtus,* Thunb.). A less vigorous grower, with smaller, elliptic lvs.—*C. orbiculatus* is of more vigorous growth than the following species, and fruits very profusely, but the frs. are hidden by the foliage, and are not very conspicuous until the lvs. have fallen, while *C. scandens* bears its frs. above the lvs.

CC. *Fls. and fr. in terminal panicles.*

scándens, Linn. False Bitter-sweet. Wax-Work. Fig. 855. High, climbing to 20 ft.: lvs. cuneate, ovate to ovate-lanceolate, acuminate, crenate-serrate, glabrous, 2–4 in. long: fls. in terminal, many-fld. panicles or racemes 2–4 in. long: fr. about ⅓in. diam., orange-yellow, with crimson seeds. Canada to S. D. and New Mex. Em. 545. A.G. 11:29, 31. G.F. 5:569 (adapted in Fig. 855). Gng. 5:119. A.F. 9:534. V. 3:315. Gn. 33, p. 393 (habit).



854. Celastrus orbiculatus. (×½)

paniculàtus, Willd. (*C. depéndens,* Wall.). Branches brown with numerous small white lenticels, pendulous: lvs. ovate-oblong or obovate, sometimes to 5 in. long: fls. in terminal pendulous panicles 4–8 in. long. Himalayas.—Not hardy N.



855. Celastrus scandens. (×½)

BB. *Lvs. 4–6 in. long and 3–5 in. broad: branchlets angular.*

angulàtus, Maxim. (*C. latifòlius,* Hemsl.). Glabrous shrub, climbing to 20 ft.: branchlets angular, finely lenticellate: lvs. broadly ovate or roundish, abruptly short-acuminate, crenately serrate: terminal panicles 4–6 in. long: fr. subglobose, nearly ½in. thick, on thick short stalks, yellow with orange seeds. N.W. and Cent. China. H.I. 23:2206.—Even without fr. effective on account of its large foliage; has proved hardy at the Arnold Arboretum.

AA. *Under side of the lvs. bluish white.*

hypoleùcus, Warb. (*C. hypoglaùca,* Hemsl. *Erythrospérmum hypoleùcum,* Oliver). Glabrous shrub with terete brown branches scarcely lenticellate: lvs. elliptic or oblong-elliptic, 2–4 in. long, short-acuminate, remotely serrulate: terminal panicles 2–5 in. long, loose: fr. about ⅓in. thick on slender stalks, ⅓–½in. long. Cent. China. H.I. 19:1899.

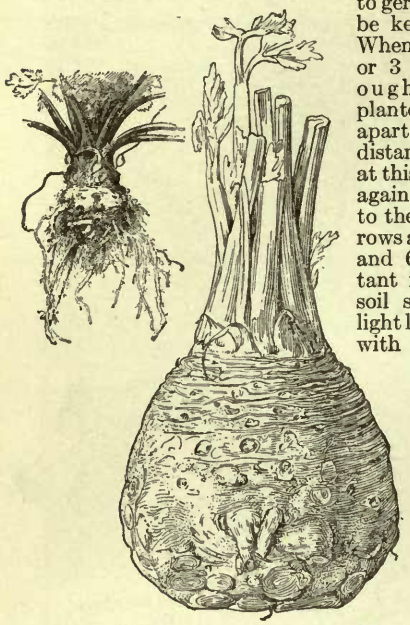
C. flagellàris, Rupr. Allied to C. orbiculatus. Branches with persistent spiny stipules, sometimes rooting: lvs. ovate or oval, small, finely serrulate, slender-petioled: fr. axillary, small. N. China, Korea, Japan. Quite hardy, but not so handsome as C. orbiculatus.—*C. nùtans,* Hort. Reasoner, not Roxbg.=Quisqualis indica.—*C. Orìxa,* Sieb. & Zucc.=Orixa japonica.

Alfred Rehder.

CELERIAC (*Apium gravèolens,* Linn., var. *rapàceum,* DC.). *Umbelliferæ.* Fig. 856. An offshoot of the celery species, producing an edible root-part instead of edible leaves.

Celeriac is very little grown in this country, and to Americans is almost unknown, but it is much prized in Europe. Here it is cultivated chiefly where there is a foreign population. Fifteen or twenty varieties are mentioned in the seed catalogues, but there is very little difference in the various sorts, some seedsmen even making no distinction between varieties, but cataloguing the plant simply as celeriac.

In general, the culture is the same as for celery, except that no blanching is required, since it is the enlarged root that constitutes the edible part. Sow the seed during the spring in a well-prepared seed-bed, preferably in a more or less shaded location. A coldframe or a spent hotbed is a good place. The seed is slow to germinate, and must be kept well watered. When the plants are 2 or 3 inches tall, they ought to be transplanted; about 3 inches apart each way is a good distance to place them at this handling. Later, again transplant them to the open ground, in rows about 2 feet apart and 6 or 8 inches distant in the row. The soil should be a rich light loam well supplied with moisture. (The seed may be sown where the plants are to remain, and thinned to the required distance, but stronger, more stocky plants are secured by transplanting as directed.) Plants thus treated will be ready for fall and winter use. If they are desired for earlier use, the seeds may be sown in a mild hotbed and transplanted to the open.



856. Celeriac trimmed for market (×½); also an untrimmed root, on a smaller scale.

Aside from frequent tillage, celeriac requires but little attention during growth. It is a frequent practice with growers to remove a little of the earth from about the plants after the root has become well enlarged, and to cut off the lateral roots. This tends to make the main root grow larger, smoother and more symmetrical in shape. For winter use, the plants may be protected with earth and straw to keep out frost, or packed in moist sand and placed in a cool cellar.

The principal use of celeriac is for the flavoring of soups and stews, but it is also served in several other ways. It may be boiled and eaten with a white sauce, like cauliflower; as a salad, either first being cooked as beets or turnips, or else cut up into small pieces and used raw; when boiled, sliced and served with oil and vinegar, it forms the dish known as "celery salad." An extract may be obtained from it which is said to have medicinal properties.

Just how long celeriac, or turnip-rooted celery, has been in cultivation is unknown. Its history as a garden vegetable can be traced definitely as far back as the middle of the seventeenth century, although writers for a century or more previous to this time made references which would seem to relate to this vegetable, but the identity is obscure. Its origin was probably the same as that of the common garden celery, of which it is doubtless a state wherein the root has become enlarged and edible. This form is supposed to be the one most remotely removed from the wild state.

H. P. Gould.

CELERY (*Àpium gravèolens*, Linn.). *Umbellíferæ.* A major garden vegetable, grown for its blanched leaf-stalks which are eaten raw and also used in cookery.

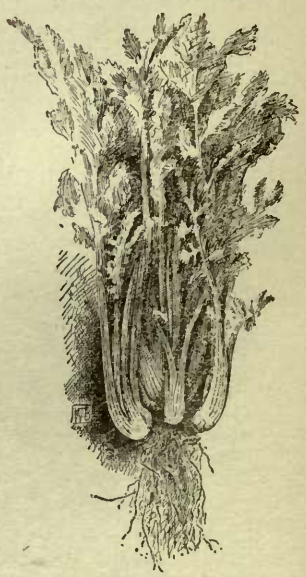
Biennial, sometimes annual, plants: lf.-stalks 6–15 in. long, bearing 3 pairs and a terminal lft. coarsely serrated and ternately lobed or divided. The fl.-stalks are 2–3 ft. high, branched and leafy; fls. white, inconspicuous and borne in compound umbels; seeds very small, flattened on the sides, broader than long. An acrid, pungent flavor characterizes the wild plants.

The genus Apium is variously understood. As mostly accepted, it comprises some 15 or 20 species of annual or perennial glabrous herbs with pinnate or pinnately compound lvs., and small greenish white fls. in compound umbels; calyx-teeth wanting; petals ovate or rounded. The species are distributed widely in temperate regions and in the mountains in the tropics. *A. graveolens* is the one important species to the horticulturist. Var. *rapaceum* is celeriac, a form or race in which the crown of the plant is thickened and turnip-like (see *Celeriac*). The wild celery plant is not stout, nor are the lf.-stalks thickened, as they are in the domesticated races. It grows 1–2 ft. high when in bloom, in marshy places near the sea, on the coasts of Eu., Afr., and Asia; and it has run wild from cult. in some parts of N. Amer.

Celery probably was not cultivated until after the Middle Ages, and the varieties now grown so extensively have been developed within the past thirty-five years. It is not many years since this vegetable was regarded as a luxury and sold at prices that could be paid only by the wealthy, but today it is one of the standard vegetables and is produced in enormous quantities for the city markets. The industry is often highly profitable on muck areas, and thousands of acres of this land are used for celery-culture in Michigan, Ohio, New York, Florida and California. Intensive market-gardeners of the North regard it as one of their most profitable crops, and results are especially satisfactory if the land can be irrigated. When good markets are available, celery is an excellent crop to follow early garden crops, such as peas, beans, beets, bunch onions, radishes and other vegetables that mature in ample time to allow the after-planting of celery to mature. Soils that have been previously cropped the same season should be manured liberally before celery is planted.

Types and varieties.

The methods of cultivation and handling of celery depend so much on the variety that this part of the subject should be discussed at the outset. Celery may be classified into two general groups—green varieties, and the so-called self-blanching varieties. Formerly, the green kinds were grown almost exclusively, but commercial growers soon discovered that the self-blanching varieties possess certain cultural advantages that make them highly desirable from a business point of view. They are more easily blanched, and this is probably the most important consideration when the crop is to be grown for commercial purposes. This is particularly advantageous in the summer crop, and equally appreciated by those who plant large areas for the late market. When boards are used for blanching, more than twice as many plants may be set on an acre as when green varieties are employed and the crop bleached with earth. It is



857. The Boston ideal.

universally conceded, however, that the light-colored varieties are somewhat inferior in quality to the green sorts. For this reason it is a mistake to rely wholly on self-blanching varieties in the home garden. Many home gardeners plant the light-colored kinds for summer use only, and green varieties for fall and winter use.

In some regions, a plant with a much-branched base is desired as in Fig. 857; but in general a less spreading or a lighter plant is grown, as in Fig. 858. These differences are mostly matters of the way in which the plants are grown, as to room in seed-bed and field.

White Plume is one of the best known of the self-blanching varieties. It is vigorous in growth and attains a greater height than Golden Self-blanching and, for this reason, does not meet with as great favor among commercial growers. The quality is also inferior to Golden Self-blanching.

Golden Self-blanching is by far the most popular of American varieties. It is a favorite with amateurs and constitutes probably 90 per cent of all the celery grown in the United States. The plants attain a height of 14 to 20 inches, and are compact and stocky. The stems are short, thick, easily blanched to a creamy white, and the foliage is abundant.

Rose-ribbed Golden Self-blanching has a tinge of rose-color on the ribbing of the stems, which makes the variety attractive for the home garden. It is not grown largely for commercial purposes.

Giant Pascal is an old green-stem variety that is not surpassed in quality. In rich moist soils the plants attain a height of 30 inches or more. It is a favorite of home gardeners who take pride in producing tall, tender stalks of the highest quality.

Winter Queen is a more popular green variety among commercial growers than Giant Pascal. It does not attain such a great height and grows more compactly, so that less space is required between rows, and the crop is more convenient to store.

French Success is a very stocky compact winter variety that possesses excellent keeping qualities.

Boston Market is famous for its excellent quality. It is grown extensively about Boston in the home gardens and for commercial purposes. It is low, compact, crisp, tender and of the best flavor.

Many other varieties are planted to some extent, but the most important have been mentioned.

Soils.

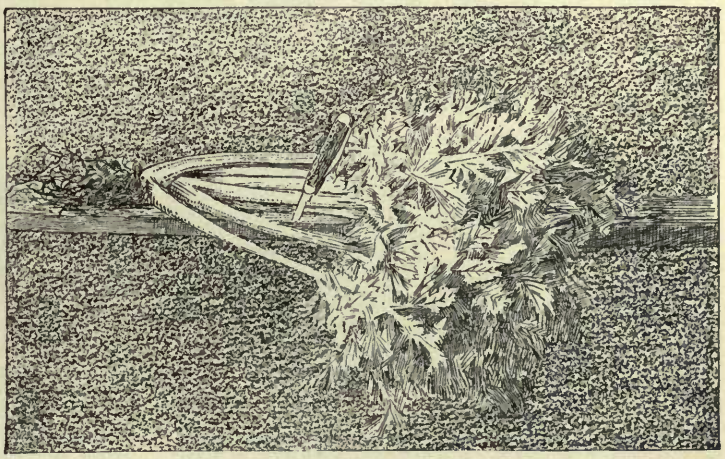
As previously stated, great commercial plantations are on muck soils, although the business is not confined to such lands. The mucks usually provide ideal conditions for the culture of celery. The plant thrives in soils abounding in vegetable matter, and as mucks contain 60 per cent or more of organic matter this requirement is fully met. A Kalamazoo (Michigan) muck soil, used extensively for celery, analyzed as follows:

	Per cent
Sand and silicates	19.16
Alumina	1.40
Oxide of iron	3.94
Lime	6.09
Magnesia	0.81
Potash	0.34
Soda	0.38
Sulphuric acid	1.31
Phosphoric acid	0.88
Carbonic acid	1.95
Organic matter (containing 2.53 per cent of nitrogen)	63.76
Water	6.51

Properly prepared mucks are loose and friable, and this is a great advantage in transplanting and in performing all tillage operations. The land is easily plowed, harrowed, leveled, marked and cultivated, and the work of ridging the plants is accomplished with the greatest ease. The depth of the water-table in muck lands varies greatly, but about 3 feet is considered most favorable; at this depth the plants never suffer from drought.

While it is universally conceded that muck soils provide the best conditions for the extensive cultivation of celery, the crop is grown with entire success on a great variety of soil types. In fact, the plants thrive in any friable soil which is adequately provided with moisture, plant-food and vegetable matter. Near all the northern cities of the United States may be found plantations of limited area that return excellent profits. This is particularly true in sections devoted to the most intensive types of market-gardening, when stable manure and commercial fertilizers are used almost lavishly. With this system of soil-management, the ground soon changes its physical properties and in some cases approaches the muck soils in mechanical composition. It is not uncommon to find small areas on various types of soil, cultivated intensely, which make a gross return of $1,000 or more to the acre. These results indicate the great possibilities of the home garden for the production of celery. There is no reason why every gardener, whatever his type of soil, should not be fully successful in growing a bountiful supply of the choicest celery for the home table.

The reclaiming of new muck lands is often an expensive undertaking. The land must be cleared of brush and sometimes timber. Drainage must be provided by means of tile or open ditches. The land is often acid, and lime should be employed to correct the acidity. For a year or two other crops than celery should be planted to get the land in the proper physical condition. The first plowing should be done in the fall so that the land will be exposed to frost during the winter. Corn is an excellent crop to plant the following spring. There should be repeated cultivation throughout the summer to destroy any other vegetation that may start.



858. A good celery plant in the general market.

Other types of soil should be prepared as in the usual way for the small garden crops. Fall plowing, after large quantities of manure have been added, is often desirable when an early crop is to be started the following spring. Smoothing harrows and plank drags should be used to make the soil fine and smooth preparatory to planting. All preparatory tillage operations should be conducted with a view to conserving soil-moisture, which is exceedingly important to celery throughout the period of growth.

Fertilizing.

As previously stated, it is important for land that is to be planted in celery to abound in vegetable matter. There must also be an abundance of available plant-food in order to secure a rapid and vigorous growth. When applying either manure or commercial fertilizer, the grower should bear in mind that this is a shallow-

rooted plant and the materials should not be placed at great depths.

All classes of growers, whether they are producing on a garden or field scale, and whatever their type of soil may be, recognize stable-manures as the best fertilizer that can be applied for this crop. Stable-manures are the most satisfactory because they furnish both organic matter and plant-food. It is often desirable to supplement stable-manures with commercial fertilizers, but the success of this crop will be far more certain if reliance is placed on barn-manures rather than chemical fertilizers.

An effort should be made to have the manures near the surface of the ground, and this can be accomplished by applying rotten or composted manure after plowing and working into the soil with a disc-harrow. If coarse fresh manure must be used and partially decayed manure is not available, it is preferable to apply it before plowing. Market-gardeners often apply thirty to forty tons to the acre, although smaller quantities give excellent results, especially if fertilizers are used in addition to the manure. Ten tons of manure on muck land is a decided advantage over no manure, even when fertilizers are used in large quantities.

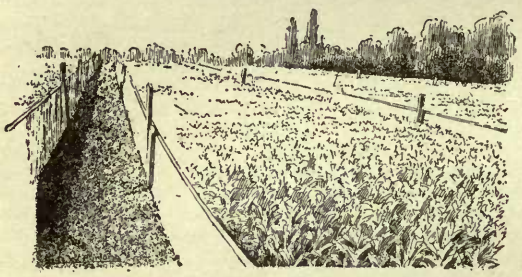
Probably no commercial grower of celery should attempt to produce this crop without the use of at least some commercial fertilizer. When stable-manures are used lavishly, a little acid phosphate, nitrate of soda or potash will often give increased profits.

When stable-manure is not used at all, or perhaps in very small amounts, commercial fertilizers should be used with freedom. Two tons of a high-grade fertilizer to the acre is not an unusual application, and some of the most intensive growers use larger amounts. In the smaller areas, from which a gross return of $800 to $1,200 to the acre is expected, there should be no hesitancy in spending $100 to $125 an acre for manure and fertilizer. Celery requires much nitrogen and the mixed fertilizer applied before planting, or afterwards as a side-dressing, should contain not less that 4 per cent of this element. There should also be an abundance of potash and phosphoric acid. A fertilizer containing 4 per cent of nitrogen, 8 per cent phosphoric acid and 10 per cent potash should meet the requirements of this crop in all soils, when applied in sufficient quantity.

Some growers have found it highly desirable to apply nitrate of soda or complete fertilizer as side-dressings after the crop is well started. These applications may vary from 100 to 200 pounds to the acre and should be made at intervals of about three weeks.

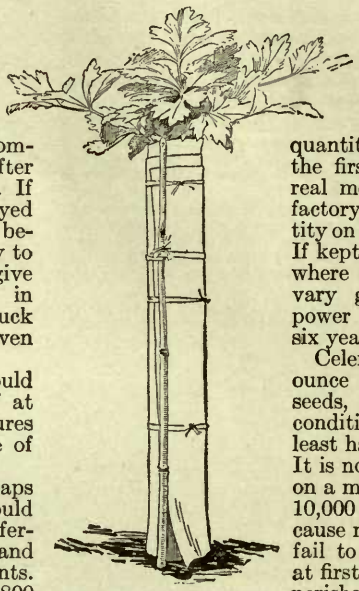
Starting the plants.

The greatest care should be exercised in procuring seed, for inferior seed may result in pithy or hollow



859. Celery planted thick, and the patch edged with boards. The "new celery-culture."

stalks, a poor stand of plants in the seed-bed, seedlings of low vitality, or a large percentage of seed shoots. Only the most reliable dealers, those who have a reputation for furnishing first-class seed of the varieties desired, should be patronized. To make certain of securing good seed, some careful growers import their seed directly from foreign producers, which, however, is unnecessary if the proper precautions are taken in the selection of a responsible seedsman. Practically all of the seed of the self-blanching varieties is grown in France, while most of the seed of green varieties is produced in California. As there is never absolute certainty of securing entirely satisfactory seed, some growers follow the excellent practice of buying in large amounts, sufficient to last several years. Only a small quantity of the seed is planted the first year to determine its real merit, and if found satisfactory there is sufficient quantity on hand to last several years. If kept in sealed jars in a room where the temperature does not vary greatly, the germinating power will be retained at least six years.



860. Blanching celery by wrapping it with paper.

Celery seed is very small. An ounce contains about 70,000 seeds, and with the very best conditions should produce at least half this number of plants. It is not safe, however, to count on a much greater number than 10,000 plants to the ounce, because many of the seeds usually fail to germinate and the plants at first are very small and easily perishable. The seeds are slow to germinate. They should be planted in fine soil which, if possible, should be kept constantly moist but never wet.

Seed for the early crop is seldom sown before the first of March. If checked in growth at any time, there is great danger of the plants producing seed shoots which renders them unsalable. Plants started the first of March will, with proper care, be ready for market in August. Earlier sowing is possible and sometimes desirable, but adequate facilities must be provided to avoid crowding the plants, which invariably results in checking the growth. Some gardeners have found it to be profitable to start the plants the latter part of February, finally transplanting into frames, where the crop is matured.

Seed for the early crop may be sown in the beds of the artificially heated frame or greenhouse. Many growers use flats or shallow plant-boxes, which are placed in the hotbed or greenhouse. While broadcasting of the seed is often practised, it is better to sow in drills 2 inches apart. The furrows should be very shallow, as the seeds should not be covered with more than $\frac{1}{8}$ inch of earth. Muck mixed with a small amount of sifted coal-ashes, sand and a little bone-meal, is most excellent for starting plants under glass. After sowing and lightly covering the seed, place a piece of burlap over the bed, and water it. Keep the bed covered with burlap or a piece of cloth until the plants begin to come up. Do not water more than necessary to keep the bed moist. When the plants appear they will need plenty of light, sunshine and fresh air. A temperature of 70° to 75° is most favorable to germination, but 10° lower should be maintained if possible after the plants are up. Higher temperatures, however, will do no harm if the proper attention is given to ventilation.

When the rough leaves appear, the seedlings should be transplanted into beds or preferably flats, spacing the plants $1\frac{1}{2}$ inches apart each way. Stronger plants will be developed if they are set 2 inches apart. The flats may be about 2 inches deep and half filled with

rotten manure, the remainder of the space being filled with good rich soil. The manure will furnish ideal conditions for the roots of the young seedlings and make it possible to transplant them to the open ground with blocks of earth and manure so that there will be practically no check in growth. If earliness is an important consideration, this method of treatment is highly important. Young celery plants require considerable nursing, and it will not do to take them from warm greenhouses or hotbeds to coldframes before the season is well advanced. They will suffer even more than tomato plants from low temperature. One of the most successful of our American growers invariably plants from the greenhouse to the open ground, beginning about May 10 .

Spraying the seedlings several times with bordeaux mixture may be the means of avoiding loss from fungous diseases.

Seed for the late crop should be sown in the open ground or in protected beds as soon in the spring as the soil can be prepared. Delay in starting the plants is often responsible for a failure of the late crop. It is not so easy to control moisture in the outdoor seedbeds. If overhead irrigation lines are available, there will be no difficulty in this matter. The beds are often shaded with brush or lath screen. Small beds may be kept covered with moist burlap. When starting on a large scale, the rows may be a foot or more apart. Thinning is often necessary to secure stocky plants. The plants may be set where they are to mature any time after they have attained a height of about 3 inches. Ordinarily seedlings started out-of-doors are transplanted directly to the permanent bed or field without an intermediate shift, although this is an advantage in developing stronger plants with better roots. If the plants attain a height of 5 inches or more before they are set in the field, the tops should be cut back before transplanting.

Planting in the field.

As previously indicated, plants for the early crop should not be set in the open ground until about May 10 in the latitude of Philadelphia and New York. There is danger of injury from hard frosts if transplanted before this time, and such injury may result in a large percentage of the plants producing seed shoots, thus rendering them unsalable. Seedlings for the late crop may be transplanted in permanent quarters any time after June 20.

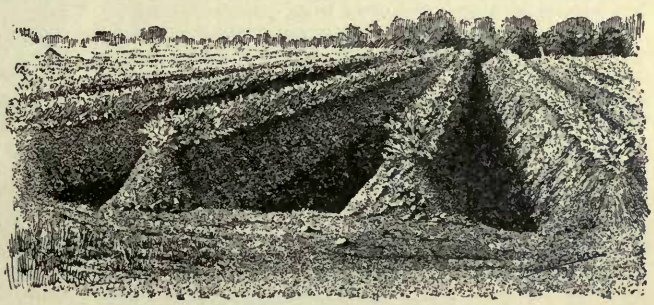
The time of planting in the field will depend largely on the varieties to be used. For example, Golden Self-blanching may be set out three or four weeks later than Giant Pascal and have time to mature fully before hard freezing weather is likely to occur. Many commercial growers do not transplant the late crop until nearly the first of August. In most parts of the North, it is better to transplant early in July. The date of transplanting, however, is not so important as to have the plants, as well as the ground, in proper condition before transplanting is started. Plants that are 3 to 5 inches high are much more likely to live and thrive than taller ones. The ground should be smooth, fine and moist. It is exceedingly important to have the rows perfectly straight and this can be accomplished by the use of a marker. A line may be used for this purpose, but transplanting may be accomplished much more rapidly by using a rope-and-peg marker.

There is the greatest variation in the planting distances for celery. Some of the most intensive growers plant 7 or 8 inches apart each way. Others prefer to space the rows about a foot apart and have the plants stand 4 inches apart in the row. When such close planting is followed, it is known as "the new celery-culture" (Fig. 859). The plants stand so close together when this method is used that they blanch themselves and it is unnecessary to use boards or other devices. "The new celery-culture" is better adapted to greenhouse and coldframe use, where the plants can be watered by sub-irrigation. When plants stand so close together, there is little circulation of air and heart-rot or other diseases are likely to occur in hot moist weather. The possibilities of a small area by use of this method are very large and the system appeals to growers who have only small tracts of land to cultivate.

A more common practice is to space the rows 18 inches to 2 feet apart and to set the plants 4 or 5 inches apart in the row. This method is now almost universally employed for Golden Self-blanching when boards are to be used for blanching the crop. When transplanted 4 by 24 inches apart, about 60,000 plants are required to set an acre. If horse implements are to be used in planting, it is better to allow at least 28 inches between rows.

Some growers prefer to plant Golden Self-blanching in double rows 6 inches apart, placing the plants 4 or 5 inches apart in the row. This plan is not universally popular because it is not favorable to the full development of every plant. Boards are also used for blanching when this system of planting is followed.

When soil is to be used for blanching, more space must be allowed between rows. Formerly the almost universal practice was to allow 5 feet between rows. With tall-growing varieties, such as Giant Pascal, this is not too much space to provide sufficient soil for blanching. When lower-growing varieties, such as Winter Queen, are used, the rows need not be more than 4 or 4½ feet apart to give sufficient space for blanching with earth. The larger varieties of the green type should not be planted quite so close together in the row as Golden Self-blanching; for the best development of the plants, it is better to space them 5 or 6 inches apart in the row.



861. The last earthing-up or banking of celery.

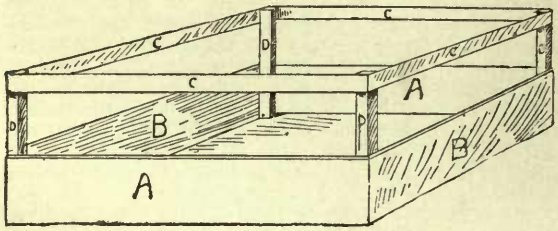
Growers who plant both early and late varieties often alternate the rows. The early variety is removed first, of course, and then there is 4 feet or more of space between the rows of late varieties which are blanched with earth. Transplanting should proceed as rapidly as possible without undue exposure of the roots to the air. If the plant-beds are watered twenty-four hours in advance of transplanting, the plants may be removed with less injury.

Subsequent tillage practice in the North.

Celery is often inter-cropped with other vegetables. One of the most common plans is to plant five rows of onions about a foot apart as early in the spring as the ground can be prepared. The fifth rows are pulled for bunching, and celery is planted instead of the onions. This is a most excellent combination for muck soils where good markets can be found for both crops. Radishes are also excellent to precede celery. If desired, the small button-shaped varieties may be

used, every fifth row to be planted in celery and later-maturing varieties of radishes in the four rows between.

Frequent tillage is necessary for the best results with celery. As it is a shallow-rooted plant, tools that run at considerable depth should be avoided. For horse tillage, there is nothing superior to the spike-tooth cultivator in general use. If the plants are small, great care should be exercised to avoid throwing dirt on top of the hearts. If the ground contains many



862. Water-holding celery crate.

weeds, more or less hand work will be required between the plants in the rows.

The mulching of soils with horse-manure has been a very popular and profitable practice in recent years. It has been shown in the laboratory as well as in field practice that a fine mulch of 3 or 4 inches of horse-manure conserves moisture more perfectly than the most thorough tillage. The mulching of celery in the field not only conserves moisture but it reduces the labor of tillage and also furnishes nourishment to the plants. The rains carry liquid food to the roots and a more rapid growth invariably follows. Considerable hand labor is required, of course, to place the manure between the rows, but this is probably no greater than the labor needed to till the crop when a mulch is not used. It is customary to use fresh horse-manure, which has been aërated in thin layers for a few days before making application. The ground is completely covered, although the manure is not allowed to touch the plants. The mulch may be applied immediately after planting or, as some prefer, the plants may be tilled for ten days or two weeks and the mulch then applied. Very few weeds will appear if 3 or 4 inches of horse-manure is used.

Irrigation makes the crop more certain, and it is also a means of securing larger and more vigorous growth and consequently better quality. Most of the intensive growers of the East are prepared to irrigate. Various methods are employed. Some who cultivate very small areas use the hose or other sprinkling device. The method that is now in most common use is the overhead system of irrigation, providing for parallel pipe lines about 50 feet apart (see *Irrigation*). These are turned at will by means of levers at the ends and the water is thrown out at any desired angle through small nipples placed about 4 feet apart on the lines. It is important to do the watering if possible in the evening or at night so that the foliage may be as dry as possible during the day. It is also important to make thorough applications, as it is not advisable to water more frequently than absolutely necessary.

Blanching.

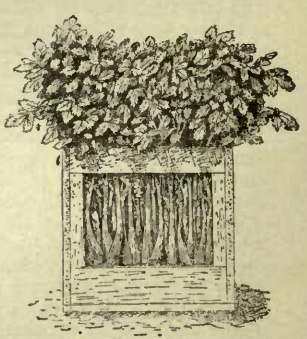
All American markets demand celery with creamy white stalks. This light color is secured by causing the plants to grow with the stalks in the dark, or nearly so, which prevents the development of chlorophyl. When boards, earth, paper, tile or other means are used, most of the leaves are not covered, and growth is not hindered in the least.

Green varieties are blanched almost exclusively by the use of earth. There should be no ridging until the weather is cool and, therefore, this operation is not usually undertaken until early in September at the North. At first the ridging should be only a few inches high, but later should extend to the full height of the stems. Finally, the rows are ridged so that only the tops protrude above the ridges, as shown in Fig. 861. Special tools are available for this operation and the work may be done very rapidly.

The early crop is blanched mostly by means of boards, although paper (Fig. 860) and other devices are sometimes used. Hemlock, pine and cypress lumber are used for this purpose in various parts of the country. The boards need not be more than 10 inches wide, although 12-inch boards are commonly used. They may be of any convenient length, say 14 to 16 feet long. To prevent warping and splitting, cleats about 3 inches wide and ½inch thick should be nailed at each end and in the middle of the boards. The boards are placed on edge, one on each side of the row and brought as close together as convenient at the upper edge and secured by means of wire hooks. Sometimes stakes are driven at the sides, although wire hooks are more convenient. The hooks should be 6 or 7 inches long and may be made of heavy fence wire. From ten days to two weeks is required for proper blanching with boards. As the crop is sold, the boards are shifted from place to place so that they may be used several times during the season. When not in use, the boards should be stored under cover or stacked in piles with strips between them. With good care, boards that are sound when purchased will last fifteen years.

Harvesting and marketing.

The harvesting of the celery crop when grown in coldframes usually occurs in the month of July. If the climate is not too severe, it is possible to have celery ready for market the latter part of June. The late crop, which is produced without the use of boards, is not usually ready for market until August. It is lifted with forks or perhaps cut with a sharp knife just beneath the surface and conveyed to the packing-house where it is prepared for market. In some sections the roots are not trimmed at all, the plants being tied in bunches of a dozen and packed in a standard crate such as is shown in Fig. 862. These crates are 24 by 24 inches at the base, and contain six to sixteen dozen plants, depending on the size of the celery. The height of the crate may be varied to suit the height of the celery. Another form of celery crate is shown in Fig. 863. In some regions, the roots are trimmed into tapering cubes as shown in Fig. 864. A very convenient method of bunching is to place three plants side by side, tapering the roots as indicated, tying the tapering roots tightly and then securing the tops. Formerly twine was used almost entirely for bunching, while in recent years many growers have found it desirable to use either blue or red tape, which gives the celery a more attractive appearance on the market. Michigan growers and other producers of celery in the Great Lake district use small crates of very thin lumber. These vary in size and range about as follows: 6 by 12 by 24 inches; 6 by 16 by 24 inches; 2 by 20 by 24 inches; 6 by 26 by 24 inches and 6 by 30 by 24 inches. The number of bunches in the crates depends on the size of the celery and of the crate, but varies from four to twenty-four dozen. For local markets, the plants may be tied in bunches of the most popular size and packed in any crate of convenient form and size.

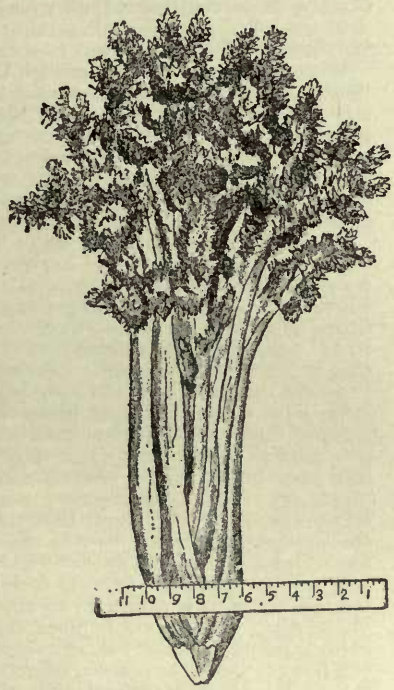


863. Celery crate.

Storage.

A large percentage of the late celery crop is placed in city cold-storage houses. It is packed with the roots on, and there is very little trimming. Golden Self-blanching keeps fairly well in cold storage, or at least the hearts are presentable when they come out of storage. This is the product that now meets the general demand of the large cities until celery begins to arrive from Florida.

In the North, this crop is very commonly stored in trenches. The trenches are dug in well-drained ground and must be deep enough to accommodate the plants so that the tops will not extend more than about 2 or 3 inches above the trenches. The celery will keep better if the trenches are not too wide. Ordinarily they are dug 10 to 14 inches wide. The plants are lifted and stood as close together in the trench as possible. Some growers prefer to place a little earth over the roots, although this is not necessary. If the tops of the plants are dry when stored, and if the plants are not permitted to wilt by being in the sunshine, they should keep in perfect condition in the trenches. Boards are nailed together in the form of a trough and placed over the trenches as rapidly as they are filled. Early in the season, and especially if the weather is quite warm, it is an advantage to provide additional ventilation by placing stones or blocks under the edges of the trough. As the season advances and the weather becomes colder, these should be removed and when necessary, earth, or, better, manure, thrown over the boards to give additional protection. Four or 5 inches of manure will protect the crop thoroughly in most sections until Thanksgiving and perhaps Christmas, depending on the weather. Two kinds of trench storage are shown in Figs. 865, 866.



864. Celery plant trimmed for market.

The late crop is often stored in coldframes of sufficient depth to receive the plants. The frames are usually covered with boards lapped in roof fashion, and straw or marsh hay is placed over the boards when necessary to give additional protection.

Ordinary house cellars, which are well ventilated and not too warm, may be used for storing a limited quantity of celery. Various types of houses have been built for keeping the crop. Cement or brick structures are perhaps the most serviceable. It is important to provide ample ventilation in structures of this kind. In some regions, as around Boston, pits are constructed. The sides of these should be about 2 feet high and the roof may be constructed in an even-span form or simply a shed roof against some other building. Boards are also used for the roofs and covered with straw or hay to give protection during cold weather.

Enemies.

Celery does not have any serious insect enemies. Diseases are much more destructive and difficult to control. The most important diseases are the blights (*Cercospora apii* and *Septoria petroselini* var. *apii*), leaf-spot (*Phyllosticta apii*), and rust (*Puccinia bullata*). The application of bordeaux mixture in the seed-bed will help to control some of these diseases. Many growers also find it necessary to make frequent applications of bordeaux mixture in the field in order to prevent serious losses. The complete control of diseases in the field may be the means of avoiding loss in storage. The earlier applications of bordeaux mixture are regarded as the most effective. Rotation is also desirable in preventing losses from disease.

R. L. Watts.

Celery-growing in the South.

The method of raising celery seedlings is not the same in the South, and especially in Florida, as it is in the North. Sowing is done in July, August, and September, at a time of the year when there is continued warm weather, and frequent beating rain.

A place is chosen for the seed-bed near the celery field,—usually a plot at the edge. The size of the field to be planted will determine the extent of the seed-bed. The width of the seed-bed varies from 18 to 36 inches. Rows are sown across it, making it possible to weed and keep the earth worked from both sides. Immediately after sowing, pieces of heavy burlap (usually old fertilizer sacks) are placed over the beds to conserve the moisture, cool the soil, and to protect the seeds against the beating of heavy rains. The seed-beds are sprinkled as often as is necessary to keep the surface moist.

After the seeds have germinated and the seed-leaves have pushed their way through the ground, the sacking is removed and a screening of cheese-cloth is placed over the bed. Some beds may be covered with cheese-cloth parallel to the surface of the soil. In other cases, a wire is run lengthways over the middle of the bed, and the cheese-cloth is placed over the wire and secured at the sides like a roof. The covering is about 8 to 12 inches above the bed, which gives room for the circulation of air. The beds are kept moist by repeated watering, applied directly through the cheese-cloth.

As soon as the plants are 2 or 3 inches high and are well greened, they will be strong enough to stand direct sunlight and will shade the ground sufficiently to keep it from drying out rapidly.

The best variety.

Formerly nearly all varieties of which seeds were offered by seedsmen were planted. In recent years, however, all have been nearly eliminated except the Golden Self-blanching. The seed of this variety is very high in price and, in years of scarcity, seed supplied under this name is often found to be more or less untrue to type. Seed of low-germinating quality is often found to contain many plants that will make unwelcome vegetables, probably because the undesirable green and red strains that may occur in the Golden Self-blanching variety are more resistant to deterioration than the true type.

Planting and blanching.

Blanching is secured entirely by the boarding-up method. For this purpose, second- or third-grade cypress boards are used; these low-grade boards usually have defective parts or are filled with worm-holes so as to be obtainable rather cheaply. The expense of the lumber, notwithstanding, is so great that it becomes necessary to plant the celery in double rows. Two rows are planted 8 or 10 inches apart, and the plants set 6 or 8 inches apart in the row. By alternating the settings in the two rows, additional space is secured for the plants.

A space of 30 to 40 inches is allowed between the sets of double rows. As soon as the celery has reached the proper stage of growth, or the market has arrived at a condition in which it is thought wise to ship the celery, the boards are placed alongside the plants and held in place by stakes driven into the ground. Further to exclude the air and light, a small quantity of soil is plowed against the bases of the boards, although this is unnecessary when the soil is sufficiently mellow. The tops of the boards are placed firmly together so that only a part of the foliage extends above them. With the Golden Self-blanching variety, it is only a few days until the celery is sufficiently blanched and crisp to make a good vegetable.



865. An old method of growing celery in trenches. It is yet sometimes stored for winter in such trenches.

Fertilizer.

In the preparation of the field, large quantities of fertilizer are used. Stable manure is not a favorite, unless it can be applied to the land early enough to become thoroughly rotted before the plants are set out. The quantity obtainable, however, is usually so small and the price so high in the South that commercial fertilizers have largely replaced it. The quantity of fertilizer applied may range up to $80 or even $125 worth per acre (of the formula given on page 704.)

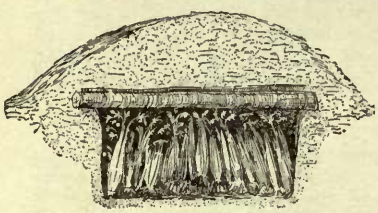
Irrigation.

In the most productive celery regions, sub-irrigation systems (as described under *Irrigation*) are established. The laterals are laid 15 to 25 feet apart, according to the contour of the land, and the notion of the grower. The irrigation system at the same time serves as a drainage system. This makes it especially convenient, since abundant artesian water is present in nearly all the celery-growing sections far south. The system has been found so convenient that a large amount of damage has been done by over-irrigation, not only in carrying off much soluble fertilizer, but also by water-logging the soil and thus driving the roots of the celery plants so near the surface as to be constantly liable to injury. In the hands of careful celery-growers, however, the system is the best that has been invented.

P. H. Rolfs.

Celery-growing in California.

There are two principal celery-growing districts in California,—Orange County, which is situated in the swamp lands south of Los Angeles; and the northern district, which includes the peat or swamp lands along the Sacramento and San Joaquin Rivers between Sacramento and Stockton.



866. A good form of trench storage.

Several varieties of celery have been tested in this state, but the Golden Self-blanching is most popular and profitable.

Seeding.

In California the seed is sown in the open ground, but, owing to its extremely small size, it is difficult to get a good stand unless the ground is well pulverized. It is commonly estimated that enough plants may be grown on 1 acre of seed-bed to plant 20 acres in the field. To produce healthy, vigorous plants, heavy watering is the rule at first, but as soon as the plants have begun to grow the quantity of water is reduced, and it should never be allowed to stand on the surface of the bed. In order to accomplish this the land must be well drained. The seed is usually sown in March, April or May.

Irrigation and drainage.

Although not nearly so much water is required for the plants in the field as in the seed-bed, celery plants cannot stand drought at any stage of their growth; a well-controlled irrigation system is imperative, except where the water-table is close to the surface.

Good drainage is as important as irrigation, for, if water is allowed to stand in the field even for a short time, the plants will suffer seriously. As most of the California celery land is low and the ordinary drainage is poor, an extended system of tile drainage has been laid in nearly all celery fields, especially in Orange County, to prevent losses from standing water.

Subsequent tillage.

When the plants are large enough to be transplanted, they are pulled from the seed-beds, placed in tin pans and hauled to the field, where they are planted 6 inches apart in the furrows 3½ feet apart. The depth of the furrows in which the plants are set is somewhat varied, depending on the soil-moisture, and the size of the plants. The average depth is from 3 to 5 inches.

After the plants have been set in the field for about three weeks or a month and have recovered from the transplanting, the field is "crowded." This operation consists in moving the earth away from the young plants so that they will have more air around them and to kill what weeds have grown so close to the plants that it is impossible to reach them with the cultivator.

As the earth between the rows of plants is left in a ridge after the plants have been "crowded," a large wooden roller, which extends across several rows, is now used to flatten down these ridges and to pack the soil more firmly. The roller is used only when the plants are small, otherwise they would be injured by being crushed. If the plants have grown so large that there is danger of injury by this rolling of the middles, the ridges are smoothed down by the cultivator.

When the plants are 12 to 15 inches tall, earth from between the rows is drawn up to them. This is termed "splitting." This should be done carefully, for, if the earth is put too close or too high up on the plants, they will become tender and weak, especially if the weather is hot. The object of "splitting" is gradually to encourage the plants to grow tall and straight instead of spreading out. This operation is repeated twice in the season, the first time when the plants are 14 to 16 inches tall and the second time just before banking. This last "splitting" also aids blanching.

Blanching.

Practically all the celery grown in California is banked with earth for blanching. Banking is done when the celery is reaching its maturity and is nearly ready for shipment. This is the last field operation before the crop is cut. When the celery is banked for the first time, the earth is not drawn very high on the plants, but each time the field is banked the soil is drawn higher so as firmly to hold the leaves together and in an upright position. If celery that has been banked for the last time is not harvested shortly, it will soon become "punky." The length of time that it can safely be left in the bank depends upon the character of the soil, the weather conditions, and upon the condition of the plants themselves. Celery on sandy soil will keep much longer in the bank than on heavy clay loam or peat soil. If the celery has not matured or if the weather is hot or moist, its keeping quality

will be injured. Holding too long in the bank will result in a wilted and "punky" product.

Harvesting and shipping.

When the celery is ready to harvest, a cutting machine is used which cuts off the plants just below the crown, leaving a few roots attached. The plants are then lifted and shaken from soil, trimmed and thrown in piles by laborers, who are usually Japanese. Another gang of men then place the plants in crates, marking on each crate the number of dozens it contains. More men follow, nail the crates securely, load them on wagons which transport them to the railroad siding, where they are ready for shipment and distribution to the various markets in the United States and Canada.

The celery is packed in the fields in crates 22-by-24-inch base and 18 to 24 inches in height, according to the quality. One of these crates holds from five to ten dozen celery plants. An ordinary car holds from 160 to 165 of these crates. The shipping of the crop starts in October and continues through March, but the bulk of the crop is harvested during November, December and January. The earlier shipments come into competition with celery from Michigan and other middle western states, and the later shipments come into competition with celery from Florida. A very efficient system of marketing has been developed by means of various associations of the growers which have representatives in the leading markets in the United States so that the celery is shipped to points of greatest demand.

Enemies.

The most important disease in California is the late blight (*Septoria petroselini* var. *apii*), which has done an immense amount of damage in the past but is now handled successfully by most of the growers. Spray with bordeaux mixture. For early blight (*Cercospora apii*) keep plants growing thriftily and spray with bordeaux. (For a detailed account of the diseases of celery in California see Bulletin No. 208, published by the University of California.) STANLEY S. ROGERS.

CELMÍSIA (a name in mythology). *Compósitæ.* More than 40 New Zealand perennial herbs, and 1 in Austral. and Tasmania, some of which may be expected in botanic gardens and collections. Lvs. radical and in rosettes, or densely imbricated if borne on the sts., usually tomentose: heads large and solitary on a long or short scape, with imbricate pubescent or glandular bracts in several or many series; rays in a single row, always white. The celmisias are characteristic plants of New Zeal., covering the mountain slopes and valleys, especially in the South Isl., with the showy daisy-like fls. Probably none is regularly in cult.
L. H. B.

CELÒSIA (Greek, *kelos*, burned; referring to the burned look of the flowers in some species). *Amarantàceæ.* COCKSCOMB. Popular garden annuals, grown for the showy agglomerated flower-heads and sometimes for colored foliage.

Alternate-leaved annual herbs, the lvs. entire or sometimes lobed, mostly narrow: fls. in dense terminal and axillary spikes, the spikes in cult. forms becoming densely fascicled and often the sts. much fasciated; perianth very small, 5-parted, dry, the segms. oblong or lanceolate, erect in fr.; stamens 5, the filaments united at base: fr. a circumscissile utricle, with 2 to many seeds.—About 35 species, all tropical, in Asia, Afr. and Amer.

There are two main types of celosias, the crested form and the feathered or plumy ones. The crested cockscomb is very stiff, formal and curious, while the feathered sorts are less so, and are used to some extent in dried bouquets. The plumy sorts are grown abroad for winter decoration, especially under the name of *C. pyramidalis*, but to a small extent in America. The crested cockscomb is less used as a summer bedding plant than formerly, but it is still commonly exhibited in pots at small fairs, the object being to produce the largest possible crest on the smallest plant.

For garden use, the seeds are sown indoors in early spring, and the plants set out May 1 to 15. If the roots dry out, the leaves are sure to drop off. The cockscomb is a moisture-loving plant, and may be syringed often, especially for the red-spider, which is its greatest enemy. A light, rich soil is needed.

A. *Spikes crested, monstrous.*

cristàta, Linn. COCKSCOMB. Fig. 867. Height 9 in. or more: st. very glabrous: lvs. petiolate, ovate or somewhat cordate-ovate, acute, glabrous, 2–3 in. long, 1 in. wide: spikes crested, subsessile, often as wide as the plant is high: seeds small, black, shining, lens-shaped. Tropics. Gn. 13, p. 231. R.H. 1894, p. 58.—There are 8 or 9 well-marked colors in either tall or dwarf forms, the chief colors being red, purple, violet, crimson,



867. Celosia cristata.

amaranth and yellow. The forms with variegated lvs. often have less dense crests. *A. japónica,* Mart., little known to botanists, is said to be a distinct garden plant with branching, pyramidal habit, each branch bearing a ruffled comb.

AA. *Spikes plumy, feathery, or cylindrical.*

argéntea, Linn. Taller than the above: lvs. shorter-stalked, narrower, 2–2½ in. long, 4–6 lines wide, linear-lanceolate, acute: spikes 1–4 in. long, erect or drooping, long-peduncled, pyramidal, or cylindrical. India.—This species is considered by Voss (in Vilmorin's Blumengärtnerei) to be the original one from which the crested forms are derived. He makes 9 botanical forms, to one of which he refers *C. cristata.* The range of color is even greater in the feathered type than in the crested type. The spikes are very various in form and habit. Various forms are shown in Gn. 6, p. 513; 9, p. 149; 17, p. 331 (all as *C. pyramidalis*). R.H. 1857, p. 78, and 1890, p. 522 (as *C. pyramidalis*).

Hùttoni, Mart. Height 1–2 ft.: habit bushy, pyramidal: st. sulcate-striate: lvs. reddish or crimson, lower ones lanceolate, subsessile: spikes red, cylindrical, oblong, obtuse, 1½ in. long; perianth-segms. oblong (not lanceolate, as in *C. argentea*). Java.—A foliage plant, and less common than the 2 species above.

C. spicàta, Hort.=(?). Not the C. spicata, Spreng.; perhaps some form of C. cristata.—*C. Thómpsonii magnífica,* Hort., is a trade name and apparently without botanical standing.
WILHELM MILLER.

CÉLSIA (Olaus Celsius, 1670–1756, a Swedish orientalist). *Scrophulariàceæ.* Herbs, with yellow fls. in terminal racemes or spikes, closely allied to Verbascum, but has only 4 stamens, and they are of 2 sorts. About 40 Old World species, mostly from the Medit. region.

Only **C. crética,** Linn. f., is known in Amer., and that very sparingly. It is a hardy or half-hardy biennial, with alternate lvs., of which the lower are slightly pinnate and lanceolate, and the upper ovate-lanceolate, toothed and clasping: fls. large (nearly 2 in. across), and somewhat as in Antirrhinum, yellowish, with dark markings in the center and conspicuous deflexed stamens. Stout hairy plant, 3–6 ft. high, from Crete. B.M. 964.—A very showy plant well worth much wider cult. See page 3566.

C. póntica, Hort. Has whitish lvs. and pure white fls.

N. Taylor.†

CÉLTIS (ancient Latin name). *Ulmàceæ.* Nettle-Tree. Woody subjects grown chiefly as shade or lawn specimens.

Trees or rarely shrubs, sometimes spiny: lvs. alternate, petiolate, stipulate, deciduous or persistent, usually oblique at the base and 3-nerved: fls. polygamous-monœcious, inconspicuous, apetalous, 4–5-merous, axillary, the staminate in small clusters on the lower part of the branchlets, the fertile solitary in the axils of the lvs. on the upper part of the branchlets, with a 1-celled superior ovary crowned by a 2-parted style and with 4–5 short stamens: fr. a 1-seeded, small drupe, edible in some species; embryo with broad cotyledons.—Seventy species in the temperate and tropical regions of the northern hemisphere, of which a few hardy ornamental species are cult.



868. Celtis occidentalis (×½). (Detail ×¼)

The nettle-trees are valuable as shade trees or as single specimens on the lawn, mostly with wide spreading head and light green foliage, which is rarely seriously injured by insects or fungi; they thrive in almost any soil and even in dry situations; they are of vigorous growth when young, and are easily transplanted. The straight-grained wood is light and elastic, easily divided, and much used for the manufacture of small articles and for furniture; that of *C. australis* is valued for carving. Propagated by seeds, sown after maturity; also by layers and cuttings of mature wood in fall; rarer kinds are sometimes grafted on *C. occidentalis.*

A. *Lvs. entire, or rarely with few teeth, thin, at length glabrous.*

mississippiénsis, Bosc (*C. lævigàta,* Willd. *C. integrifòlia,* Nutt.). Tree, 60–80 ft.: lvs. unequally rounded or cuneate at the base, oblong-lanceolate or ovate, acuminate, usually falcate, smooth above, 2–4 in. long: fr. orange-red, nearly globular, ¼in. thick, on slender pedicel, longer than the petiole; stone pitted. From S. Ill. to Texas and Fla., west to Mo. S.S. 7:318. G.F. 3:41, figs. 9–11. Mn. 7:225, 227.

AA. *Lvs. serrate, sometimes entire and pubescent.*

B. *Ovary and fr. glabrous.*

C. *Branchlets usually and lvs. more or less pubescent, at least when young.*

D. *Fr.-stalks slender, longer than petioles: lvs. usually rough above: stone pitted.*

E. *Under surface of lvs. glabrous at maturity.*

occidentàlis, Linn. Fig. 868. Large tree, occasionally 120 ft.: branchlets glabrous or slightly pubescent: lvs. oblique and rounded at the base, ovate-acuminate, pubescent when young, usually rough above, sometimes smooth at maturity, usually entire toward the base, light green, 2–6 in. long: fr. orange-red, ⅓–½in. long, on slender pedicel, longer than the petiole. S.S. 7:317. G.F. 3:40 (adapted in Fig. 868) and 43. Em. 304. Mn. 7:231, 233. A.G. 20:240, 531.—Very variable species. Var. **crassifòlia,** Koch (*C. crassifòlia,* Lam.), has firm, very rough and large lvs., to 5 in. long, usually cordate at base and more strongly serrate. Michx. Hist. Arb. 3:228.

EE. *Under surface of lvs. pubescent.*

austràlis, Linn. Tree, to 60 ft.: lvs. oblique, broadly cuneate or rounded at the base, ovate-oblong, long-acuminate, pubescent beneath, 2½–5 in. long: fr. over ½in. long, dark purple, sweet; pedicels 2–3 times longer than the petioles. Medit. region to Persia. H.W. 3:40, p. 11.—Not hardy N.

Hélleri, Small. Tree, to 30 ft.: branchlets pubescent: lvs. ovate or ovate-oblong, obtuse or acute, truncate to subcordate at the base, rough above, grayish and pubescent or tomentose, and reticulate below, 2–3 in. long: fr. ⅓in. thick, light brown, on pubescent pedicels about ½in. long and rather stout. Texas.—Sometimes planted as a street tree in Texas.

DD. *Fr.-stalks rather stout, as long or slightly longer than petioles: lvs. grayish green beneath: stone smooth.*

sinénsis, Pers. (*C. japónica,* Planch.). Tree, to 30 ft.: lvs. usually rounded or cordate at the base, broadly ovate to oblong-ovate, acuminate, serrate-dentate, pubescent when young, pale or glaucescent and prominently reticulate beneath, 2–4 in. long: fr. dull orange-red; pedicels rather stout, not much longer than the petioles. China, Japan. S.I.F. 1:36.—Has proved hardy at the Arnold Arboretum.

CC. *Branchlets and lvs. quite glabrous: stone smooth.*

D. *Foliage bluish or grayish green.*

Tournefórtii, Lam. (*C. orientàlis,* Mill., not Linn.). Tree, to 20 ft., or shrub: lvs. ovate, acute, usually rounded or subcordate at the base, 1½–3 in. long, of firm texture, not reticulate, sometimes pubescent: fr. reddish yellow, about ⅓in. across, its stalk about as long as petiole, ½in. long or somewhat less. Greece, Sicily and Asia Minor.—Not quite hardy N.; attractive on account of its bluish green foliage.

DD. *Foliage bright green, lustrous.*

Bungeàna, Blume. Tree: lvs. usually rounded at the base, ovate, acuminate, crenate-serrate, nearly glabrous when young, green and shining on both sides, 1½–2½ in.: fr. purplish black, small; pedicels longer than the petioles. N. China.—Hardy, and a very distinct species, with dark green and glossy foliage.

BB. *Ovary and fr. pubescent; subtropical, tender tree.*

Kraussiàna, Bernh. Tree: lvs. oblong-ovate, usually rounded at the base, acuminate, crenate-serrate, pubes-

Univ. of California



XXIV. Cœlogyne cristata, one of the popular and easily grown orchids.

cent on the veins beneath, semi-persistent: ovary tomentose: fr. mostly pubescent, slender pedicelled. S. Afr. to Abyssinia. Sim, Forest Fl. Cape Colony, 134. —Hardy only S.

C. Bióndii, Pampanini. Lvs. broader than in C. Bungeana, grayish below: frs. dark blue, small. Cent. China.—*C. caucásica*, Willd. Allied to C. australis. Lvs. broadly rhombic-ovate, somewhat smaller: fr. smaller, reddish brown. Caucasus, N. Persia.—*C. Davidiàna*, Carr. Allied to C. Bungeana. Small tree: lvs. ovate-oblong or elliptic-oblong, often sparsely hairy on the veins below, 2–5 in. long. N. China. Incompletely known.—*C. georgiàna*, Small. Allied to C. occidentalis. Shrub or small tree: branchlets pubescent: lvs. ovate, acute, entire or sharply serrate, 1–2 in. long: fr. ¼in. across, short-stalked. Md. to Fla., Ala. and Mo.—*C. orientàlis*, Linn.= Trema orientalis.—*C. orientàlis*, Mill.= C. Tournefortii.— *C. reticulàta*, Torr. (C. mississipiensis var. reticulata, Sarg.). Small tree, to 50 ft.: branchlets pubescent. lvs. ovate, usually cordate, entire or serrate, rough above, pubescent and reticulate below, 1½–3 in. long: fr. ½in. thick, orange-red. Colo. to Texas and Ariz.—*C. Smàllii*, Beadle. Allied to C. mississippiensis. Lvs. lanceolate or oblong-lanceolate, thin, sharply serrate, 2–4 in. long: fr. ¼in. thick, slender-stalked. N. C. and Tenn. to Ga. and Ala.

ALFRED REHDER.

CEMETERY GARDENING. Treated under Landscape Gardening.

CÉNCHRUS (an ancient Greek name). *Gramíneæ*. Mostly annual grasses with simple racemes of burs that become detached and adhere readily to clothing and animals. Spikelets as in Panicum, but 2–6 together in a spiny involucre or bur. **C. carolinìanus**, Walt. (*C. tribuloìdes* of American authors), SAND-BUR, is a common weed in sandy soil. Dept. Agric. Div. Agrost. 20:40.

A. S. HITCHCOCK.

CÈNIA (Greek for *empty*, in allusion to the hollow receptacle). *Compósitæ*. Low herbs from S. Afr., with the aspect of mayweed. Head small and rayed, the ray-fls. pistillate, the disk-fls. compressed and 4-toothed, the receptacle gradually enlarged from the top of the peduncle, and hollow. About 8 species, none of which are of much horticultural value. **C. turbinàta**, Pers. (*C. pruinòsa*, DC.), is a common weed in Cape Colony, and it is occasionally seen in American gardens. It is annual, diffusely branched, and a foot or less high, with finely dissected, soft, almost moss-like foliage, and long-peduncled, small, yellow heads. Of easy cult. United with Cotula by Hoffmann in Engler & Prantl.

L. H. B.

CENTAURÈA (a *Centaur*, famous for healing). *Compósitæ*. CENTAURY. DUSTY MILLER. BACHELOR'S BUTTON. CORNFLOWER. KNAPWEED. Annuals or hardy and half-hardy perennials with alternate leaves, useful for bedding, vases, baskets and pots, and for borders and edgings; species many and various.

Involucre ovoid or globose, stiff and hard, sometimes prickly: receptacle bristly: marginal florets usually sterile and elongated, making the head look as if rayed. Differs from Cnicus in having the achenes obliquely attached by one side of the base or more laterally.—Species about 500, much confused, mostly in Eu., Asia and N. Afr., 1 in. N. Amer., 3 or 4 in Chile. Several Old World species have become weeds in this country. J.H. 43:76. The species are of simple cult., coming readily from seeds. Many of the perennial species make excellent border plants, and their blue and purple heads are welcome additions to the horde of yellow-flowering composites.

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A. DUSTY MILLER.—*White-tomentose low plants, used for bedding or for the sake of their foliage.*

1. **Cinerària**, Linn. (*C. candidissima*, Lam.). Fig. 869. Perennial: sts. erect, 3 ft., branched, the entire plant white-tomentose: lvs. almost all bipinnate (except the earliest), the lower petioled, all the lobes linear-lanceolate, obtuse: scales of the ovate involucre appressed, with a membranous black margin, long-ciliate, the apical bristle thicker than the others: fls. purple. S. Italy, Sicily, etc.—Much used as a bedding plant, not being allowed to bloom. The first lvs. of seedlings are nearly entire (as shown in Fig. 869), but the subsequent ones become more and more cut. Grown both from seeds and cuttings. Seedlings are very apt to damp off unless care is taken in watering.

2. **depréssa**, Bieb. A flat, almost prostrate perennial: st. floccose-tomentose and much branched: lower lvs. scarcely denticulate, the upper oblong-linear, entire: bracts of the involucre white- or black-margined: fls. showy, the blue rays about ½in. long. Persia, Caucasus. July.

3. **gymnocárpa**, Moris & DeNot (*C. argéntea*, Hort. *C. plumòsa*, Hort.). Fig. 870. Perennial: entire plant covered with velvety white pubescence: sts. 1½–2 ft. high, erect: lvs. bipinnatisect; segms. linear, entire, acute: fl.-heads small, in a close panicle, mostly hidden by the lvs.; fls. rose-violet or purple. Caprea. V. 4:337.—Very ornamental on account of its velvety finely cut lvs. Much used, like No. 1, for low foliage bedding: lvs. more compound, and usually not so white.



869. Lower leaf from a young plant of Centaurea Cineraria. (×½)



870. Radical leaf of Centaurea gymnocarpa. (×½)

4. **Cleméntei**, Boiss. Perennial, the entire plant densely white-woolly: sts. erect, branching, with few lvs.: root-lvs. petioled, pinnate, the lobes ovate-triangular, sharp-pointed; st.-lvs. sessile: fl.-heads terminal on the branches, globose; involucre scales with scarious, ciliate margins, scarcely spiny; fls. yellow. Spain.

AA. CORNFLOWER, OR BACHELOR'S BUTTON.—*Tall-growing annual, with very narrow lvs., grown for the showy fls.*

5. **Cyanus**, Linn. (*Cyanus arvénis*, Moench.) BLUEBOTTLE. BLUET. BACHELOR'S BUTTON (see also *Gomphrena*). CORNFLOWER. RAGGED SAILOR. FRENCH PINK. Fig. 871. Annual, slender, branching, 1–2 ft. high, woolly-white when young: lvs. linear, entire or the lower toothed, sometimes pinnatifid: fls. blue, purple, pink or white, the heads on long, naked sts.: involucral bracts rather narrow, fringed with short, scarious teeth. S. E. Eu. Gt. 38, p. 641; 39, p. 537. V. 5, p. 44; 13:361.—One of the most popular of garden fls., variable. It is perfectly hardy, blooming until frost

and coming up in the spring from self-sown seed. The following are varieties of this: *Pure White; Victoria*, a dwarf, for pots and edgings (Gn. 40, p. 147); *Emperor William*, fine dark blue; *flore pleno*, with the outer disk-fls. converted into ray-fls.; *nana compacta*, dwarf. (Gt. 44, p. 150.) *Centaurea Cyanus* is one of the "old-fashioned flowers," everywhere well known and popular. It often escapes from gardens.

AAA. SWEET SULTANS.—*Straight-growing smooth annuals or perennials, with dentate lvs., grown for the large fragrant heads.*

6. **moschàta,** Linn. (*C. suavèolens*, Linn. *C. odoràta*, Hort. *C. Amberbòii*, Mill. *Amberbòa moschàta*, Less.). SWEET SULTAN. Fig. 872. Annual: sts. 2 ft. high, branching below, erect: whole plant smooth, bright green: lvs. pinnatifid, the lobes dentate: fl.-heads long-peduncled; involucre round or ovate, smooth, only the innermost of the involucral scales with scarious margins: fls. white, yellow or purple, fragrant. Orient. Mn. 4, p. 149. Gn. 54 : 372. I.H. 42, p. 106. Gng. 4:147. G. 5: 289; 16:267; 25:71.

Var. **álba,** Hort. (*C. Margarìtæ*, Hort.). Fls. white. Gn. 19, p. 337; 54: 372. A.G. 13: 607. This form, known as *C. Margaritæ*, is pure white and very fragrant. It was intro. by an Italian firm in 1891. Var. **rùbra,** Hort. Fls. red. Gn. 54: 372.—A popular, old-time garden fl., with long-stalked heads; of easy cult. It does not bear transplanting well.—*C. imperiàlis*, Hort., is said to be the offspring of *C. moschata* and *C. Margaritæ*, intro. into the American trade in 1899. Gn.M. 13:74. Plants are said to inherit the vigorous free growth of *C. moschata*, being of the same easy cult. and forming clumps 3–4 ft. high. The fls. resemble *C. Margaritæ*, but are twice as large and abundantly borne on long sts. from July until frost. They range through white, rose, lilac and purple, are fragrant, and if cut when first open will keep 10 days. *C. Màriæ*, Hort., intro. 1899, resembles *C. imperialis*, but the fls. open sulfur-yellow, become lighter, and are tipped with rose. All sweet sultans do best if the bloom is secured before very hot weather.



871. Centaurea Cyanus. (×½)

7. **glastifòlia,** Linn. A strong-growing border perennial with a rough much-branched and winged st.: lvs. oblong, entire, decurrent, the basal lvs. petiolate, sometimes divided: fls. yellow, the heads solitary, without bracts, and quite smooth. Cent. Eu. B.M. 62. June–Sept.

AAAA. OTHER CENTAUREAS *of various kinds, occasionally grown in hardy borders, for their fls. or imposing stature.* See page 3567.

B. *Foliage green on both sides.*

C. *Lvs. pinnate or bipinnate.*

8. **spléndens,** Linn. (*C. Margaritàcea*, Ten.). Perennial: sts. erect, branched: lvs. smooth, the lowest bipinnate, the upper pinnate, all with very narrow, linear, entire, acute lobes: fl.-heads subglobose; scales of the involucre with a rounded almost entire rather lax tip; fls. purple. Spain, Italy.

9. **ruthénica,** Lam. Hardy perennial about 3 ft.: st. erect, branching, smooth: lvs. pinnatisect, the lobes linear-toothed, sharply narrowed at both ends, the base often somewhat decurrent: fl.-heads usually solitary, the pale-yellow rays about ¾in. long; pappus double: achenes glabrous. Cent. Eu. July. G. 26:630.

CC. *Lvs. entire or dentate, not pinnatisect.*

10. **americàna,** Nutt. (*Plectocéphalus americànus*, Don). BASKET FLOWER. Fig. 873. Hardy annual, nearly smooth: sts. stout, simple or sometimes a little branched, 2–5 ft., thickened under the naked head: lvs. mostly entire, oblong-lance-shaped, mucronate: involucre ½–1½ in. diam., its bracts all with fringed scarious appendages: fls. rose or flesh-colored, sometimes purplish; disk 1–3 in. diam.; narrow lobes of the ray-fls. often 1 in. long. Mo. and Ark. to La. and Mex. F.S. 4:327. S.H. 2:223. A.F. 16: 1644 (*alba*). Gng. 9:341 (*alba*). —Very attractive.

11. **macrocéphala,** Puschk. Perennial: sts. simple, erect, swollen below the fl.-head, leafy, 2½–3 ft. high: lvs. ovate-lanceolate, slightly decurrent, scabrous, acute, somewhat serrate, gradually diminishing upwards to the base of the single terminal head: head subglobose, larger than a hen's egg, often 3–4 in. diam.; involucre of 8–12 rows of appressed, scarious-margined, rusty, fringed scales; fls. yellow, the marginal and disk alike. Armenia. B.M. 1248. J.H. III. 33:331; 52: 547; 63 : 319.—Often grown from seeds.

12. **nìgra,** Linn. KNAPWEED. HARDHEADS. Perennial, 1–2 ft. high: sts. branching, rough pubescent: lvs. lance-shaped and entire or lower sparingly toothed or lobed, but not pinnatifid: involucral bracts with pectinate-ciliate-fringed black appendages: fls. all alike, the disk and marginal ones of the same size. Eu. Var. **variegàta,** Hort. Lvs. edged with creamy white, tufted. A very striking border plant; useful in dry or open places.

BB. *Foliage white or tomentose, at least beneath (often green above).*

C. *Sts. low, weak, not strict.*

13. **leucophýlla,** Bieb. (*C. declinàta*, Bieb.). Perennial: sts. short, decumbent, with very few lvs.: root-lvs. petioled, tomentose-woolly on both sides, pinnate, the ovate lobes undulate, sparsely cut-lobed or sinuate-toothed: fl.-head with few bracts, solitary, terminal; scales of the ovate involucre lanceolate, acuminate, brown, long-ciliate; fls. purple. Caucasus.

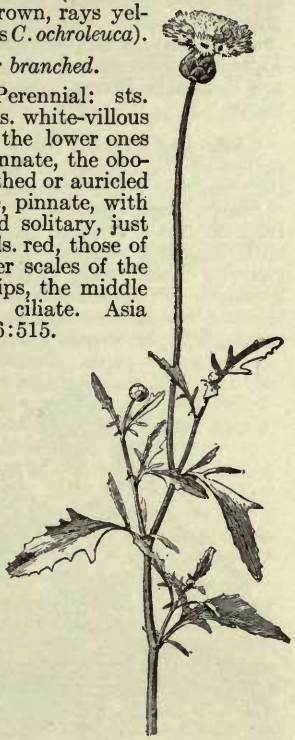
14. **montàna,** Linn. MOUNTAIN BLUET. Perennial: sts. low, stoloniferous, unbranched, 12–16 or rarely 20

in. high: lvs. decurrent, the young ones silvery white, oval-lance-shaped: involucre of 4 or 5 rows of scales, black-ciliate along the margins: fls. blue, the marginal ones 1 in. long; disk-fls. very short, becoming purple. Eu. B.M. 77. G.M. 47:243. Var. **álba,** Hort. Fls. white. G. 25:71; 29:109. G.M. 51:162. Var. **rôsea,** Hort. Fls. rose-colored. Var. **citrìna,** DC. (var. *sulphùrea,* Hort.). Disk-fls. brown, rays yellow. Armenia. B.M. 1175 (as *C. ochroleuca*).

cc. *Sts. erect, simple or branched.*

15. **dealbàta,** Willd. Perennial: sts. sub-erect, 8–24 in. high: lvs. white-villous beneath, glabrous above, the lower ones 1–1½ ft. long, petioled, pinnate, the obovate lobes coarsely cut-toothed or auricled at the base; st.-lvs. sessile, pinnate, with oblong-lance lobes: fl.-head solitary, just above the uppermost lf.; fls. red, those of the disk rosy or white; outer scales of the involucre with lanceolate tips, the middle rounded, deeply fringed, ciliate. Asia Minor, Persia. J.H. III. 46:515.

16. **nervòsa,** Willd. A stout perennial about 2–2½ ft. tall with a simple unbranched rough st.: lower lvs. glandular, usually slightly toothed, the st.-lvs. clasping by the auriculate base; heads solitary, the rays deep purple. A branched and numerous-fld. form is known in the wild but not to the trade. Cent. Eu. July., Aug.



872. Centaurea moschata. (×¼)

17. **atropurpùrea,** Waldst. & Kit. (*C. calocéphala,* Willd.). Perennial: sts. erect, branched, about 2–3 ft. high, the branches white-woolly at the summit: lvs. bipinnate, lobes linear-lanceolate, acuminate; lowest lvs. petioled, uppermost pinnatifid: fl.-heads without bracts; involucral scales with fringed ciliate white lanceolate tips, the innermost ones rounded, scarious-margined; fls. black-purple. Hungary.

18. **babylónica,** Linn. Silvery white perennial: sts. simple, stout, erect, 6–10 or 12 ft. high: lvs. long, coriaceous, strongly decurrent on the st., the radical lyrate, the lower st.-lvs. oval or oblong-acute, entire or undulate, the upper lance-acute: fls. yellow, the globular heads almost sessile in the axils of narrow bract-like lvs.; one-third to half of the st. fl.-bearing; involucre-scales with a short, recurved tip. Asia Minor, Syria. Gn. 2, p. 73; 8, p. 263. R.H. 1859, pp. 540–1.—Tall, stout and striking plant.

C. alpìna, Linn. Lvs. downy beneath, prickly: fl.-heads yellow; scales of involucre ovate, obtuse: hardy herb, 3 ft., from Eu., sometimes seen in collections.—*C. eriophora,* Linn. A low plant with a spiny calyx and silvery lvs., is cult. in England. Not known in Amer.—*C. pulchérrima,* Willd. (Æthiopappus pulcherrimus, Hort.). A stout hardy perennial about 2½ ft. with brilliant rose fls. is known in the trade.—*C. rigidifòlia,* Hort. Stout perennial, 2½ ft., with crimson heads is apparently C. orientalis, Linn.—Not much known in U. S.

N. TAYLOR.†

CENTAURÍDIUM: *Xanthisma.*

CENTAURY: *Sabatia.*

CENTRADÈNIA (Greek for *spurred gland,* alluding to the anther glands). *Melastomàceæ.* Tropical herbs or sub-shrubs grown in warmhouses for their showy-colored leaves and pretty flowers.

Branches angled or winged: lvs. petiolate, opposite, lanceolate or ovate, entire, ribbed: fls. with 4-lobed calyx, 4 petals, 8 stamens, and a 4-loculed ovary, pink or white, in axillary or terminal clusters.—Species 4–6, in Mex. and Cent. Amer. They fall into 2 groups,—those with very unequal stamens, and *C. floribunda* with nearly equal stamens.

Centradenias are very showy and desirable plants. The stems are often colored. They like rich leaf-mold with sharp sand, and brisk heat. Give a light but shady position. Strong plants are much benefited by liquid manure, and such applications give better colors in both flowers and fruit.

grandifòlia, Endl. Branches 4-winged: lvs. ovate-lanceolate, strongly 3-nerved, brilliant red beneath, long-pointed and curving at the end: cymes many-fld., shorter than the lvs., the fls. light rose, rotate, the petals very obtuse, the stamens unequal. Mex. B. M. 5228.—The plant grows 2 ft. high, and blooms in winter. Very showy, and the species usually cult. The cut branches hold their color a long time, making the plant useful for decorations.

inæquilateràlis, Don (*C. ròsea,* Lindl.). Lvs. ovate-lanceolate, unequal-sided, entire, ciliate, reddish beneath: fls. pink, in terminal corymbose racemes: dwarf. Mex. B.R. 29:20.

ovàta, Klotzsch. Lvs. ovate-acute, smooth and shining, pale beneath, 3-nerved: fls. pink in large terminal clusters. Cent. Amer.

floribúnda, Planch. Branches obscurely angled, pubescent, red: lvs. narrow-lanceolate, tapering below, 3-nerved, red-nerved below: fls. pink, in terminal panicles. Mex. F.S. 5:453.

L. H. B.†

CENTRÁNTHUS (Greek, *spurred flower*). *Valerianàceæ.* CENTRANTH. Annual and perennial herbs, one of which is frequent in old gardens.

Leaves opposite, entire, dentate, or pinnatisect: fls. in dense clusters, small, red or white, terminating the branches; calyx cut into 5–15 narrow divisions, enlarging after flowering; corolla slender-tubed, 5-parted, spurred at the base; stamen 1; fls. with a pappus-like crest.—About a dozen species in the Medit. region, some of them sometimes half shrubby. *C. ruber,* the common garden species, sometimes escapes and becomes more or less spontaneous.

rùber, DC. RED VALERIAN. JUPITER'S BEARD. Perennial, 1–3 ft., smooth and glaucous, forming a compact and floriferous bushy plant: lvs. ovate to lanceolate, some of them toothed at base but mostly entire: fls. numerous, deep crimson to pale red, fragrant. Eu., E.—A very handsome old garden plant, too much neglected; blooms all summer; excellent for cutting. Increased by division; also by seeds. There is a white-fld. form (var. *álbus*).

angustifòlius, DC. Perennial, glaucous, to 2 ft., simple or somewhat branched: lvs. linear-lanceolate or linear, very entire, nearly perfoliate: fls. clear rose, fragrant. S. Eu.—There is a white-fld. form (var. *albus*).

macrosìphon, Boiss. Annual, of easy cult. in any good soil: 1–2 ft.: lvs. ovate, glaucous, toothed: fls. larger than in the last, deep



873. Centaurea americana. (×½)

rose. Spain.—There are white-fld. (var. *álbus*) and dwarf (var. *nànus*) forms. Excellent for rockeries and borders; also for lawn vases. L. H. B.

CENTROPÒGON (Greek *kentron*, spur, and *pogon*, beard, referring to the fringed stigma). *Campanulàceæ*. Sub-shrubs or shrubs, often scandent, grown under glass.

Plants with alternate mostly dentate lvs., and axillary, long, tubular fls. which are violet, purple, red, or orange, and usually borne singly on long peduncles: corolla 2-lipped, the tube incurved: bracteoles very small or wanting.—More than 100 species in Trop. Amer. Warmhouse perennials useful for hanging-baskets, prop. by cuttings which it is better to put under a bell-jar.

Lucyànus, Houll. Height 1–2 ft.: st. somewhat woody: lvs. short-petioled, finely toothed: fls. rose, hemispherical, with lanceolate segms. recurved at the tips. R.H. 1868:290. Native country unknown.—Described from a cult. specimen and said to be a hybrid of *C. fastuosus* and *Siphocampylus betulæformis*, but seems to show little influence of the latter, which has longer petioles and peduncles, more coarsely toothed lvs., longer calyx-segms., and a yellow-tipped corolla.

fastuòsus, Scheidw. Lvs. peach-like, oblong, acute, bordered with glandular teeth, very glabrous, short-petioled: fls. rose-colored, winter; calyx hemispherical, with 5 lanceolate denticulate segms. Mex. R.H. 1853: 181. Wilhelm Miller.

CENTROSÈMA (Greek, *spurred-standard*). *Leguminòsæ*. Butterfly-Pea. Twining or trailing herbs, one of which is sometimes cultivated.

Leaves pinnate, 3–7-foliolate: fls. in the axils, showy, white or reddish, papilionaceous, the standard spurred on the back, the keel broad, and the style bearded at the apex: pod long and narrow, many-seeded, with 2 thick-edged valves.—Species about 30 in Trop. Amer. and 2 in U. S. Centrosema is a more recent name than Bradburya of Rafinesque, but it is thoroughly established in usage and is retained in the "nomina conservanda" of the Vienna Congress.

virginiànum, Benth. (*Bradbùrya virginiàna*, Kuntze). Roughish, climbing, 2–6 ft.: lfts. ovate to linear, shining, stipitate: fls. 1–4 in the axil, 1 in. long, violet and splashed, showy: pod straight and long-pointed, 4–5 in. long. N. J. and S., in sandy lands. A.G. 13:649.—Intro. to cult. many years ago, but again intro. in 1892 (as *C. grandiflorum*), and much advertised. It is a hardy and desirable perennial vine, blooming the first season from seed; easily grown. There is a white-fld. form. L. H. B.

CENTURY PLANT: *Agave*.

CEPHAÈLIS (Greek-made compound, referring to the fls. being borne in heads). *Rubiàceæ*. Tropical shrubs, sub-shrubs or herbs, one of which yields ipecac; some of them sometimes rarely seen in growing collections. As the genus is commonly delimited, it comprises perhaps 75 species of both the eastern and western hemispheres. Engler & Prantl and others, however, unite it with the Linnæan Uragoga. Lvs. opposite, usually ovate, oblong or obovate: fls. mostly small, white, collected in an involucrate head; calyx 4–7-toothed and persistent; corolla trumpet-shaped or salver-shaped, the short limb 4–5-lobed; stamens 4 or 5, inserted in the throat of the corolla: fr. a dry or fleshy 2-seeded drupe. *C. Ipecacuánha*, Willd. (*Psychòtria Ipecacuánha*, Muell.-Arg. *Uragòga Ipecacuánha*, Baill.), from the root of which the commercial ipecac is produced, is a low creeping herb (4–8 in. high) with oblong-ovate entire lvs. which are pubescent beneath: heads becoming pendulous: root slender, knotty; it is exported in large quantities from Brazil. L. H. B.

CEPHALANDRA: *Coccinia*.

CEPHALANTHÈRA (Greek for *head* and *anther*). *Orchidàceæ*. About 10 species of small temperate-region terrestrial orchids, allied to Epipactis and Pogonia. Some of them are western N. American, and others are European. Sepals 3; petals small, ovate; lip saccate: lvs. (sometimes wanting) lanceolate or oblong: fls. mostly small (sometimes showy), in an open spike. The species are scarcely known in cult., but 2 Japanese species have been offered by importers. These are **E. falcàta** Blume, yellow, and **E. erécta,** Blume, white.

CEPHALANTHUS (Greek, *head* and *flower;* flowers in heads). *Rubiàceæ*. Button-Bush. Bush grown for its attractive white flower-heads appearing in summer.

Shrubs with opposite or whorled entire stipulate lvs.: fls. small, tubular, white or yellowish, 4-merous, with included stamens and long exserted style, in globular heads; ovary 2-celled: fr. dry, separating into 2 nutlets.—Five species in Amer. and Asia, of which only the one N. American species is cult: hardy ornamental shrub, with handsome glossy foliage and very attractive with its fl.-balls appearing late in summer. It thrives in any good garden soil, best in a sandy, somewhat moist one; naturally it grows in swamps and on the borders of streams and ponds, often with the sts. partly submerged. Prop. by seeds or by cuttings of ripened wood in fall, and also by greenwood cuttings taken from forced plants early in spring.



874. Cephalanthus occidentalis. (×⅓)

occidentàlis, Linn. Fig. 874. Shrub, 3–12 ft., sometimes tree-like: lvs. long-petioled, ovate or oval, acuminate, glossy above, glabrous or slightly pubescent below, 3–6 in. long: heads about 1 in. diam., long-peduncled, 3 or more at the end of the branches. July–Sept. From New Brunswick south, west to Ont. and Calif. Em. 394. R.H. 1889, p. 280. S.S. 14:711. Var. **angustifòlia,** André. Lvs. oblong-lanceolate, usually in 3's. R.H. 1889, p. 281.

C. natalénsis, Oliv. Branchlets hairy: lvs. ovate, acuminate, 1 in. long: fls. green, in solitary heads: fr. edible. S. Afr. B.M. 7400. Alfred Rehder.

CEPHALÀRIA (Greek for *head*, alluding to the capitate flower-clusters). *Dipsàceæ*. Coarse annual or perennial herbs planted to some extent in herbaries.

Much like Dipsacus, but the heads less spiny and mostly smaller: heads terminal, ovoid or globular, bearing many 4-parted yellowish, whitish or bluish florets; stamens 4, perfect; style filiform: fr. a 4–8-ribbed achene, the calyx-border often remaining on its summit.—About 30 species in the Medit. region, N. and S. Afr. and W. Asia; also in Abyssinia. Lvs. entire, dentate, or lobed. They are not much planted in Amer., but they make striking subjects for summer bloom, and the long sts. make them useful for cut-fls. The bloom is something like that of scabiosa. Of simple cult.; grown readily from seeds.

alpìna, Schrad. Perennial: tall and widely branched, 5 or 6 ft.: lvs. pubescent and pinnatifid, the segms. cut

and decurrent: fl.-heads sulfur-yellow; involucre with 8 aristate teeth. S. Eu.—A good coarse plant for summer bloom. Hardy N.

leucántha, Schrad. Perennial: lvs. pinnate-parted, the lobes linear or oblong: fls. in subglobose heads, creamy white, in autumn. S. Eu. Variable.

transylvánica, Schrad. Annual, slender, 2–3 ft.: lower lvs. lyrate; the segms. serrate and the terminal one large; upper lvs. pinnate-parted into linear-lanceolate divisions: fls. in globular heads on long peduncles, the ray-corollas bluish and disk-corollas whitish (fls. said to be yellow, in trade lists, to bloom June–Aug. and plant perennial). Greece and eastward.

tatárica, Schrad. Perennial, 6 ft., rank, with striate sts., suited to the rear border, where strong effects are desired, with showy cream-white, flat heads in July and Aug.: lvs. pinnate, the lfts. broad-lanceolate and serrate. Russia, Asia Minor and E.—Grows readily, and is increased by seed or dividing the clumps.

L. H. B.

CEPHALOCÈREUS (referring to the crown of long hair). Syn. *Pilocèreus*. *Cactàceæ*. Mostly large columnar plants, single or branched, usually characterized by an abundance of wool or long white hair developing at the top or on one side near the top: fls. nocturnal, small, thick, fleshy, naked: fr. small, globular berry, naked: seeds black.—Some 16 or more species are known.

The culture of the species is similar to that of the arborescent species of Cereus. The species of Cephalocereus are well suited only for large collections and are rarely seen elsewhere, except in the case of *C. senilis*, of which enormous quantities are shipped to Europe by commercial dealers. See *Succulents*.

senilis, Pfeiff. (*Pilocèreus senìlis*, Lem.). Old Man Cactus. Columnar, reaching a height of 35 ft. and a diam. of 1 ft., branching at the very base, the branches becoming parallel with the parent: ribs 20–30, very little elevated; areoles bearing 20–30 white, wavy bristles 2–5 in. long; later appear also, at first 1, then 3–5 strong, yellowish spines: fls. very numerous in the cephalium, nearly 4 in. long, red outside, reddish white within: fr. violet, 2 in. long. Cent. Mex. R.H. 1889, p. 568; 1890, p. 128.

Sartoriànus, Brit. & Rose (*Pilocèreus Houllètii*, of authors, not of Lem.). Tree-like, attaining 40 ft. in height: branches divaricate: cult. plants usually 3–4 in. diam.: ribs 6–8, rounded, glaucous: radial spines 7–9, spreading, ½in. long, honey yellow; central twice as long and stronger: areoles of the sterile st. with more or less hairs, which in the fruiting area are very numerous, making a shaggy tract sometimes 1 ft. long: fls. 3 in. long, imbedded in the wool, turbinate, greenish-red outside, rose-red within: fr. dark red, depressed-globose. Mex. R.H. 1862, pp. 427–30.

Róyenii, Brit. & Rose (*Pilocèreus Róyenii*, Rümpl. *P. floccòsus*, Lem.). Columnar, branching, reaching 15 ft. height, 2–3 in. diam.: ribs 9–10, obtuse, bluish, pruinose: spines 12–16, rigid, divaricate, bright amber-yellow, the inner ones larger, nearly an inch long: on the sterile branches long hairs are found on areoles, on the fertile bract these are more numerous and aggregated: fls. and fr. as in the last species, but lighter in color. Isl. of St. Croix.

Hoppenstédtii, Schum. (*Pilocèreus Hoppenstédtii*, Web.). Columnar, simple, slender, reaching a height of 30 ft.: ribs numerous, more than 16: radial spines 14–18, very short; centrals 5–8, the lower longest one reaching 3 in.; all the spines at first yellowish, then white: cephalium of 1–2 in. long tufts of yellowish hairs, forming a narrow bract on the north side of the plant: fls. 3 in. long, bell-shaped, whitish, with rosy tips. Mex.

polylòphus, Brit. & Rose (*Pilocèreus polylòphus*, Salm-Dyck. *Cèreus Nickelsii*, Hort.). Columnar, attaining a height of 50 ft. and a diam. of 1½ ft., rarely branching: ribs 10–22, sharp-angled, shallow, the old sts. perfectly cylindrical: spines small and bristle-like, less than ½in. long; radials 5–6; central usually 1; spines of the flowering area 2–3 in. long, crowded: fls. large, trumpet-shaped, dark red: fr. red, scaly. Mex.

scopàrius, Brit. & Rose (*Pilocèreus scopàrius*, Poselg.). Tree-like, richly branched, 25 ft. high, 1 ft. diam.: radial spines 12–15, very short; centrals 7–8, not much longer; in the flowering branches the spines change to longer stout bristles and the areoles are closer together, forming a bristly cephalium: fls. small, bell-shaped, reddish: fr. size of a hazelnut. Near Vera Cruz, Mex.

exèrens, Rose (*Pilocèreus exèrens*, Schum. *P. vìrens*, Lem.). Branching at base, 3–4 ft. high, 2–3 in. diam., tapering above: ribs 4–6, obtuse, the sterile shoots with short, sparse, woolly hairs at the top: spines commonly 7: radials, very short, 1–3: centrals 4 times as long; woolly hairs much more abundant on the blooming plant: fls. about 3 in. long, trumpet-bell-shaped, without wool or spines. Brazil.—Not common, if occurring at all, in cult. in U. S.

The following species have been reported or may be expected in cult., but none is as yet at all common. *C. chrysocánthus*, Brit. & Rose; *C. comètes*, Brit. & Rose; *C. lanuginòsus*, Brit. & Rose; *C. Russellìanus*, Rose (Cereus Russellianus, Rümpl.). *C. nóbilis*, Brit. & Rose.

J. N. Rose.

CEPHALOSTÀCHYUM (Greek, *head* and *spike*). *Gramìneæ*. A few species of grasses of the bamboo tribe in E. Indies and Madagascar, one of which (*C. pergracile*) has been offered in this country. Tall shrubs: spikelets in dense solitary heads at the ends of the branches or in scattered glomerules, the heads bristly with the subtending lvs.; stamens 6; empty glumes 1–2; style long, 2–3-cleft: fr. elongated and beaked. **C. pergrácile,** Munro. Forty ft., sts. 2–3 in. thick: lvs. 14 in. or less long: an elegant species, growing in clumps. Burma. It is offered in S. Calif. In Fla., it loses most of its lvs. in winter, but the new growth in spring and summer is very attractive; it is said not to do well there on high dry pine land, preferring moderately moist soil; it needs much water in summer, and responds readily to fertilizer.

L. H. B.

CEPHALOTÁXUS (Greek, *head; Taxus*-like plant, with fls. in heads or clusters). *Taxàceæ*. Yew-like plants, grown for their handsome evergreen foliage.

Trees or shrubs, with evergreen linear pointed lvs. with 2 broad, glaucous lines beneath, arranged in 2 rows: fls. diœcious, staminate in 1–8-fld., short-stalked clusters, pistillate consisting of a small cone with several bracts, each bearing 2 naked ovules: seed inclosed in a fleshy envelope, drupe-like, about 1 in. long, reddish or greenish brown. From allied genera it may be easily distinguished by the resin-canal in the center of the pith; and by the glaucous lines beneath from Taxus, which has the lvs. yellowish green beneath; and from Torreya by the glaucous lines being broader than the 3 green lines, while in Torreya the glaucous lines are narrower than the green ones.—Six closely allied species from Himalayas to Japan.

These are ornamental evergreen shrubs, in appearance very like a yew, but of more graceful habit. Not hardy North, or only in very sheltered positions. They thrive best in a somewhat moist but well-drained sandy loam, and in partly shaded situations. Propagated by seeds, stratified and sown in spring; imported seeds usually do not germinate until the second year; increased also by cuttings in August, under glass, and by veneer-grafting in summer, on one of the species or on *Taxus baccata*. For cions and cuttings, terminal shoots should be chosen, which form regular plants with whorled branches like seedlings, while cuttings from lateral branches grow into irregular, low, spreading shrubs.

A. *Lvs. 2–3 in.: branchlets yellowish green, pendulous.*

Fórtunei, Hook. Lvs. tapering gradually into a sharp point, usually falcate, dark green and shining above: fr. greenish brown, obovate. N. China, Japan. B.M. 4499. F.S. 6:555. R.H. 1878, p. 117.—This is the most graceful species, with long and slender branches, attaining in its native country 50 ft. in height, in cult. usually remaining a shrub.

AA. *Lvs. 1–2 in. long.*

B. *Base of lvs. cuneate; lvs. loosely 2-ranked.*

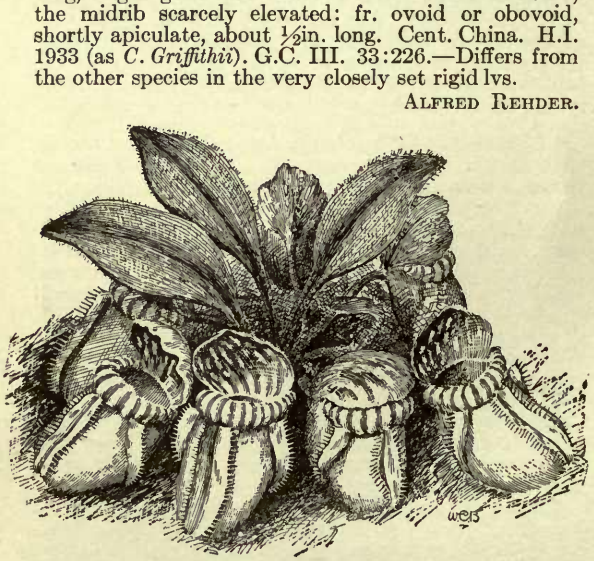
Harringtònia, Koch (*C. pedunculàta*, Sieb. & Zucc. *C. drupàcea* var. *Harringtònia*, Pilger). With spreading, often somewhat pendulous branches, dark green when young: lvs. to 2 in. long, narrowed into a sharp point, shining and dark green above: staminate fls. distinctly peduncled: fr. ovoid, rounded at both ends, rarely globular. Japan, China. G.C. II. 21:113; III. 18:716; 33:228.—In Japan, tree to 25 ft., usually shrub in cult. A remarkable form is var. **fastigiàta,** Silva Tarouca (*C. pedunculàta* var. *fastigiàta*, Carr. *Podocárpus koraiàna*, Sieb. & Zucc.), of columnar habit, with upright branches and spirally arranged lvs. G.C. II. 21:112; III. 33:229. S.H. 2:450. Gng. 2:341. Var. **sphæràlis,** Rehd. (*C. pedunculàta* var. *sphæràlis*, Mast.), has globose fr.: lvs. falcate, subacuminate, 1½–2 in. long. G.C. II. 21:117.

drupàcea, Sieb. & Zucc. Branches spreading, stiff, usually light green when young: lvs. about 1 in. long, abruptly pointed, narrow and straight, often upturned: staminate fls. very short-stalked: fr. usually obovate, narrowed at the base. Japan. G.C. III. 18:717; 33: 227. B.M. 8285.—The dwarfest species. Var. **sinénsis,** Rehd. & Wilson. Shrub, to 12 ft.: lvs. linear-lanceolate, tapering to sharp point. Cent. and W. China.

BB. *Base of lvs. truncate; lvs. very closely set.*

Óliveri, Mast. Shrub or small tree: lvs. strictly 2-ranked, rigid, broadly linear, spiny-pointed, about 1 in. long, bright green with 2 broad white bands beneath, the midrib scarcely elevated: fr. ovoid or obovoid, shortly apiculate, about ½in. long. Cent. China. H.I. 1933 (as *C. Griffithii*). G.C. III. 33:226.—Differs from the other species in the very closely set rigid lvs.

ALFRED REHDER.



875. Cephalotus follicularis.

CEPHALÒTUS (Greek, *head-shaped*, in reference to the knob-like swelling behind each anther). *Cephalotàceæ*, a monotypic family near *Saxifragàceæ*. The one species **C. follicularis,** Labill. (Fig. 875), is abundant at King George's Sound and Swan River in S. W. Austral. From there it has frequently been intro. into cult., and is now met with in American collections. The short creeping rhizomes form 2 sets of lvs. each season: a set of 4–6 flat spatulate lvs., and later as many dainty pitchered lvs. that are richly colored green, crimson or purple, and white. The pitchers are ½–1½ in. long, are covered externally with minute alluring glands, and these with the coloring attract insects. They slip from the smooth-ribbed rim into the cavity, and there are digested by ferment liquids poured out by special glands. The erect scape bears an interrupted spike of small white apetalous fls., each with a 6-parted calyx, 12 stamens, and 6 separate 1-seeded carpels. The plant grows best under a bell-jar, and in a pot amongst fine sandy loam that is covered by sphagnum moss. The lower part of the pot should stand in a vessel with about ½in. of water, and the whole should be placed in a cool greenhouse near the light, when the pitchers assume richest colorings. Prop. is easily effected by separation of small pieces of rhizome that bear 1 or 2 lvs., also by seeds that mature not unfrequently under cult. R. B. 23, p. 233. I.H. 27:391. F.S. 3:290. G. 23:340. G. W. 8:390. J.H. III. 35:260.

J. M. MACFARLANE.



876. Cerastium arvense.

CERÁSTIUM (Greek for *horn*, alluding to the shape of the pod). *Caryophyllàceæ*. MOUSE-EAR CHICKWEED. Decumbent annuals or perennials, used in rockeries or for bedding and borders.

Pubescent or hirsute herbs, rarely glaucous: lvs. small, opposite, entire: fls. white, borne in terminal, dichotomous cymes; sepals 5, rarely 4; petals as many, emarginate or 2-cleft; stamens 10, rarely fewer; styles 5, rarely 4 or 3, opposite the sepals: caps. cylindric, often curved, dehiscing at the top by 10, rarely 8, teeth.—About 100 species of world-wide distribution according to the largest delimitation of the genus; by some authorities reduced to 40 or 50 species.

Cerastiums are of easy culture in ordinary garden soil. They are propagated by divisions or by cuttings taken after flowering and planted in a shady place. They are more or less used for edgings and in rockeries.

A. *Lvs. green, merely pubescent.*

arvénse, Linn. (var. *oblongifòlium*, Holl. & Brit.). STARRY GRASSWORT. Fig. 876. Perennial, low, much branched and matted: sts. 8–12 in. long: lvs. oblong or lanceolate, pale green, pubescent, obtuse, ½–1½ in. long, ¼in. wide: fls. very numerous, appearing in Apr. and May; petals 5, deeply bifid: caps. twice as long as the calyx.—A species of very wide range, growing mostly in dry rocky places from Labrador to Alaska and south to Ga. and Calif.; also in Asia and Eu. Gn. 71, p. 504.—Recommended as a bedding plant, for its mat-like habit, covered with white bloom. Var. **compáctum,** Hort., is hardy in S. E. Canada.

purpuráscens, Adams. Perennial, hairy, pubescent, cespitose, about 4 in. high: lower lvs. oblong, narrowed into the petiole; upper lvs. linear-lanceolate: cymes dichotomous or often simply umbelliform; fls. white; petals twice as long as calyx, ovate-oblong: caps. cylindric, twice as long as calyx. Asia Minor.—Hardy.

AA. *Lvs. silvery or grayish.*

B. *Caps. equaling the calyx.*

grandiflòrum, Waldst. & Kit. (*C. argénteum,* Bieb.). Creeping perennial: lvs. linear, acute, the margins reflexed: infl. dichotomous; fl.-sts. 6–8 in. high; petals oval, 2-parted, transparent white, twice as long as calyx. E. Eu.

BB. *Caps. much longer than the calyx.*

Biébersteinii, DC. Perennial: sts. 6 in., creeping, diffuse, branched: lvs. ovate-lanceolate, tomentose-woolly: peduncles erect, dichotomous; fls. white: caps. ovate-cylindrical. Tauria. B.M. 2782. Gn. 59, p. 470. —Like *C. tomentosum,* but with larger lvs. Fine for edgings.

Boissièri, Gren. Perennial, low: lvs. silvery, ovate-lanceolate, acute, entire, sessile: peduncles 4–12 in. high; infl. a dichotomous cyme; fls. large, white. Spain.

tomentòsum, Linn. SNOW-IN-SUMMER. Perennial, low, creeping, branched: lvs. oblong, spatulate, grayish woolly, upper lvs. lanceolate: peduncles 6 in. high, erect, dichotomous; fls. white: caps. cylindrical. Eu. G. 29:555. Gn. 69, p. 143.—Much used for edgings.

E. Z. B.†

CÉRASUS (from *Cerasunt* or *Cerasonte,* a place in Asia Minor on the Black Sea, whence cherries are said to have been brought to Italy before Christ). CHERRY. *Rosàceæ.* Tournefort in 1700 founded the genus Cerasus, but by general usage it is now combined with Prunus inasmuch as no single important character holds clearly between the two groups. The name is sometimes kept distinct in trade lists, representing the cherries as distinct from the plums. Botanically, the group is distinguished from Prunus proper (the plum group) in having conduplicate vernation (young lvs. with the halves folded together) rather than involute vernation, fls. more characteristically in umbels or racemes, fr. mostly lacking bloom and pubescence, and the stone not corrugated or pitted. See *Prunus.*

L. H. B.

CERATÌOLA (Greek, *a little horn,* referring to the four-branched, serrate stigma). *Empetràceæ.* A heath-like evergreen, from the sand barrens of South Carolina to Florida and Alabama; rarely cultivated North, but not hardy.

Branches often whorled as are the lvs., which are narrow, strongly revolute and thus almost tubular: fls. diœcious, 2–3-whorled in the axils, sessile; sepals, petals and stamens, each 2.—Only 1 species.

ericoìdes, Michx. Height 2–8 ft.: branches subverticillate, marked with scars of numerous fallen lvs., the younger and upper ones only retaining foliage: lvs. crowded, ½–¾in. long, linear, rigid, shining, pale: fls. inconspicuous reddish, whorled in the axils: drupe round, orange-yellow, berry-like. B.M. 2758.

N. TAYLOR.†

CERATÓLOBUS (Greek for *horned pod*). *Palmàceæ,* tribe *Calámeæ.* Low or creeping pinnate palms allied to Calamus, and not as yet common in the American trade.

Stems and lf.-stalks spiny but not the lf.-blades: sts. frequently 30 ft. or more long and armed with stout spines an inch long: lvs. pinnate, often as much as 7 ft. long, with numerous alternate or opposite lfts., which are crenate-dentate towards the apex: fls. polygamous-monœcious, in a paniculately branched spadix: fr. drupe-like, 1-seeded.—There are only 3 wild species and 2 species known in horticultural literature, the botanical status of which is doubtful. All the wild species come from Java or Sumatra. For cult., see *Calamus* to which Ceratolobus is closely related, differing in having rhomboid, not linear lfts. G.C. II. 23:338.

glaucéscens, Blume. St. up to 30 ft. and about as thick as one's wrist: lvs. 6–7 ft. long, of 14–18 sessile, erect or spreading lfts. which are 8–10 in. long, 2½–3½ in. wide, opposite above, alternate below: spadix from the axils of the upper lvs.: spathes 2-horned, 4–6 in. long. Java.

C. cóncolor, Blume. Similar, with 10-14 lfts., relatively broader than in C. glaucescens. Sumatra.—*C. Findleyànus,* Hort. Lvs. 2–4 ft. long, clear pale shining green. Hab.(?). A.G. 15:169.—*C. Micholitziàna,* Hort. Very elegant palm, the st. and lf.-rachis with scattered spines: lvs. oblong, the lfts. remote, linear-oblong, acute, pale on the under surface.—Horticulturally the most attractive of the group.

N. TAYLOR.

CERATÒNIA (Greek for *horn,* in reference to the large pod). *Leguminòsæ.* CAROB. A handsome evergreen tree, bearing large pods that are used somewhat for human food but chiefly for forage.

One of the Cassia tribe: calyx-tube disk-bearing, somewhat top-shaped, the segms. 5 and short; petals 0; stamens 5: pod long (4–12 in.), compressed, thick and coriaceous, indehiscent, filled with a pulpy substance, bearing obovate transverse seeds. **C. Síliqua,** Linn. (Figs. 877, 878), the only species, is now widely distributed in warm countries, being grown both for shade and for the edible pods. It reaches a height of 40–50 ft.: lvs. pinnate, shining, the 2–3 pairs of lfts. oval and obtuse: fls. in small lateral red racemes, polygamo-diœcious, the trees said to be variable in sexuality at different ages. It thrives well in S. Calif. and S. Fla. The dry pods are occasionally seen in the fruit stands in northern markets. There are many varieties, differing in the size and shape of pod. The Ceratonia is known also as Algaroba, Karoub, Caroubier, and St. John's Bread. The last name records the notion that the seeds and sweet pulp are respectively the locusts and wild honey which St. John found in the wilderness. The dry valves or pods have been supposed to be the husks that provided the subsistence of the prodigal son. See G.F. 3:318, 323. The seeds are said to have been the original carat weight of goldsmiths.



877. Ceratonia Siliqua.

L. H. B.

The carob is of much importance as a farm crop throughout the Mediterranean basin and other hot and semi-arid regions. According to Alphonse de Candolle, its original home was about the eastern end of the Mediterranean, including the southern coast of Asia Minor and Syria and perhaps Tripoli. Its cultivation began in historic times, and was diffused by the Greeks in Italy and Greece and was carried by the Arabs west as far as Spain and Morocco. In all these countries the large pods, rich in protein and sugar, are a very important forage crop, being eaten with avidity by all kinds of stock, besides furnishing considerable sustenance to the poor in times of scarcity, and are also used for the manufacture of syrups and different fermented drinks. Carob pods were the main sustenance of Wellington's cavalry in the Peninsular campaign and at the present time are the chief food of the British army horses on the island of Malta and the horses of the tramways in the cities of southern Italy. They form one of the principal exports of Palestine, Syria and especially of the island of Cyprus. Thousands of tons are annually imported into England where they are ground for stock-feed. A. Aaronsohn, Chief of the

Jewish Experiment Station in Palestine, says that an acre of carob trees on arid soil yields a much greater quantity of food matter than an equal area planted with the best alfalfa. He gives the sugar content at 40 per cent and in some varieties even higher, and the protein content as 7 to 8 per cent. The French and Portuguese writers give somewhat lower percentages, but this seems to be much a matter of climate and varieties. The analysis published by Rivière and Lecoq points to a high digestive coefficient, and nutritive value a little higher than oats; it is estimated that 147.5 kilos of carobs equals 100 kilos of wheat (a kilo is nearly 2¼ pounds).

The first introduction of the tree into this country on a considerable scale was by the U. S. Patent Office from Alicante, Spain, in 1854 and from Palestine in 1859. About 8,000 plants, grown from seed in Washington, were distributed during the spring of 1860, mostly in the southern states. Some of these plants probably found their way to California, as a number of old trees are growing in various parts of that state from San Diego on the south to Napa and Butte counties on the north. The latest importation was in June, 1911, from Valencia, Spain, by the Office of Foreign Seed and Plant Introduction of the Department of Agriculture. This shipment consisted of cuttings of six of the leading varieties grown in that district which are now being propagated by budding at the Chico (California) Introduction Field Station and will soon be available for distribution.

Centuries of cultivation have given rise to a large number of varieties, differing in quality of pods, vigor and productiveness and adaptability to various soils. The species is either diœcious or monœcious. All trees in California are of course seedlings and, as far as examined by the writer, monœcious, although Aaronsohn states that the best kinds in Palestine are diœcious, and a sufficient number of staminate trees, therefore, must be planted with those varieties to pollinate the female trees. In the province of Algarvia, Portugal, seventeen named varieties are cultivated and about as many in France and Spain. The best of these should be introduced into this country.



878. Pods of Ceratonia Siliqua.

The carob tree thrives only in a warm climate, the range being about the same as that of the orange, but with a little protection for two or three winters, the range can be considerably extended. At the Government Field Station at Chico, several varieties have survived temperatures of 18° to 22°, while others when young have been killed to the ground by the same degrees of frost. The old trees scattered about the Pacific Coast States show that a large area is adapted to it.

In France, Spain and Portugal, the carob grows in most kinds of soil, except in stiff clay or wet ground, and even in gravel if fertile and permeable to the roots. The crop is sufficiently valuable to make it worthy of the best soil and treatment.

The carob is usually grown from seed and afterwards budded to the best varieties. It can be raised from cuttings, but requires bottom heat and careful treatment. At the Chico Field Station, where thousands of seedlings are grown, the best success is had by planting under glass. Quicker germination is secured by soaking the seed in water for three or four days or until they begin to swell. The tree is difficult to transplant and usually fails unless moved with a ball of earth. The best results are had by growing the plants in pots or in "flats" in tenacious soil, as is the practice with eucalyptus, when the trees are cut apart and lifted with squares of earth attached. At Aleppo, in Syria, the growers make pots of a mixture of clay and cow-dung which, dried in the sun, are strong enough to hold the earth in which the seeds are planted. When ready to put into the orchard the pot is sunk where the tree is to stand. As soon as the pot becomes moist from contact with the earth, it is readily permeable by the roots.

While the carob is a rather slow grower, it lives to a great age and should be planted not less than 35 to 40 feet apart, with interplanting of peaches or other growths for income until the carobs begin to bear. In Algiers and Tunis, it is often planted as a border tree, for which its beauty and utility admirably fit it. When well established, the seedlings are budded with the best varieties. If buds are taken from bearing trees, fruit may be expected in three or four years. In California seedlings bear when six to eight years of age. While it is eminently a dry-climate tree, two or three summer irrigations will greatly aid the development, hasten fruiting and increase the yield. It will respond to the same good treatment that is given to a well-kept fruit orchard.

The crop matures in September and October and, as with most other fruit trees, it is most abundant every second year. When ripe, the pods turn brown and begin to fall. Those that fail to drop are easily knocked down with bamboo or other poles.

Aaronsohn gives the crop in Palestine in good years at an average of 450 pounds to the tree, and states that he has seen wild stocks fifteen to eighteen years after grafting give a yield of 900 to 1,000 pounds of pods. Du Breuil gives the yield in southern France at 220 pounds and mentions single trees at Valencia, Spain, that produce as high as 1,380 kilos, or 3,040 pounds. Rivière and Lecoq report the yield of trees in Algiers at 100 to 300 kilos, or 220 to 660 pounds. Francis de Mello Lotte gives the crops of mature trees on deep fertile soil in Algarvia, Portugal, at 300 to 750 kilos, or 660 to 1,650 pounds each. As the pods are equal in nutrients to barley and superior to oats for feeding and fattening cattle, sheep, hogs and horses, and the yield is from three to four times the weight per acre of grain, it is evident that few crops will give the farmer an equal value. In the mild climate of the Gulf States, especially the coastal regions of Texas, the southern parts of New Mexico and Arizona and the greater part of California, this beautiful and valuable evergreen tree, when once appreciated, is bound to become a staple addition to farm crops for the nourishment of both man and beast.

G. P. Rixford.

CERATOPÉTALUM (Greek, *horned petal*). *Cunoniàceæ;* by some, *Cunoniaceæ* is included in *Saxifragaceæ*. Greenhouse trees or shrubs.

Glabrous and resinous trees and shrubs: lvs. opposite, compound, with 1–3 digitate lfts.: fls. small, white, rose or yellow, in terminal branching cymes or panicles; calyx-tube short, 5-lobed; petals 0, or, if present, laciniate; stamens 10, with connectives: fr. a small and hard achene-like body, with persistent calyx-lobes, 1-seeded.—Two or 3 species, in Austral.

gummíferum, Smith. Tree, 30–40 ft.: lfts. 3, lanceolate, serrulate, narrowed at base, shining and strongly nerved: petals deeply 3–5-lobed, not exceeding the calyx.—Said to thrive in a peaty soil, and to prop. by cuttings of half-ripened wood under glass. L. H. B.

CERATÓPTERIS (Greek, *horned fern*). *Ceratopteridàceæ*. Very succulent tropical ferns, forming also a distinct family. They are the only truly aquatic plants among true ferns and grow floating or rooted under water in the mud or sometimes only occasionally flooded. The lvs. are borne in rosettes, the sterile



879. Ceratopteris pteridoides. (×⅓)

spreading, often floating, the fertile more erect, 2–4-pinnate, with very slender rolled-up pod-like segms.: sporangia very large, borne separately along the veins and covered by the revolute margins somewhat as in Pteris.—Species very few. Best grown by planting in pots, slightly submerged. Reproduced by buds which arise from all parts of the lvs. New plants must be developed each season. Useful in ponds and aquaria.

pteridoìdes, Hook. Fig. 879. Sterile lvs. broadly deltoid, short-stalked, the margins irregularly lobed, floating; the fertile lvs. taller, completely divided into long whip-like segms.: sporangia with a very small annulus, and containing 32 spores. Fla. to S. Amer.

thalictroìdes, Brongn. Sterile lvs. narrowly deltoid, long-stalked, 1–2 pinnatifid into deltoid segms. not floating; fertile lvs. similar but with linear segms.: annulus well developed. Old World tropics.

R. C. Benedict.

CERATOSTÍGMA (Greek, *horned stigma*). *Plumbaginàceæ*. Diffuse glabrous perennial herbs or subshrubs, one of which is in cultivation as a bedding and border plant.

Ceratostigma differs from Plumbago in having no glands on the calyx, stamens adnate to the corolla-tube, fls. in dense clusters rather than spicate, and other technical characters: lvs. alternate, lanceolate or obovate, more or less ciliate: fls. mostly in terminal heads, blue or rose; calyx tubular, deeply 5-parted, the lobes narrow; corolla salver-shaped, the tube long and slender, the limb spreading and with 5 obovate obtuse or retuse lobes; stamens 5, attached on the corolla-tube: fr. a 5-valved caps. inclosed in the calyx.—Species 4 or 5, in N. China, Himalayas, Abyssinia.

plumbaginoìdes, Bunge (*Plumbàgo Lárpentæ*, Lindl. *Valoràdia plumbaginoìdes*, Boiss.). Herb, 6–12 in., the st. red and branchy: lvs. entire, strongly ciliate on the edges: fls. with a deep blue limb, the 5 lobes minutely toothed, collected in dense heads or umbels. China. B.M. 4487. F.S. 4:307.—A hardy bedding plant, producing profusely of its deep blue fls. late in fall; very valuable. Needs covering in winter in the N.

Under the name *C. Pólhilli*, a dwarf and creeping shrub, with delicate lavender fls., is mentioned in British journals as coming from high elevations in W. China and giving promise as an outdoor subject.

L. H. B.

CERATOTHÈCA (Greek for *horned capsule*). *Pedaliàceæ*. Tropical African glasshouse herbs.

Leaves opposite, ovate: calyx 5-parted; corolla 2-lipped, the lower lip very long in proportion to the upper: fls. in pairs in the axils: caps. 2-horned.—Five species. **C. trîloba,** Mey., is occasionally grown in S. Fla., and it may be adapted to glasshouses. It is a tall herb (5 ft.), with the habit of foxglove, probably biennial, hairy and rather fleshy: lower lvs. stalked, broadly ovate or almost round, the upper sometimes broadly angular and even 3-lobed, both kinds crenate-dentate: corolla 3 in. long, blue or violet-blue, pubescent, deflexed, the lower lobe prolonged. Handsome. B.M. 6974.—Could be grown in temperate house N. in sandy loam.

N. Taylor.†

CERATOZÀMIA (Greek, *horned Zamia;* referring to the horned scales of the cones, which distinguish this genus from Zamia). *Cycadàceæ*. Handsome Mexican foliage plants, with cycas-like leaves, but less cultivated in American palm-houses than Cycas.

Trunk erect in age, crowned by a whorl of pinnate cycas-like lvs. which are petiolate and unarmed: fls. in cones borne from among the lvs., the cones often stalked: seeds rare and little known. —Six species. Best raised from young imported plants, but rarely prop. by seeds, or by offsets from the slow-growing trunk. Burn out the center of the plant with a hot iron, and a number of offsets will spring from the trunk and the crown; these may be used for prop.

mexicàna, Brongn. Fig. 880. Trunk thick, short, covered with the remains of fallen lf.-stalks: lvs. rich, dark green, pinnate, on prickly petioles 5–6 in. long, which are shaggy when young; lfts. very numerous, 6–12 in. long or more, lanceolate: cones produced annually on separate plants; female cones 9–12 in. long, 4–6 in. thick, the scales 2-horned; male cones narrower, longer, on a hairy stalk, the scales with 2 small teeth. Mex. Gn. 9, pp. 308–9.—An excellent decorative plant, best grown in sandy loam. Give freely of water and heat in spring and summer, but keep cooler and drier in winter. Somewhat tender although grown in Cent. Fla.

C. Miqueliàna, Wendl. A plant with 20–30 pairs of lfts. and a lf.-stalk 18 in. long: fr. not known certainly. Cult. in botanic gardens and worthy of wider use. Mex. and W. Indies.

N. Taylor.†

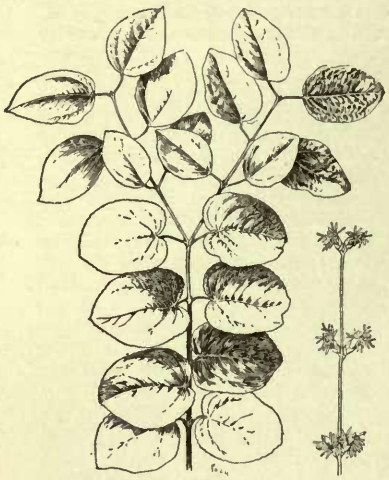
CERCIDIPHÝLLUM (*Cercis* and *phyllon*, leaf; the lvs. resemble those of Cercis). *Trochodendràceæ*. Tree grown for its handsome foliage and habit.

Leaves deciduous, usually opposite, petioled and palmately nerved: fls. dicœcious, inconspicuous, apetalous, solitary; staminate nearly sessile, bearing numerous stamens with slender filaments; pistillate pedicelled,



880. Ceratozamia mexicana.—Young plant (fertile).

consisting of 3–5-carpels, ending in long, purplish styles and developing into about ¾in. long, dehiscent pods, with many seeds.—One species in Japan and W. China. Hardy, ornamental, shrubby tree of pyramidal and, when young, almost fastigiate habit, with handsome, light green foliage, purplish when unfolding, turning bright yellow or partially scarlet in fall. It prefers rich and moist soil, and grows rapidly when young. Prop. by seeds, sown in spring, and by greenwood-cuttings, taken from forced plants in early spring, or by layers; cuttings from half-ripened wood in summer, under glass, grow also, but not very well.



881. Cercidiphyllum japonicum. (×⅓)

japónicum, Sieb. & Zucc. Fig. 881. Bushy tree, commonly with several trunks, usually 20–30 ft., but sometimes rising to 100 ft., with slender, glabrous branches: lvs. opposite, occasionally alternate, slender-petioled, cordate, orbicular or broadly ovate, obtuse, crenate-serrate, glabrous, glaucous beneath, 2–3 in. long. Japan. G.F. 7:106, 107, and 6:53. Mn. 3:74. Gng. 5:135. F.E. 32:211 (habit). P.G. 2:105. S.I.F. 1:41. —A very desirable tree, one of the best introductions from Japan. Var. **sinénse,** Rehd. & Wilson. Tree, to 120 ft., usually with a single trunk: petioles shorter, about ¾in. long, somewhat hairy on the veins beneath: caps. gradually narrowed at the apex, ½in. long. W. China.—This recently intro. variety is perhaps still more desirable than the type. It is the largest of all broad-lvd. trees known from China; the trunk is sometimes free of branches for nearly 50 ft. above the ground and attains to 25 ft. or exceptionally to 55 ft. in girth.

ALFRED REHDER.

CÉRCIS (*Kerkis*, ancient Greek name). *Leguminòsæ.* JUDAS TREE. RED-BUD. Trees or shrubs grown for their pink flowers profusely produced early in spring before the leaves; very interesting, also, in mode of branching, as seen in mature trees.

Leaves deciduous, alternate, petioled, palmately nerved, entire: fls. papilionaceous, pedicelled, pink or red, appearing before or with the lvs., in clusters or racemes from the old wood; calyx 5-toothed, red; petals nearly equal, the uppermost somewhat smaller: pod compressed, narrow-oblong, narrow-winged on the ventral suture, many-seeded.—Seven species in N. Amer., and from S. Eu. to Japan.

These trees and shrubs are very ornamental, with handsome distinct foliage and abundant showy flowers in spring, very effective by their deep pink color. They are well adapted for shrubberies or as single specimens on the lawn, and attain rarely more than 20 or 30 feet in height, forming a broad, irregular head when older. Only *C. canadensis* is hardy North, while *C. chinensis* can still be grown in sheltered positions near Boston, but is occasionally injured in severe winters; the others can not be grown successfully farther north than New York. They grow best in rich sandy and somewhat moist loam, and should be transplanted when young, as older plants can hardly be moved with success. Young plants, four or five years old, produce flowers freely and may be recommended for forcing, especially *C. chinensis* and *C. racemosa*, which are the most beautiful of all. Propagated by seeds, sown in spring, best with gentle bottom heat; sometimes increased by layers, or by greenwood cuttings from forced plants in early spring; *C. chinensis* grows also from greenwood cuttings in summer under glass.

A. *Lvs. abruptly and short-acuminate.*

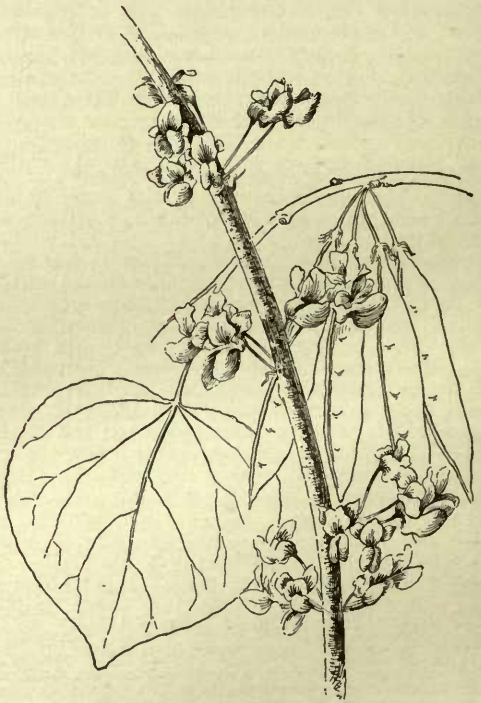
B. *Fls. in clusters: lvs. usually pubescent only beneath near the base.*

canadénsis, Linn. Fig. 882. Tree, to 40 ft.: lvs. roundish or broadly ovate, usually cordate, 3–5 in. long: fls. rosy pink, ½in. long, 4–8 in clusters: pod 2½–3½ in. long. From N. J. south, west to Mo. and Texas. S.S. 3:133–4. A.F. 13:1370. Gng. 6:290. F.E. 9:593. Mn. 2, p. 139. M.D.G. 1899:434–5 (habit). Gn. 25, p. 347.—A very desirable ornamental tree for the northern states. Var. **álba,** Rehd. Fls. white. Var. **plèna,** Schneid. Fls. double.—Recently *C. canadensis* has been split by Greene into several new species (see Fedde, Rep. Spec. Nov. Veget. 11:110).

chinénsis, Bunge (*C. japónica,* Sieb.). Fig. 883. Tree, to 50 ft., shrub in cult.: lvs. deeply cordate, roundish, with a white, transparent line at the margin, subcoriaceous, glabrous, shining above, 3–5 in. long: fls. 5–8, purplish pink, ¾in. long: pod 3–5 in. long, narrow. China, Japan. F.S. 8:849. Mn. 2:139. G.F. 6:476.—A very beautiful species, with the fls. nearly as large as those of *C. Siliquastrum* and more abundant.

BB. *Fls. in pendulous racemes.*

racemòsa, Oliv. Tree, to 30 ft.: lvs. broadly ovate, truncate or subcordate at the base, pubescent beneath,



882. Cercis canadensis. (×½)

2½–4 in. long: fls. rosy pink, about ½in. long on slender pedicels of about equal length, in many-fld. racemes 1½–3 in. long: pod 2½–4 in. long. Cent. China. H.I. 1894.—The handsomest of all. Young plants have not proved hardy at the Arnold Arboretum, but it is perfectly hardy in S. England.

AA. *Lvs. rounded or emarginate at the apex, usually broader than long.*

occidentàlis, Torr. (*C. califórnica,* Torr.). Shrub, to 15 ft.: lvs. cordate, roundish, glabrous, about 2 in. wide: fls. rose-colored, ½in. long: pod 2–2½ in. long. Calif. Torrey in U. S. Explor. Exped. 1838–1842, 17, pl. 3.—A closely allied species is *C. renifórmis,* Engelm. (*C. texénsis,* Sarg.). Small tree: lvs. subcoriaceous, 3–5 in. wide, sometimes pubescent beneath: pod 2–4 in. long. Texas, New Mex. S.S. 3:135.

Siliquástrum, Linn. Tree, to 40 ft.: lvs. roundish, deeply cordate, glabrous, 3–5 in. wide: fls. 3–6, purplish rose, ¾in. long: pod 3–4 in. long. S. Eu., W. Asia. B.M. 1138. Gn. 25, pp. 346, 347, 350; 33, p. 416; 42:342, p. 343; 44, p. 379; 52, p. 5. G.C. III. 52:6 (habit). G. 25:209. R.H. 1899:469 (abnormal form). Var. **álba,** Carr. (var. *álbida,* Schneid.) with white fls.



883. Cercis chinensis. (Natural size)

CERCOCÁRPUS (Greek, *tail* and *fruit;* the fruit with a long, hairy tail). *Rosàceæ.* Mountain Mahogany. Small trees or shrubs but rarely grown for their attractive evergreen or half-evergreen foliage and the peculiar feathery tailed achenes.

Leaves alternate, persistent, rather small: fls. inconspicuous, apetalous, whitish or reddish, in the axils of fascicled lvs.; calyx-tube cylindric, elongated, abruptly expanded at the apex into a cup-shaped deciduous, 5-lobed limb bearing 15–30 stamens with short filaments; ovary 1-celled, inclosed in the calyx-tube, with a long exserted style.: fr. a 1-seeded achene, surmounted by the persistent, long and hairy style.—Small genus of about 10, mostly rather local species, in the Rocky Mts. from Mont. south to Mex. and in Calif.

The cercocarpuses are not particularly ornamental, yet they are attractive with their small evergreen dark foliage and their feathery tailed fruits; they are adapted for planting on dry rocky or gravelly slopes in arid temperate regions, as they thrive under very unfavorable conditions. The very heavy and close-grained wood is manufactured into small articles, and valued as fuel and for making charcoal. *C. ledifolius* and *C. parvifolius* are the hardiest and stand frost to zero, while *C. Traskiæ* can be grown only in southern California. They may be cultivated in any well-drained soil in sunny positions, and propagated by seeds or by cuttings of half-ripened wood under glass.

A. *Margin of lvs. toothed: fls. 2–5 in a cluster.*

B. *Lvs. oval to suborbicular, usually rounded at the base.*

Tráskiæ, Eastw. Tree, to 25 ft.: lvs. coarsely sinuate-dentate above the middle, lustrous above, tomentose below, 1–2½ in. long: achene with the style 2–2½ in. long. Santa Catalina Isl., Calif. S.S. 13:635.

BB. *Lvs. usually cuneate-obovate, smaller.*

parvifòlius, Nutt. Bushy tree, to 25 ft.: lvs. dull green and pubescent above, pubescent or tomentose beneath, ½–1½ in. long, with 4–5 pairs of veins: style 2–4 in. long. From Neb. and Ore. to Low. Calif. and W. Texas. S.S. 4:166. H.I. 4:323.—D. M. Andrews, of Colo., who handles this shrub, writes of it as follows: "Mountain mahogany, 6 feet. A nearly evergreen rosaceous shrub of peculiar and attractive habit of growth. Fls. white, early, followed by the long, plumose achenes, which are 3–5 in. long, strangely curled and twisted, arranged above and on each side of the slender branches, so that at a little distance they have an appearance suggestive of ostrich plumes. Easily transplanted, and thrives anywhere."

betulæfòlius, Nutt. (*C. parvifòlius* var. *glàber,* Wats. *C. parvifòlius* var. *betuloìdes,* Sarg.). Small tree, to 30 ft.: lvs. thinner, bright green and glabrous above at maturity, pubescent or glabrescent beneath, ½–2 in. long, with 5–6 pairs of veins: style 2–4 in. long. Calif. W.G.Z. 4, pp. 554–5. H.I. 4:322.

AA. *Margin of lvs. entire, revolute: fls. solitary or in pairs.*

ledifòlius, Nutt. Tree, to 40 ft.: lvs. lanceolate, coriaceous, lustrous and glabrous above at maturity, pubescent below, resinous, ½–1 in. long, veins obscure: style 2–3 in. long. From Wyo. and Wash. to S. Calif. and New Mex. S.S. 4:165. H.I. 4:324.

Alfred Rehder.

CEREALS (*Ceres,* goddess of agriculture). The agricultural grains, properly those of the grass family: maize or Indian corn, kafir, wheat, emmer, spelt, rice, oats, barley, rye, sorghum (for grain); popularly held to include buckwheat, but not accurately so. Consult Vol. II, Cyclo. Amer. Agric.

CÈREUS (from the Latin, but of uncertain application). *Cactàceæ.* Usually arborescent, columnar cacti with the surface covered with spiny ribs.

Flowers large, borne singly along the sides of the st.; fl.-tube slender and, as it decays, cutting off from the ovary; petals numerous; stamens numerous; style single, thick: fr. a large, naked, fleshy berry; seeds small, black. The genus Cereus, as it has generally been treated, contained more than 100 species which differed greatly in habit, armament, fls. and fr., and was one of the most complex and difficult of the family. As now understood, it contains species of uniform habit, with similar fls. and frs., while a number of species of very different habit have been referred elsewhere. Even as here treated, more than half of the species are anomalous. Until the fls. and frs. have been studied, it seems best to leave them in Cereus. The species are all from S. Amer.

Only a few species of true Cereus are grown in this country, and most of these are grown under glass. The flowers do not compare in size and attractiveness with those of the so-called night-blooming Cereus, which is described elsewhere under the genus Selenicereus. Several of the species have cristate and other abnormal forms which make them desirable to certain growers. *C. lepidotus* is a rather common cultivated species in certain of the West India Islands, where it grows to considerable height, and several of the species are grown in Europe along the Riviera, where they reach great size. With us, however, they do not grow very rapidly. They are easily propagated from seed or by cuttings. See *Succulents.*

The species treated in the first edition of this work that are not here given may be looked for under the following genera: Acanthocereus, Aporocactus, Bergerocactus, Carnegiea, Cleistocactus, Escontria, Harrisia, Heliocereus, Hylocereus, Lemaireocereus, Lophocereus, Myrtillocactus, Oreocereus, Pachycereus, Rathbunia, and Selenicereus.

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A. *Sts. erect, 2 in. or more diam.*

B. *New growth green, not pruinose or covered with a bloom.*

C. *Ribs of st. 10 or more.*

1. **Pasacàna,** Web. A gigantic species, reaching a height of 20–30 ft., and sometimes even 50 ft., and a diam. of 12–16 in.; sparingly branching above; in new growth dark green, becoming gray or bluish: ribs 15–20, or in young plants only 9–10: areoles ⅜–¾in. apart, large, brown, becoming yellowish and finally gray: radial spines 10–13, about 1 in. long, the under one or lowest pair straight, subulate, the others curved; centrals mostly 4, the under and upper ones the longest, reaching 2 in. length, straight or curved; the young spines are clear brown, often with alternating rings of light and dark tissue, later gray, bulbose at the base: fls. from the lateral areoles about 6 in. long, white. Argentina.—This is the giant cereus of the Argentine desert, as *Carnegiea gigantea* is of the certain N. American deserts. It is not a true Cereus.

2. **cándicans,** Gillies. Sts. upright, low, cylindrical, bright green, 2½–3 ft. high by 6–8 in. diam.; freely branching from the base: ribs 10, obtuse-angled: areoles ⅝–¾in. apart, large, depressed, white, becoming gray: radial spines 11–14, spreading, at first thin, needle-form, later stronger, stiff, straight, about ¾in. long; central solitary or later 3–4 additional ones appearing above, stronger, reaching a length of 1¼ in., sometimes somewhat curved; all the spines horn-colored, with tips and bases brown, later becoming gray: fls. long, funnelform, resembling those of Echinopsis, 10 in. long by 6 in. diam.: fr. spherical to ellipsoidal, about 3 in. diam., red, somewhat spiny, flesh white. Argentina.—Not a true Cereus.

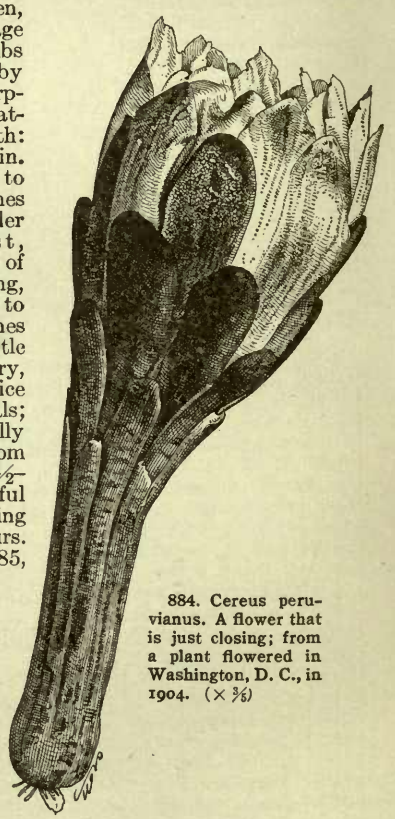
3. **lamprochlòrus,** Lem. Related to *C. candicans*, of a taller growth, cylindrical, 3–6½ ft. high by about 3 in. diam., at first simple, but later branching at the base; in new growth bright green, later dirty green: ribs 10–11 or occasionally 15; conspicuously crenate, later blunt and but little crenate: areoles medium size, about ½in. apart, yellowish white, becoming gray; above each areole 2 radiating grooves form a letter V: radial spines 11–14, spreading, straight, sharp-pointed, about ⅜in. long, clear to dark amber-color; some are strong and rigid, while others are bristle-form; centrals mostly 4, somewhat longer, stronger and deeper colored, with brown bases, becoming dark gray, about ¾in. long: fls. from the previous year's growth, about 8–10 in. long by 6 in. diam., white. Argentina.—Not a true Cereus.

4. **Spachiànus,** Lem. Sts. upright, at first simple, later profusely branching at the base, branches ascending parallel with the main st., 2–3 ft. high by 2–2½ in. diam., columnar: ribs 10–15, obtuse, rounded: areoles about ½in. apart, large, covered with curly yellow wool, becoming white: radial spines 8–10, ¼–⅜ in. long, spreading, stiff, sharp, amber-yellow to brown; central solitary, stronger and longer; all the spines later becoming gray: fls. about 8 in. long by about 6 in. diam., white. Argentina.—Not a true Cereus.

5. **chiloènsis,** DC. (*Cáctus chiloénsis*, Colla). Sts. strong, upright, simple (so far as known), about 2½ ft. high by 3½–5 in. diam., cylindrical to somewhat clavate, bright, clear green: ribs 10–12, obtuse: areoles about an inch apart, large: radial spines straight, sharp, rigid, at first 9, but later 4 others appear above these; centrals mostly 4, seldom but a single one, bulbose at the base; the young spines are brown honey-yellow, becoming white, with dark tips, and finally gray: fls. from the upper lateral areoles about 6 in. long, white, resembling those of Echinopsis. Chile.—This is not a true Cereus.

CC. *Ribs of st. 7–9.*

6. **euphorbioìdes,** Haw. (*C. Olfersii*, Otto). Columnar, simple, 10–16 ft. high by about 4½ in. diam., in young growth pale green, changing with age to gray-green: ribs 8–10, separated by sharp grooves, sharp-angled, becoming flattened in older growth: areoles about ⅜in. apart, small, white to gray: radial spines mostly 6, the under one the longest, reaching a length of over an inch, strong, yellowish brown to black, the upper ones shorter and bristle form; central solitary, in young plants twice as long as the radials; all the spines finally become gray: fls. from near the crown, 3½–4 in. long, beautiful flesh-red, remaining open for 24 hours. Brazil. R.H. 1885, p. 279.—This plant is insufficiently understood; it may be a form of some species of Cephalocereus.



884. Cereus peruvianus. A flower that is just closing; from a plant flowered in Washington, D. C., in 1904. (× ⅗)

7. **Sèpium,** DC. (*C. Roèzlii*, Haage.) Upright, columnar, about 3 in. diam.: ribs 9, separated by sharp, somewhat serpentine grooves, obtuse, above the areoles, 2 radiating, slightly curved grooves form a letter V: areoles ½–¾in. apart, comparatively large, slightly sunken, yellowish, later gray: radial spines 9–12, radiate, nearly ½in. long, straight, subulate, tolerably sharp, slightly thickened at the base, clear brown, with darker stripes; central solitary, reaching 1½ in. long, straight, porrect, later somewhat deflexed, clear brown; later all the spines become gray. Andes of Ecuador.—Near Borzicactus; needs further critical study.

8. **tetracánthus,** Labour. Upright, arborescent or bushy, freely branching, young branches leaf-green, later gray-green: ribs 8–9, low, arched: areoles medium-sized, slightly sunken, about ½in. apart, white to gray: radials 5, later 7, radiate, about ⅜in. long, straight, subulate, stout, white, with brown tips and bases, later ashy gray; centrals 1–3, under one largest and porrect, when young yellow and translucent, later gray: fls. resemble those of *C. tortuosus*. Bolivia.—This species should doubtless be referred to Eriocereus.

CCC. *Ribs of st. 3–6.*

9. **Hankeànus,** Web. Upright, robust, not branching (so far as known), young growth bright green, later dark green, about 2 in. diam.: ribs 4–5, compressed, about 1¼ in. high, conspicuously crenate, with an S-form line passing from each areole toward the center of the st.: areoles, ⅜–1 in. apart, horizontally elliptical to heart-shaped, brown, becoming gray below and yellow above: radial spines 3, needle-like, stout, sharp-pointed, about ⅜in. long, amber-colored when young, turning to brown; central solitary, straight, porrect, ⅝in. long, stronger than the radials, horn-colored; later all the spines become gray: fls. 4–5 in. long, white. S. Amer.

BB. *New growth blue, white- or gray-pruinose.*

C. *Ribs of st. comparatively broad and low: st. more or less triangular in cross-section.*

10. **macrogònus,** Otto. Arborescent, sparsely branching, reaching a height of 20 ft. (in cult., 6 ft. high by 3–5 in. diam.), branches columnar: ribs mostly 7, seldom 8–9, thick, slightly undulate, obtuse and with convex faces, about 1 in. high, bluish green, frequently having a depressed line near the areole: areoles about ½in. apart, large, gray: radial spines 6–9, radiate or spreading, strong, subulate, ¾in. long, horn-color, later black; central spines 1–3, somewhat stronger and longer than the radials, more or less conspicuously porrect: fls. from the lateral areoles near the end of the branches, 2½–3 in. long, tolerably fleshy, white: fr. depressed-globose, 2 in. diam. by little more than 1 in. long. Brazil.

CC. *Ribs of st. strongly compressed laterally.*

11. **peruviànus,** Haw. (*C. monoclònos,* DC.). HEDGE CACTUS. Fig. 884. Tall, 30–50 ft., branching freely toward the base, columnar, 4–8 in. diam., new growth dark green and glaucous, becoming a dull green with age, and, in old sts. becoming corky: ribs 5–8, compressed: areoles ½–1 in. apart, in new growth covered with conspicuous, curly brown wool, becoming gray: radial spines about 6–7, about ⅜–½in. long; central solitary, reaching a length of 2½ in.; the number of spines increases with age to as many as 20, all are rigid, brown: fls. abundant, from the lower part of the st., white, nocturnal, 6–7 in. long by 5 in. diam. S. Amer. G.C. III. 24:175 (var. *monstrosus*).

Var. **Alacriportànus,** K. Schum. (*C. Alacriportànus,* Mart.). Of somewhat weaker growth, low, and less conspicuously pruinose in the new growth, which is consequently nearly clear green. S. Brazil.

12. **Jamacàru,** Salm-Dyck (*C. válidus,* Haw.). Sts. upright, robust, rigid, 12–16 ft. high by as much as 6 in. diam.; young growth azure-blue, turning dark green with age, glaucous: ribs 4–6, thin, compressed, crenate: radial spines 5–7, stiff, needle-like, clear yellow with brown points, or brown and finally black, about ½–¾ in. long; centrals 2–4, somewhat stronger, porrect, ¾–3 in. long: fls. large, 10 in. long by 8 in. diam., white, nocturnal. Brazil, Venezuela.

13. **chalybæus,** Otto. Sts. upright, branching above, arborescent, azure-blue and pruinose, later dark green, 1½–4 in. diam.: ribs 6, in young growth very much compressed, later depressed till the st. is nearly cylindrical: areoles about ⅜in. apart, dark gray-brown: radial spines mostly 7, about ½in. long; centrals 3–4, similar but somewhat stronger and a little longer; all the spines are pointed, stiff, when young are black, later brown to gray with black tips, bulbose at the base: fls. very similar to those of *C. cærulescens.* Argentina.

AA. *Sts. erect, less than 2 in. diam.*

B. *Ribs of st. 10 or more.*

14. **isogònus,** K. Schum. St. upright, columnar, about 1–1¼ in. diam., in young growth light green to yellow-green, later darker: ribs 15–16: areoles approximate, white, turning gray: radial spines as many as 20, spreading, at first clear or dark yellow, becoming white, and finally gray, bristle form, flexible, about ⅜in. long; centrals 6–8; two of these are somewhat stronger and stiffer, about ¾in. long, one directed upward and one downward, yellowish brown to dark honey-color; later gray, as in the radials. S. Amer.

15. **spléndens,** Salm-Dyck. Columnar, slender, short, rigid, more or less branching from the base, reaching a height of about 2 ft. and about 1–1½ in. diam., light to yellowish green: ribs about 10–12, rounded: areoles prominent, about ¼in. apart, tawny, becoming white, tomentose: radial spines 8–12, radiating, yellow and light brown, becoming gray; centrals 1–3, scarcely larger than the radial, yellowish to white; all the spines slender, bristle form, about ¼–¾in. long. —*C. Cavendishii* has been referred to this species, but with some question.

BB. *Ribs of st. 3–10.*

16. **platygònus,** Otto. At first upright, later somewhat reclining, branching, at the base about 1 in. diam., tapering in the new growth: ribs 8, low, arched: areoles about ¼in. apart, very small, yellow, becoming gray, subtruded by a small 3-angled bract: radial spines 12–15, spreading, bristle form, little more than ⅛in. long; central solitary, slightly longer and stronger; all the spines at first yellow-brown, changing to white or gray with age.

17. **cæruléscens,** Salm-Dyck (*C. Lándbeckii,* Phil.). Arborescent or shrubby, 3–5 ft. high: sts. 1–1½ in. diam.: ribs usually 8, obtuse: areoles approximate, white bud soon becoming black: spines rigid; radials 9–12, ¼–½in. long, black; centrals 4, ¾in. long, stronger, black or white: fls. from the side of the st., slightly curved, 6–8 in. long by 6 in. diam., tube bronze-green, corolla white or occasionally rose-pink: frs. ellipsoidal, pointed at both ends, about 3 in. long and half that in diam., bright red, with blue glaucous covering. Argentina. B.M. 3922.

18. **Brídgesii,** Salm-Dyck. Upright, tall, columnar, simple or later branching at the base, bright green when young, becoming blue to gray-green, 1½–2 in. diam.: ribs 5–7, very broad and low: areoles ½–¾in. apart, yellowish to gray: spines 3–5, radiating, the under one, or seldom the upper one, the longest, 1½ in. long, stiff, sharp, straight, dark honey-yellow, with brown tips, becoming gray with age. Bolivia.

Var. **lagenifórmis,** K. Schum. (*C. lagenifórmis,* Forst.). Spines more numerous, somewhat longer.

19. **azùreus,** Parm. (*C. Seidelii,* Lehm.). St. upright, tall, slender, columnar, branching from the base, in the young, fresh bluish green, later dark green with gray, glaucous covering, about 3–4 ft. high and about 1 in. diam.: ribs 5–7, rounded, enlarged at the areole: areoles about ¾–1 ft. apart, elevated, large, abundantly woolly when young: spines 8–18, nearly alike, about ⅛–⅜in. long, stiff, slender, needle-form to bristle-like, black; the 2–4 central ones somewhat longer: fls. 8–12 in. long, obliquely attached to the st., slightly curved, white. Brazil.

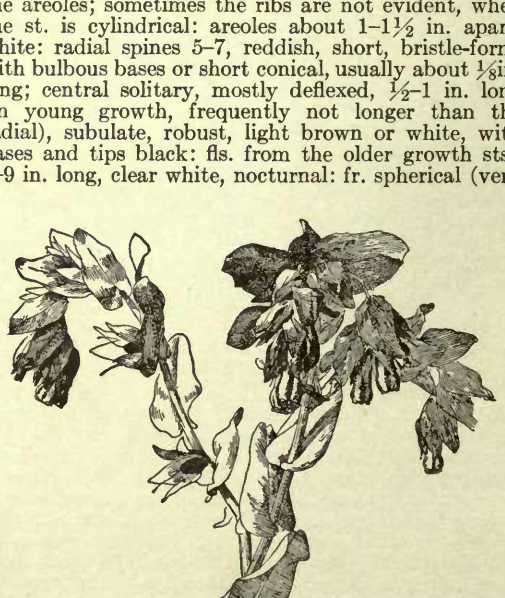
20. **cæsius,** Otto. Upright, columnar, branching at the base, somewhat tapering above; in new growth, beautiful light blue, pruinose; later, light green to slightly bluish, about 1½ in. diam.: ribs 5–6, separated by sharp grooves, about ½in. high, compressed, faintly crenate, becoming depressed in older growth: areoles about ⅜in. apart, small, yellow at first, later becoming white and finally gray: radial spines 8–10, sometimes more appear later; radiate, light amber-color, brown at the base, the lower pair the longest, mostly about ½in. long; centrals 4–7, like the radials but usually somewhat stronger, longer and darker; all the spines thin, needle-form, flexible, sharp; later, light, horn-color, finally gray. S. Amer.(?).

AAA. *Sts. weak, clambering over rocks or other plants, and without aërial roots.*

21. **Bónplandii,** Parm. Sts. at first upright, later clambering over rocks and bushes, about 1–1½ in. diam., branching and spreading, in new growth commonly of a bluish or purplish green, later gray-green: ribs 4–6, sharp, compressed, crenate, separated by broad, concave faces; later the ribs become much depressed, so that the st. is sometimes nearly cylindrical; the ribs commonly run spirally around the axis of the st.: areoles ½–1½ in. apart, at first considerably depressed, later shallower, white, becoming gray: radial spines 4–6 (later 1–4 more appear), straight, spreading, the largest about ½–1 in., stout, subulate, pointed, the under one needle-form and shorter; central solitary, straight, stronger, 1 in. long, deflexed or porrect; the stronger spines are white, with tips and bases brown, when young beautiful ruby-red, later all are gray, with black tips and bulbous bases: fls. from the lateral areoles about 10 in. long, white, nocturnal: fr. nearly spherical, about 2 in. diam., mammate, dark carmine-red. Paraguay, Brazil, and Argentina.

22. **tortuòsus,** Forbes (*C. atropurpùreus,* Haage). Sts. slender, weak, at first upright, but later reflexed, reaching a length of 3–4 ft., and 1–1½ in. diam.: ribs commonly 7, sometimes but 5, rounded, low, separated by regular serpentine grooves: areoles about 1 in. apart, large: radial spines 5–8, about ⅜–1 in. long; centrals 1–4, about ¾–1½ in. long; all the spines slender, rigid, red-brown when young, becoming ashy with age: fls. from the previous year's growth, about 6 in. long, trumpet-shaped, tube olive-green and spiny, in the axils of the reddish green scales; outer petals pale green, tinted with brown; inner petals clear white: fr. spherical, brilliant red without and white within, mammate, bearing a few spines on the summits of the lower mammas. Argentina.

23. **Mártinii,** Labour (*C. monacánthus,* Hort.). At first upright, later requiring a support; freely branching from the base, branches long, reaching nearly 5 ft., ¾–1 in. diam., slightly tapering, dark green: ribs 5–6, separated by serpentine grooves, contracted between the areoles; sometimes the ribs are not evident, when the st. is cylindrical: areoles about 1–1½ in. apart, white: radial spines 5–7, reddish, short, bristle-form, with bulbous bases or short conical, usually about ⅛in. long; central solitary, mostly deflexed, ½–1 in. long (in young growth, frequently not longer than the radial), subulate, robust, light brown or white, with bases and tips black: fls. from the older growth sts., 8–9 in. long, clear white, nocturnal: fr. spherical (very similar to *C. tortuosus*), pointed, dark carmine-red, about 2 in. diam., mammate, a few spines on the mammas, toward the base of the fr. Argentina. R.H. 1860, pp. 658–9.—This species is commonly sold under the name of *C. platygonus.*



885. Cerinthe retorta. (×⅓)

24. **Pitajàya,** DC. (*C. pernambucénsis* [*fernambucénsis*], Lem. *C. formòsus,* Salm-Dyck. *C. variábilis,* Pfeiff.). By recent authorities referred to the genus Acanthocereus. St. at first simple, later branching, in young growth light green, turning grayish green with age, pointed, ¾–1¼ in. diam.: ribs 3–5, commonly 4: areoles about 1 in. apart, large, bearing a conspicuous amount of curly hair, about ½in. long, in new growth: radial spines 5–7 and a solitary central one, uniform, about ⅜–⅝ in. long, amber color to brown and finally gray: fls. from the older growth, large, about 8 in. long, slightly curved, white, nocturnal. Uruguay, Brazil, Colombia. B.M. 4084.—*C. grándis,* Haw., according to Weber, is but a larger form of this species.

AAAA. *Sts. more or less climbing by means of aërial roots.*

25. **Martiànus,** Zucc. Of bushy growth, branching, reaching a height of 3 ft. and more: branches slender, provided here and there with aërial roots, cylindrical, about ¾in. diam.: ribs commonly 8, straight, separated by sharp grooves, very low: areoles ¼–⅜in. apart, small, white: radial spines 6–10, bristle-form, spreading, clear honey-yellow, at base brownish, later whitish and becoming gray, about ¼in. long; centrals 3–4, similar, only somewhat stouter and darker: fls. usually abundant, straight or slightly S-shaped, 4–5 in. long, scarlet-red: fr. spherical, reddish green, covered with bristles. S. Mex. B.M. 3768.

C. ventimíglia, Vaupel (Borzicactus ventimiglia, Riccob.). St. slender, 8- or 9-ribbed: spines in clusters of 8–10, spreading: perianth-tube elongated, opening into a large throat; petals red-violet: fr. small, globular, bearing few bracts. This species apparently does not belong to the true Cereus, and is probably much nearer Cleistocactus, as suggested in the Kew Bulletin. It was described from plants flowering in the Botanical Garden at Palermo, Italy, and which are said to have come from Ecuador. Borzicactus is a recently described genus, not yet intro. into American collections.

C. alamosénsis=Rathbunia alamosensis.—*C. Baùmannii*=Cleistocactus Baumannii.—*C. Berlandièri*=Echinocereus.—*C. cæspitòsus*=Echinocereus.—*C. candelàbrum*=Lemaireocereus Weberi.—*C. Chiotílla*=Escontria Chiotilla.—*C. chloránthus*=Echinocereus.—*C. coccíneus*=Echinocereus.—*C. Còchal*=Myrtillocactus Cochal.—*C. conoìdeus*=Echinocereus.—*C. ctenoìdes*=Echinocereus.—*C. cylíndricus*=Opuntia.—*C. dasyacánthus*=Echinocereus.—*C. Donkelæri*=Selenicereus Donkelærii.—*C. dùbius*=Echinocereus.—*C. Dumortièri*=Lemaireocereus Dumortieri.—*C. ebúrneus*=Lemaireocereus griseus.—*C. Émoryi*=Bergerocactus Emoryi.—*C. Éngelmanii*=Echinocereus.—*C. enneacánthus*=Echinocereus.—*C. erùca*=Lemaireocereus eruca.—*C. exténsus*=Hylocereus extensus.—*C. Féndleri*=Echinocereus.—*C. flagelliformis*=Aporocactus flagelliformis.—*C. geométrizans*=Myrtillocactus geometrizans.—*C. gigantèus*=Carnegiea gigantea.—*C. gonacànthus*=Echinocereus.—*C. grandiflòrus*=Selenicereus grandiflorus.—*C. Gréggii*=Peniocereus Greggii.—*C. gummòsus*=Lemaireocereus gummosus.—*C. hamàtus*=Selenicereus hamatus.—*C. inérmis*=Selenicereus inermis.—*C. longisètus*=Echinocereus.—*C. Mállisonii* is a hybrid.—*C. MacDónaldiæ*=Selenicereus MacDonaldiæ.—*C. marginàtus*=Pachycereus marginatus.—*C. Màynardii*=Selenicereus.—*C. mexicànus* is probably a hybrid.—*C. mojavénsis*=Echinocereus.—*C. napoleònis*=Hylocereus napoleonis.—*C. Níckelsii*=Cephalocereus.—*C. nycticalus*=Selenicereus nycticalus.—*C. paucíspinus*=Echinocereus.—*C. pectinàtus*=Echinocereus.—*C. phœníceus*=Echinocereus.—*C. princeps*=Acanthocereus pentagonus.—*C. procúmbens*=Echinocereus.—*C. queretarénsis*=Pachycereus queretarensis.—*C. Régelii*=Selenicereus hybrid.—*C. repándus*=Harrisia gracilis.—*C. Rátteri*=Echinocereus.—*C. Scheèri*=Echinocereus.—*C. sénilis*=Cephalocereus.—*C. serpentínus*=Nyctocereus serpentinus.—*C. speciòsus*=Heliocereus speciosus.—*C. spinulòsus*=Selenicereus spinulosus.—*C. stellàtus*=Lemaireocereus stellatus.—*C. stramíneus*=Echinocereus.—*C. Thùrberi*=Lemaireocereus Thurberi.—*C. triangulàris*=Hylocereus tricostatus.—*C. tuberòsus*=Wilcoxia.—*C. viridiflòrus.*=Echinocereus.

J. N. Rose.†

CERÍNTHE (Greek, *keros,* wax; *anthos,* flower: the ancients thought that the bees visited the flowers for wax). *Boraginàceæ.* Annual or perennial herbs from Europe and Asia Minor, with alternate glaucous leaves and showy purple bracts.

Calyx deeply divided, the tubular corolla with 5 very small reflexed lobes, usually differently colored from

UNIV. OF
CALIFORNIA



XXV. Celery.—The cultivation under field conditions, at the hilling-up or banking stage.

the tube.—About 6 species. The best species is *C. retorta*, which has a unique appearance in the garden, and is strongly recommended for more general cult. It is a hardy annual of easy cult.

retórta, Sibth. & Smith. HONEYWORT. Fig. 885. Height 1½–2 ft.: lvs. glaucous, often spotted white or red; lower lvs. obovate-spatulate; upper lvs. amplexicaul, with 2 round ears, on the flowering branches gradually becoming smaller and closer together until they pass into purple bracts, which form the chief attractive feature of the plant: fls. when full-blown protruded beyond the bracts; corolla tubular-club-shaped, yellow, tipped purple, with 5 small, spreading teeth: frs. smooth but not shining. Greece. B.M. 5264. Gn. 41:212. For a garden review of the other honeyworts, see Gn. 41, p. 212.

C. màjor, Linn. A showy annual 6–15 in. high: lvs. clasping the st., very rough and ciliate: fls. with showy bracts; the corolla yellow below, purplish at the top: fr. smooth, shining and brown-spotted. Medit. region. B.M. 333.

WILHELM MILLER.
N. TAYLOR.†

CEROPÈGIA (Greek, *wax* and *fountain*, the flowers having a waxy look). *Asclepiadàceæ*. Greenhouse vines of Africa and Asia.

Stems fleshy, erect and twining among the other plants in nature, or pendulous: lvs. opposite, sometimes in the S. African species wanting: fls. medium-sized, the corolla more or less inflated at the base, straight or curved; corona something as in our common milkweeds, double.—A genus of 100 species, a dozen of which are known in Old World collections but only the following in Amer. Many of them have tuberous roots, and need a season of rest and dryness. May be grown in a compost of loam, leaf-mold or peat, and sand. Temperate house is the best for the two following. Prop. by cuttings in spring over bottom heat. Odd and handsome.

Woódii, Schlecht. With many slender prostrate or trailing sts.: lvs. fleshy, about 1½ in. long, almost rotund: fls. in pairs, axillary on stalks, 3–7 in. long; corolla slightly curved, about ¾in. long, pink or with dark lines below, the upper part sometimes purplish. Natal. G.C. III. 22:357; 37:244 (desc.). B.M. 7704.

Sándersonii, Decne. St. twining, fleshy and thick: lvs. about 1¾ in. long, ovate-lanceolate: fls. cymose, 3–4 at a node, the greenish white corolla about 1½–2 in. long, curved and with an obvious inflation at the base. Natal. B.M. 5792. G.C. III. 40:383. R.H. 1901, p. 111.

C. barbertonénsis, N. E. Br. Lvs. somewhat variegated with pale green along the veins: fls. similar to C. Woodii. Transvaal.—*C. Bròwnii*, Ledger. Corolla-tube pale green with dark blotches; lobes greenish with a zone of white and dark purple in the middle. Uganda.—*C. discreta*, N. E. Br. Tuberous: tube whitish, dark-veined; lobes pale yellow at base, purple-green at apex. Madras.—*C. fúsca*, C. Bolle. Many succulent sts.: corolla dull reddish brown: coronna light yellow. Canary Isls. B.M. 8066.—*C. gemmífera*, K. Schum. A tall climbing species: fls. solitary. W. Trop. Afr.—*C. Lugárdæ*, N.E.Br. Lvs. thin, 1–2 in. long: tube 1 in. long, abruptly curved immediately above inflated base, dilated at apex into funnel-shaped mouth. Bechuanaland. G.C. III. 30:302 (desc.).—*C. Réndallii*, N. E. Br. A small species with fl. having an umbrella-like canopy surmounting the corolla: twining. Transvaal.—*C. símilis*, N.E. Br. In cult. as C. Thwaitesii. Corolla-lobes white or pale green at base, ciliate. G.C. III. 40:384. *C. Thórncroftii*, N. Br. Sts. twining: cymes axillary, many-fld.; corolla white, with purple blotches. Transvaal. B.M. 8458.

N. TAYLOR.

CERÓPTERIS (Greek, *wax fern*). *Polypodiàceæ*. Hothouse ferns of rather small size, interesting for the powdery covering on the leaves.

A rather small group somewhat related to Pteris, characterized most conspicuously by having the under surface of the lvs. covered with a colored powder, often silver, white or bright yellow (so-called silver and gold ferns). The sporangia are borne in indefinite lines and are unprotected by any indusium. The species of Ceropteris have in the past been classified under the generic name Gymnogramma, but fern students are now generally agreed in separating it as a distinct genus.

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A. *Powder commonly yellow: lvs. about as broad as long.*

1. **triangulàris**, Underw. (*Gymnogràmma triangulàris*, Kaulf.). Fig. 886. Lf.-blades 2–5 in. wide and long, on stalks 6–12 in. long, dark green above, below deep golden yellow, or occasionally white; lower pinnæ much larger than the others, deltoid; the upper lanceolate. Calif. to Brit. Col. Gn. 48, p. 444.—A white-powdered variety with a viscous upper surface and coarser cuttings (var. **viscòsa**, D. C. Eaton) is found in S. Calif.



886. Ceropteris triangularis. (×⅓)

AA. *Powder yellow: lvs. lanceolate, several times as long as broad.*

B. *Lvs. scarcely more than bipinnate.*

2. **chrysophýlla**, Link (*Gymnogràmma chrysophýlla*, Kaulf.). Lvs. 12–18 in. long, with blackish stalks and rachises, the segms. slightly pinnatifid at the base: powder golden yellow. W. Indies to Brazil. R.H. 1856:201. G.C. III. 23:373.—Often considered a var. of *C. calomelanos*. Var. **Laucheàna** (*Gymnogràmma Laucheàna*, Hort.), has triangular lvs. except in its sub-variety *gigantea*. Gn. 48, p. 437.

BB. *Lvs. tripinnatifid to quadripinnate.*

3. **sulphùrea**, Fée (*Gymnogràmma sulphùrea*, Desv.). Lf.-blades 6–12 in. long on chestnut-brown stalks, the pinnæ long, tapering, less than 1½ in. wide at base, the pinnules compact, with 3–7 divisions: powder sulfur-yellow. W. Indies.

4. **argéntea**, Kuhn (*Gymnogràmma aùrea*, Desv.). Lvs. 6–12 in. long, 7–10 in. wide, deltoid; pinnæ deltoid, 2–3 in. wide at base, the ultimate divisions cuneate. Madagascar.—By some this is referred to *Gymnogràmma argentèa*, Mett., a similar fern with white powder.

5. **decompósita**, Baker (known only under the name *Gymnogràmma decompósita*, belongs in Ceropteris). Lvs. 1½ ft. long, 1 ft. broad, deltoid, quadripinnate or even 5-pinnate; pinnæ close, lanceolate, with the ultimate divisions linear and 1-nerved: powder rather scanty. Andes. F.R. 2:25. G.C. III. 11:365. F. 1874, p. 148.

AAA. *Powder white: lvs. lanceolate.*

B. *Segms. acute.*

6. **calomélanos**, Underw. (*Gymnogràmma calomélanos*, Kaulf.). Fig. 887. Stalks and rachises nearly black: lvs. 1–3 ft. long, with lanceolate pinnæ; segms. often with a large lobe-like auricle at the upper side of the base. W. Indies to Brazil. A.G. 14:303.—The most variable species of the genus. *C. magnífica*, Hort., is probably one of the many garden varieties. Var. **chrysophýlla**, is here considered a distinct species. (See No. 2.)

BB. *Segms. obtuse, rounded.*

7. **peruviàna**, Link (*Gymnogràmma peruviàna*, Desv.). Lvs. 6–12 in. long, 3–5 in. wide, with dark

chestnut-brown stalks; pinnæ somewhat regularly pinnatifid on both sides below. Mex. to Peru. By some considered a var. of *G. calomelanos*. Var. **argyrophýlla** (*G. argyrophýlla*, Hort.) is silvery on both sides.



887. Ceropteris calomelanos. (×$\frac{8}{10}$)

8. **tartàrea,** Link (*Gymnográmma tatàrica*, Desv. *G. tatárica*, Hort.). Lvs. 9–18 in. long, 2–5 in. broad, with closely set pinnæ, tapering gradually to a point; pinnules scarcely divided or cut, mostly merely crenate. Trop. Amer. from Mex. southward.

BBB. *Segms. fan-shaped or wedge-shaped.*

9. **pulchélla,** Link (known only under the generic name, *Gymnogramma;* belongs in *Ceropteris*). Lvs. 6–12 in. long, 4 in. wide, the lower pinnæ much the largest; pinnules imbricated; texture rather thin. Venezuela. Var. **Wettenhalliàna,** Moore (*G. Wettenhalliàna*, Hort.), is a garden variety, with pale sulfur-yellow powder.

L. M. UNDERWOOD.
R. C. BENEDICT.†

CERÓXYLON (Greek, *wax* and *wood*, i.e., wax-tree). *Palmàceæ.* WAX-PALM. Tall palms with ringed stems and pinnate leaves.

Spineless, the trunk covered with wax: lvs. clustered at the top, 15–20 ft. long when full grown, equally pinnate; pinnæ long, rigid, sword-shaped, bases recurved and tips pointed, dark green above and glaucous beneath, the petiole very short and sheathed: fls. mostly unisexual, on spikes nearly or quite covered by the simple spathe; fl.-parts 3; stamens 9–15: seed as large as a hazel-nut, round, bony, inclosed in a soft or crumbling integument.—Perhaps 4 or 5 species in the Andes of Colombia and Ecuador.

andícolum, HBK. (*Iriártea andícola,* Spreng. *I. Klopstóckia,* Hort. *Klopstóckia cerífera,* Karst. *Beethovènia cerífera,* Engl.). The celebrated wax-palm of the Andes, and a good greenhouse subject: said to reach nearly 200 ft.: trunk slender, swollen at the middle: lvs. 6–8 in., the crown, the under sides silvery-scurfy.—The waxy covering of the trunk gives it a marble-like and columnar appearance. The wax, used as an ingredient in the making of candles, is an article of commerce. It is said that *Diplothemium caudescens* (*Ceroxylon niveum,* Hort.) is sometimes sold for the wax-palm by plant dealers. *C. ferrugíneum,* Regel, is probably referable to Iriartea. It appears not to be in the trade. *C. andicolum* is a free grower under cult., and is a very ornamental subject. It thrives in a warm moist house, and the seeds also germinate well under similar conditions.

L. H. B.

CESPEDÈSIA (named in honor of Juan Maria Cespedes, priest of Bogota). *Ochnàceæ.* Tall handsome glabrous trees, sometimes grown in the juvenile state in hothouses.

Leaves alternate, large, coriaceous, mostly obovate to lanceolate and narrowed at base, entire, or crenate: fls. yellow, showy, in large terminal bractless panicles; sepals 5, small and deciduous; petals 5; stamens 10 to many: fr. a 5-valved caps.; seeds very small.—Species probably 6–10, in S. Amer. and Panama.

díscolor, Bull. Lvs. large, lanceolate, drooping, handsomely colored on young growths in bright brown or tan tinted with rose and veined with yellow. Gn. W. 20:618.—A comparatively recent intro. to cult. in England.

L. H. B.

CÉSTRUM (old Greek name). Incl., *Habrothámnus. Solanàceæ.* Greenhouse shrubs (or low trees) some of them with a climbing habit, and grown in the open in southern California and elsewhere South.

Leaves alternate and entire, usually rather narrow: fls. tubular, in axillary or terminal cymes, red, yellow, greenish or white, often very fragrant; corolla salver-shaped or somewhat trumpet-shaped, the long tube often enlarged at the throat, 5-lobed, exceeding the bell-shaped or tubular 5-toothed calyx; stamens mostly 5, all perfect, attached in the tube: fr. a scarcely succulent mostly reddish or blackish berry, derived from a 2-celled stipitate ovary and seeds few or reduced to 1.—Probably 150 species, in Trop. and Subtrop. Amer. They are much grown in warm countries, where they bloom continuously. For a monograph of the West Indian species (about 20) see O. E. Schulz, in Urban, Symbolæ, Antillanæ, vi, p. 249–279 (1909–1910).

Cestrums are among the most useful of bright-flowering shrubby greenhouse plants, and they may be grown either as pot-plants, or planted against the back wall or supports of a greenhouse, where, if given a light position, they will produce an abundance of flowers from January to April. The Mexican species will do well in a winter temperature of 45° to 50°, but the species from Central America require stove temperature. They are propagated by cuttings taken in February or early in March and inserted in sand in a warm temperature, keeping them somewhat close until rooted, when they should be potted in a light soil, after which they may be grown in pots, shifting on as often as required, or planted out in the open ground toward the end of May in a sunny position, where, if kept pinched back to induce a bushy growth and attention is paid to watering, they will make fine plants by the first of September. They should then be lifted and potted in a light rich soil and kept close and shaded for a few days, and then transferred to their winter quarters. After flowering, the plants should be given a rest for a month or six weeks, gradually reducing the supply of water to induce the leaves and wood to ripen, after which they should be cut well back, the old soil shaken



888. Cestrum elegans. (×½)

off, and the roots trimmed back, and then either potted again or planted out for the summer. While in the greenhouse, cestrums are very subject to the attacks of insects, especially the mealy-bug. (E. J. Canning.)

A. *Fls. red.*

élegans, Schlecht. (*Habrothámnus élegans,* Brongn.). Fig. 888. Tall and slender, half-climbing, the branches pubescent: lvs. ovate, lanceolate, long-acuminate, of medium size, pubescent beneath: fls. red-purple, swollen

near the top of the tube, in loose clusters which nod at the ends of the branches, the lobes ciliate. Mex. F.S. 2:82.—One of the old-fashioned greenhouse shrubs, blooming almost continuously. There is a form with variegated lvs. Var. **Smíthii** (*C. Smíthii*, Hort. Bull.) has beautiful blush-rose fls., profusely produced through summer and autumn. Gn. 62, p. 242, desc.

fasciculàtum, Miers. Spring bloomer, with larger fls. than those of *C. elegans*, and more compact, nearly globular fl.-clusters, the cluster subtended by small lvs. as if an involucre: lvs. ovate. Mex. B.M. 4183 (and probably the *C. elegans*, B.M. 5659.).

Néwelli, Nichols. (*H. Néwelli*, Veitch). Fls. bright crimson, larger and more brilliant than those of *C. elegans* and *C. fasciculatum*. Gn. 34:106.—A free-growing plant, originating from seed by Mr. Newell, Downham Market, England. Evidently an offshoot of one of the preceding species.

AA. *Fls. orange or yellow.*

aurantìacum, Lindl. Of half-climbing habit: lvs. oval to ovate, more or less undulate: fls. sessile in a panicle, orange-yellow. Guatemala. R.H. 1858, p. 238.

Pseùdo-Quìna, Mart. Glabrous: lvs. membranaceous, ovate, obtusish or acute, narrowed at base: peduncles articulated at apex, axillary or in congested 4–8-fld. terminal racemes; corolla slender with acute lobes, much longer than the toothed calyx. Brazil.—Said to have marked medicinal qualities. Differs from *C. Parqui* in having glabrous filaments and pedicillate fls.

AAA. *Fls. white, greenish, or cream-yellow.*

Pârqui, L'Her. Shrub, half-hardy, nearly glabrous: lvs. lanceolate to oblong, petioled, short, acuminate: fls. sessile, long, tubular, with a wide-spreading limb, in an open panicle, greenish yellow, very fragrant at night. Chile. B.M. 1770. Adventive in Fla.

diúrnum, Linn. Quick-growing evergreen shrub, minutely pubescent or glabrous: lvs. oblong and short-acute, thickish and glabrous, shining above: fls. white, very sweet-scented by day, in axillary long-peduncled spikes; corolla-lobes roundish and reflexed: berry nearly globular; filaments erect and not denticulate. W. Indies.

noctúrnum, Linn. NIGHT-BLOOMING JESSAMINE. Shrub, 4–12 ft.: branches brownish, very slender or flexuose, glabrous or nearly so: lvs. thinner, ovate or elliptic, prominently acuminate: fls. creamy-yellow, very fragrant by night; corolla-lobes ovate and blunt: berry ovoid-oblong; filamants denticulate. W. Indies.

pùbens, Griseb. Sts. and lvs. woolly-pubescent: fls. greenish, much like those of *C. nocturnum* and also fragrant at night. Argentina.

laurifòlium, L'Her. Glabrous shrub: lvs. ovate to oblong, glossy, thick: fls. greenish yellow and changing color (sometimes described under cult as pure white), in erect heads, slightly fragrant; corolla-tube club-shaped, tapering gradually; corolla-lobes ovate-roundish and blunt; filaments toothed: berry ovoid. W. Indies, S. Amer.—Much planted in S. Calif. L. H. B.

CHÆNÁCTIS (Greek, *gaping ray:* the marginal corollas often ray-like). *Compósitæ.* West American low herbs or undershrubs sometimes planted in the open for ornament.

Leaves alternate and mostly dissected: fls. yellow, white or flesh-colored on solitary peduncles or in loose cymes; florets of one kind, but the marginal ones with a more or less enlarged limb; involucre campanulate; receptacle flat and generally naked: pappus of toothed or entire scales (wanting in one species).—About 20 species, of which 3 have been intro. as border plants; but they are little known to gardeners. Of easy cult. Prop. by seeds or division.

A. *Pappus of entire or nearly entire persistent scales.*

tenuifòlia, Nutt. Small, tufted annual, white-pubescent when young but becoming nearly or quite glabrous: 1 ft.: lvs. once or twice pinnately parted, the lobes linear or filiform: heads ⅓in. high, lemon-yellow. S. Calif.

Doûglasii, Hook. & Arn. Perennial, 3–15 in. high, usually white-woolly when young: lvs. broad, bipinnately parted into short and crowded, obtuse lobes: heads ½–¾in. high, white or whitish, usually in crowded, cymose clusters. Mont. south and west.—Variable. Var. **achilleæfòlia,** A. Nelson, is often sold for the type. It has more finely divided lvs.

AA. *Pappus of fimbriate and deciduous scales, or even wanting.*

artemisiæfòlia, Gray. Tufted annual, 1–2 ft., rusty pubescent and somewhat sticky on the under side of the lvs., glandular hairy above: lvs. twice or thrice pinnately parted into short-linear or oblong lobes: heads ½in. high, the involucre viscid, the florets white or cream-color. S. Calif. N. TAYLOR.†

CHÆNOMÈLES (Greek *chainein*, to gape, to split, and *melea*, apple: the fruit was supposed by Thunberg to split into five valves). *Rosàceæ*, subfamily *Pòmeæ*. Woody plants, grown chiefly for their handsome brightly colored flowers appearing early in spring; formerly commonly included in Cydonia.

Shrubs or small trees, sometimes spiny: lvs. subpersistent or deciduous, alternate, short-petioled, serrate: fls. solitary or fascicled, before or after the lvs., sometimes partly staminate; calyx-lobes entire or serrate; petals 5; stamens numerous; styles 5, connate at the base: fr. 5-celled, each cell with many seeds.—Four species in China and Japan. See page 3567.

These are ornamental plants, nearly hardy North except *C. sinensis*, which can be grown only South. *C. japonica* and *C. Maulei*, with handsome glossy foliage and abundant flowers in early spring, varying in all shades from pure white to deep scarlet, are highly decorative, and especially adapted for borders of shrubberies and for low ornamental hedges. The fruit of all species can be made into conserves. They thrive in almost any soil, but require sunny position to bloom abundantly. Propagated by seeds, usually stratified and sown in spring; also readily increased by root-cuttings made in fall or early spring, and rarer kinds or less vigorous-growing varieties are grafted in the greenhouse in early spring, on stock of the Japanese or common quince; they grow also from cuttings of half-ripened or nearly mature wood, under glass, and from layers.

A. *Fls. solitary, with reflexed serrate calyx-lobes, with or after the lvs.: stipules small.* (*Pseudocydonia.*)

sinénsis, Koehne (*Pŷrus sinénsis*, Poir. *Cydònia sinénsis*, Thouin. *Pseudocydònia sinénsis*, Schneid.). Shrub or small tree: lvs. elliptic-ovate or elliptic-oblong, acute at both ends, sharply and finely serrate, villous beneath when young, 2–3 in. long: fls. light pink, about 1⅓ in. across: fr. dark yellow, oblong, 4–6 in. long. May. China. B.R. 11:905. R.H. 1889:228. A.G. 12:16. B.M. 7988.—The lvs. assume a scarlet fall coloring. Not hardy north of Philadelphia, except in favored localities. See also *Quince.*

AA. *Fls. in leafless clusters, nearly sessile, before or with the lvs.; calyx-lobes erect, entire: stipules large.* (*Chænomeles proper.*)

B. *Lvs. lanceolate or narrow-lanceolate, pubescent beneath while young.*

cathayénsis, Schneid. (*Pŷrus cathayénsis*, Hemsl. *Cydònia cathayénsis*, Hemsl.). Shrub, to 10 ft.: lvs. lanceolate or oblong-lanceolate, acute, finely and sharply serrate, 2½–4½ in. long and ½–1½ in. broad;

petioles about ½in. long: fls. in clusters, red, 1½ in. across; styles pubescent at the base; petals distinctly clawed: fr. oblong-ovoid, 6–7 in. long, with a cavity at each end. Cent. China. H.I. 27:2657, 2658.—Closely related to the following species, but lvs. much narrower; less hardy.

BB. *Lvs. elliptic-oblong to obovate, glabrous.*

japónica, Lindl. (*Pỳrus japónica,* Thunb. *Cydònia japónica,* Pers. *Chænomèles lagenària,* Koidzumi). JAPAN QUINCE. JAPONICA. Fig. 889. Shrub, 3–6 ft., with spreading, spiny branches: lvs. ovate or oblong, acute, sharply serrate, glabrous, glossy above, 1½–3 in. long: fls. in 2–6-fld. clusters, scarlet-red in the type, 1½–2 in. across: fr. globular or ovoid, 1½–2 in. high, yellowish green. March, April. China, Japan. R.B. 1:260. L.B.C. 16:1594. Gn. 33, p. 491; 40:126; 50, p. 106 (frs.); 71, p. 262 (habit). G.C. III. 34:434. B.H. 1:260 (frs.). R.H. 1876:330 (fr.). G.M. 35, suppl. Nov. 12. V. 4:38.—Many garden forms in all shades from white to deep scarlet, and also with double fls. Some of the best are the following: Var. **álba,** Lodd. Fls. white, blushed. L.B.C. 6:541. Var. **álbo-cíncta,**



889. Chænomeles japonica, the Japan or flowering quince. (×½)

Van Houtte. Fls. white with pink margin. F.S. 14:1403. Var. **álbo-rósea,** Spaeth. Fls. white, partly pink. G.W. 7:113. Var. **atrosanguínea plèna,** Hort. Fls. deep scarlet, semi-double. Var. **Báltzii,** Spaeth. Fls. beautiful rosy pink, very floriferous. G.W. 7:113. Var. **cándida,** Hort. Fls. pure white. Var. **cardinàlis,** Carr. Fls. large, deep scarlet. R.H. 1872:330, f. 1. Var. **ebúrnea,** Carr. Fls. pure white, rather small. R.H. 1872:330, f. 4. Var. **Gaujárdii,** Lem. Fls. salmon-orange. I.H. 7:260. Var. **grandiflòra,** Rehd. (*C. álba grandiflòra,* Carr.). Fls. nearly white, large. R. H. 1876:410. Gn. 13:144. Var. **Mállardii,** Carr. Fls. rose, bordered white. R.H. 1872:330, p. 2. I.H. 4:135. G.Z. 1:208. Var. **Moerloòsei,** Versch. Fls. white, striped pink. I.H. 3:107. F.S. 5:510. Var. **Papeleùi,** Lem. Fls. yellow, bordered pink. I.H. 7:260. Var. **péndula,** Temple & Beard, with slender, pendulous branches. Var. **ròsea plèna,** Hort. Fls. rose, semi-double. Var. **rùbra grandiflòra,** Hort. Fls. large, deep crimson. Var. **sanguínea plèna,** Hort. Fls. scarlet, double. Var. **serótina,** André. Fls. in stalked leafy clusters in autumn. R.H. 1894, pp. 424, 425; 1903, p. 20. Var. **Sìmonii,** André. Fls. dark crimson, semi-double: low and upright. G.W. 7:113. Var. **sulphùrea,** Hort. (var. *sulphùrea perfécta,* Van Houtte). Fls. yellowish. Var. **umbilicàta,** Sieb. & De Vries. With rose-red fls., and large frs. umbilicate at the apex. F.S. 5:510.

Maùlei, Schneid. (*Pỳrus Maùlei,* Mast. *Cydònia Maùlei,* Moore. *C. alpìna,* Koehne). Low shrub, 1–3 ft.: branches spiny, with short, rough tomentum when young: lvs. roundish oval to obovate, obtuse or acute, coarsely crenate-serrate, glabrous, 1–2 in. long: fls. bright orange-scarlet, 1–1½ in. across: fr. yellow, nearly globular, about 1½ in. across. March, April. Japan. B.M. 6780. G.C. II. 1:757 and 2:741; III. 34:435. Gn. 13:390; 33, p. 490; 50, p. 106; 55, p. 354. F. 1875:49. R.H. 1875:195. F.M. 1875:161. H.B. 26:241.—A very desirable hardy shrub, with abundant fls. of a peculiar shade of red. Var. **alpìna,** Schneid. (*C. japónica* var. *alpìna,* Maxim. *Cydònia Sárgentii,* Lemoine). Dwarf spiny shrub, with procumbent sts. and ascending branches: lvs. roundish oval, ½–1 in. long: flowering and fruiting profusely. R.H. 1911:204. Var. **supérba,** Hort. Fls. deeper red. Var. **trícolor** Hort. Dwarf shrub, with pink and white variegated lvs.—By some botanists this species is considered to be the typical *C. japonica,* and the preceding species is called *C. lagenaria.*

ALFRED REHDER.

CHÆNÓSTOMA (*gaping mouth,* in allusion to the shape of the corolla). *Scrophulariàceæ.* African herbs or sub-shrubs sometimes planted in greenhouses, or in the open in mild climates.

Leaves simple, mostly opposite: fls. axillary or terminal-racemose, showy; stamens attached to the throat of the corolla, more or less exserted; style filiform and club-shaped, and obtuse at the apex; corolla tubular, swollen in the throat, with a 5-lobed spreading limb: fr. a caps. with numerous seeds.—Recent authorities combine this genus with Sutera, which, in the enlarged sense, comprises more than 190 species in Afr. and the Canary Isls. Chænostoma, as separately limited, has 25–30 S. African plants with white, yellow or reddish fls. axillary or in terminal racemes, lvs. usually opposite, mostly dentate, 4 didynamous stamens which are exserted rather than included as in typical Sutera and the top of the style club-shaped and stigma obtuse rather than 2-lobed.

híspidum, Benth. (*Sùtera brachiàta,* Roth). Small perennial, sometimes an under-shrub, with opposite, oval or oblong, toothed lvs., and blush-white or rosy white star-like fls. ¼in. across, in dense clusters. S. Afr. J. H. III. 33:636.—An old and deserving greenhouse or pot-plant, but rarely seen at present. It blooms almost continuously, the fls. sometimes hiding the foliage. Prop. by seeds or cuttings, either in fall or spring. Begins to bloom when 4–6 in. high. To be recommended for windows, and for summer vases. It has been listed as *Schœnostoma hispidum.* In S. Calif., it is a half-hardy dwarf shrub (12 to 20 in. high and withstanding 4–6 degrees of frost), recommended for edgings.

N. TAYLOR.†

CHÆROPHÝLLUM (Greek-made name, referring to the agreeably scented foliage). *Umbellìferæ.* Scented herbs, annual, biennial or perennial, glabrous or hirsute, often tuberous-rooted, of 30–40 species in the northern hemisphere, one of which is cult. Lvs. pinnately or ternately decompound, the segms. also toothed or cut: fls. small, white, in a compound many-rayed umbel; calyx-teeth 0: carpels with 5 more or less apparent ribs, the beak 0 or much shorter than the body. **C. bulbòsum,** Linn., of Cent. Eu. and the Caucasus, biennial, is the turnip-rooted chervil. (See *Chervil.*) St. hairy, at least below, 3–5 ft. tall, branching, swollen below the joints, the root tuberous (and edible): lvs. much compound, the ultimate divisions very narrow.

L. H. B.

CHÆTOSPÉRMUM (from Greek, *hair* and *seed*). *Limonia* § *Chætospermum,* Roemer. *Rutàceæ,* tribe *Citreæ.* A small spiny tree, proposed as a stock for citrus fruits.

Chætospermum bears hard-shelled frs.: lvs. persistent, trifoliate: fls. pentamerous with 10 free stamens; ovary 8–10-celled, with numerous ovules in each cell; cells filled with spongy vesicular tissue; seeds hairy, the cotyledons aërial in germination: first foliage lvs. opposite.—Only one species is known.

glutinòsa, Swingle (*Limònia glutinòsa,* Blanco. *Ægle decándra,* Naves. *Ægle glutinòsa,* Merrill). TABOG. Fig. 890. Petioles margined; lateral lfts. small, sessile, scarcely one-third as long as the terminal one; spines slender, straight, sharp, axillary usually in pairs in the axils of the lvs.: fls. rather large, occurring singly, or in few-fld. clusters on long slender pedicels in the axils of the lvs.: fr. oblong, 2–3 x 1½ in. with a thick leathery rind longitudinally ribbed, 8–10-celled; it contains numerous flattened hairy seeds, ⅜ to $\frac{3}{16}$in. immersed in a watery tissue. Native to the Isl. of Luzon, Philippine Archipelago. Ill. Blanco., Fl. Filip. ed. III, pl. 124. Vidal y Soler, Sinop. de fam. Fil. pl. 25. Bull. Soc. Bot. Fr. 58, Mem. 8d. pl. 5.—The tabog is a rapid-growing tree when young, and in a warm greenhouse shows a vigorous root-growth. This species is being tested as a stock for use in commercial citriculture. Experiments have shown that oranges, lemons, grapefruits and kumquats grow well when budded or grafted on young tabog plants. WALTER T. SWINGLE.

CHÁLCAS (from Greek for *copper,* as the wood has a copper-colored grain). *Murràa* of Koenig. *Rutàceæ.* Small spineless trees or shrubs, suggested as a stock for citrus fruits.

Leaves pinnate, alternate: fls. large, 4–5-merous, solitary or in terminal or axillary cymes; ovary 1–5-celled, with 1 to several ovules: seeds white, woolly or glabrous, cotyledons aërial in germination: first foliage lvs. opposite.

exótica, Millsp. (*Murràa exótica,* Linn.). ORANGE JESSAMINE. A small tree with pale bark, twigs and petioles usually puberulous: lvs. pinnate; lfts. usually 5–9, ovate, obtuse or obtusely acuminate, often emarginate, dark green above, paler below: fls. fragrant, campanulate, 5-parted; petals white; stamens 10, free; ovary 2-celled, style deciduous: fr. subglobose, ⅔–½in. long, pointed, red. Ill. Beddome, Outlines Bot., pl. vii., Wight, Ic., pl. Ind. I, pl. 96.—The orange jessamine is commonly grown in greenhouses on account of its abundant and very fragrant fls. These are often to be seen along with the mature red fr., which makes a striking contrast with the panicles of white fls. and delicate foliage. The root-growth of this species is remarkably vigorous under greenhouse conditions. Lemons can be budded on it and make a rapid growth. It is being tested as a stock for the common citrus fruits in situations in which a vigorous root-system is desired. WALTER T. SWINGLE.

CHAMÆBÀTIA (Greek, *dwarf,* and *bramble,* alluding to its bramble-like flowers). *Rosàceæ.* A woody plant, grown for its handsome white flowers and for the finely divided aromatic foliage.

Low shrub, clothed with glandular pubescence: lvs. alternate, stipulate, tripinnatifid, persistent: fls. in terminal corymbs, white; calyx-tube broadly campanulate; petals 5; stamens numerous; pistil solitary, with short style and decurrent stigma: fr. a small achene inclosed by the persistent calyx.—One species in Calif. Ornamental shrub of agreeable aromatic odor, with graceful foliage and showy white fls. in June and July. It can be grown only in warmer temperate regions, and thrives best in sandy well-drained soil and sunny position. Prop. by seeds sown in spring and by greenwood cuttings under glass.

foliolòsa, Benth. Two to 3 ft.: lvs. nearly sessile, oval or ovate-oblong, closely tripinnately dissected, 1½–2½ in. long: fls. white, ¾in. wide, in 4–8-fld. corymbs. B.M. 5171. G. 29:29. B.H. 10, p. 295. H.F. 1861:9. Gn. 3, p. 27. ALFRED REHDER.

CHAMÆBATIÀRIA (in allusion to the similarity of this plant to *Chamæbatia*). *Rosàceæ.* Shrub grown for its handsome white flowers and the finely divided foliage; allied to the spireas.

Deciduous, with glandular aromatic pubescence: lvs. alternate, bipinnate, with numerous minute segms.; stipules lanceolate, entire: fls. in terminal panicles; calyx turbinate, with 5 erect lobes; petals 5, suborbicular; stamens about 60: carpels 5, connate along the ventral suture, at maturity dehiscent into 2 valves: seeds few, terete, with a simple testa.—One species in W. N. Amer. Very similar in general appearance to Chamæbatia, but easily distinguished by the bipinnate lvs. and the large dense panicles, and very different in its floral structure. An upright aromatic shrub with finely cut foliage and white fls. in large terminal



890. Chætospermum glutinosa. (×½)

panicles; one of the first shrubs to burst into leaf. It is hardy as far north as Mass., but, like other plants from the same region, it dislikes an excess of moisture, particularly during the winter, and is likely to be killed by it. It prefers a sunny position and a well-drained soil, and likes limestone, but grows nearly as well without; it is not a plant for dense shrubberies. Propagated by cuttings of half-ripened wood taken with a heel in August with slight bottom heat; usually by seeds sown in spring, and treated like those of spirea.

Millefòlium, Maxim. (*Spiràea Millefòlium,* Torr. *Sorbària Millefòlium,* Focke). Shrub, to 3 ft., glandular-pubescent: lvs. bipinnate, short-stalked, ovate-oblong to linear-oblong in outline, 2–3 in. long, primary segms. linear, deeply pinnatifid, with closely set obtuse lobes about a line long: fls. white, ½–⅔in. across, short-pedicelled, in terminal panicles 3–6 in. long: carpels hairy. Calif. to Wyo. and Ariz. B.M. 7810. G.C. III. 22:237; 40:183. Gn. 75, p. 459. G.F. 2:509. R.H. 1900, p. 515. M.D. 1905:198. M.D.G. 1908:208. ALFRED REHDER.

CHAMÆCÉRASUS: *Lonicera.*

CHAMÆCÝPARIS (*chamai*, dwarf, and *kuparissos*, cypress; referring to its affinity). *Pinàceæ*. Trees or shrubs grown for their handsome evergreen foliage; also valuable timber trees; RETINOSPORAS, in part.

Evergreen, with opposite scale-like lvs. in 4 rows, densely clothing the compressed branchlets: fls. monœcious, small; pistillate inconspicuous, globose; staminate yellow or red, oblong, often conspicuous by their abundance: cones small, globular, with 6–11 bracts, each bearing 2, or rarely 5, winged seeds, ripening the first season. Closely allied to Cupressus, which differs in its larger cones maturing the second year, the bracts containing 4 or more seeds, and in its quadrangular branches and minutely denticulate lvs.—Six species in N. Amer. and E. Asia, all very valuable timber trees in their native countries. Highly ornamental evergreen trees of pyramidal habit, of which only *C. thyoides* is fully hardy N., while the Japanese species



891. Chamæcyparis pisifera.

are hardy in sheltered positions north to New England, and *C. Lawsoniana* only from Mass. south; the horticultural varieties are often shrubby.

They grow best in somewhat moist but well-drained, sandy loam and in a partly shaded position, sheltered against dry winds. *C. Lawsoniana* and *C. obtusa* like more dry, the others more moist situations, and *C. thyoides* grows well even in swamps. Propagated by seeds sown in spring; increased also by cuttings from mature wood in fall, inserted in a sandy soil and kept in a coolframe or greenhouse during the winter; if in early spring gentle bottom heat can be given, it will hasten the development of roots considerably. All the so-called retinosporas and the dwarfer forms, and most of the varieties of *C. Lawsoniana*, are readily increased in this way, while the other forms of *C. nootkatensis*, *C. obtusa* and *C. thyoides* do not grow well from cuttings; therefore for most varieties veneer-grafting on seedling stock during the winter in greenhouse is preferred, but dwarf forms always should be grown from cuttings, as they often lose their dwarf habit if grafted. The so-called retinosporas of the gardens, with linear, spreading leaves, are juvenile forms, which have retained the foliage of the seedling state. There are similar forms in Thuja. For their distinguishing characters, see *Retinospora*. For the numerous gardens forms, see Beissner, Handb. der Nadelholzk., 2d ed., pp. 528–574, quoted below as Beissner.

A. *Lvs. green on both sides or paler beneath.*

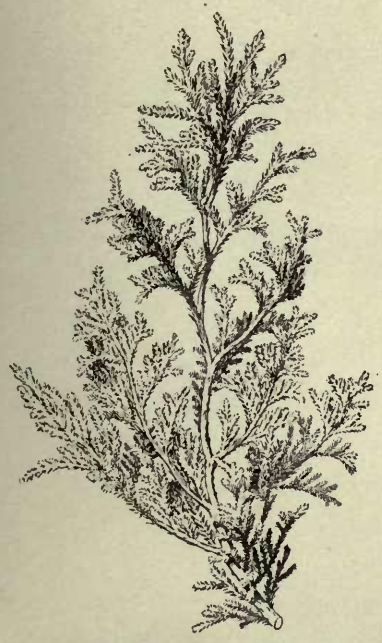
thyoìdes, Brit. (*C. sphæroìdea*, Spach. *Cupréssus thyoìdes*, Linn.). WHITE CEDAR. Tree, to 70 or 80 ft., with erect-spreading branches: branchlets irregularly arranged, spreading, not pendulous, very thin and slender, flattened: lvs. closely imbricate, glaucous or light green, with a conspicuous gland on the back, fragrant: cones small, ¼in. diam., bluish purple, with glaucous bloom. From Maine to Fla., west to Miss. S.S. 10:529. M.D.G. 1896:301 (habit). Beissner 529 (habit). Var. **ericoìdes**, Sudworth (*C. ericoìdes*, Carr. *Retinóspora ericoìdes*, Hort.). Compact shrub, of erect, dense habit: lvs. linear-lanceolate, spreading, with 2 glaucous lines beneath, coloring in winter usually reddish brown. Beissner 532; see also *Retinospora*. Var. **andelyénsis**, Silva-Tarouca (*C. sphæroídea andelyénsis*, Carr. *C. leptóclada*, Hochst. *Retinóspora leptóclada*, Hort., not Zucc.). Intermediate form between the former and the type; bluish green, and of erect growth, with loosely appressed, lanceolate lvs.; often some branchlets with lvs. of the type and some with lvs. of the var. *ericoìdes*. R.H. 1869, p. 32, and 1880, p. 36. M.D.G. 1890:329. R.B. 2:155. Beissner 532; see also *Retinospora*. Var. **glaûca**, Sudworth (*C. sphæroídea glaùca*, Endl. Var. *kewénsis*, Hort.). Of compact habit, very glaucous, with silvery hue. Var. **variegàta**, Sudworth (*Cupréssus thyoìdes variegàta*, Loud.). Branchlets partially colored golden yellow.

nootkaténsis, Sudworth (*Cupréssus nootkaténsis*, Lambert. *C. nutkaénsis*, Spach. *Thuyópsis boreàlis*, Hort.). YELLOW CEDAR. Tree, to 120 ft., with ascending branches, pendulous at the extremities: branchlets distichously arranged, slightly flattened or nearly quadrangular, pendulous: lvs. densely imbricate, usually dark green, acute, mostly without glands: cones subglobose, nearly ½in. diam., dark red-brown, with glaucous bloom. From Sitka to Ore. S.S. 10:530. R.H. 1869, p. 48. G. 19:345. F.E. 25:543. Gt. 53, p. 542. G.W. 8, p. 484; 10, pp. 41, 227. Beissner 555. Gn. 5:395. G.C. III. 40:167. Var. **glaûca**, Regel (*Thuyópsis boreàlis* var. *glaùca*, Jaeger). With very glaucous foliage. Var. **péndula**, Beissn. Distinctly pendulous. Gt. 53, p. 542. G.W. 1, p. 300. G.C. III. 40:166. Beissner 539. Var. **lûtea**, Beissn. The young growth colored light yellow. J.H.S. 1902:427, fig. 113. Gn. 50, p. 68. Gn.W. 11:313.—There are other forms with variegated lvs. *C. nootkatensis* is about as hardy as the Japanese species.

AA. *Lvs. with glaucous or whitish marks beneath: branches with horizontally spreading ramifications.*

Lawsoniàna, Parlatore (*Cupréssus Lawsoniàna*, Murr. *C. Boursièri*, Decne.). LAWSON'S CYPRESS. Tree, to 200 ft., with horizontally spreading and usually pendulous branches: branchlets frond-like arranged, flattened: lvs. closely appressed, obtuse or somewhat acute, usually bright green, with a gland on the back: staminate catkins bright red (yellow in all other species): cone globose, about ⅓in. across, red-brown and often glaucous. From Ore. to Calif. S.S. 10:531. Gng. 2:327. S.M. 2, p. 49. F.E. 23:309; 33:559. G.W. 10, p. 42. Beissner 541. G. 1:121; 7:129.—This is one of the most beautiful conifers and very variable, about 80 garden forms being cult. in European nurseries and collections. The following are some of the best: Var. **álbo-spìca**, Beissn. Tips of branchlets creamy white, of

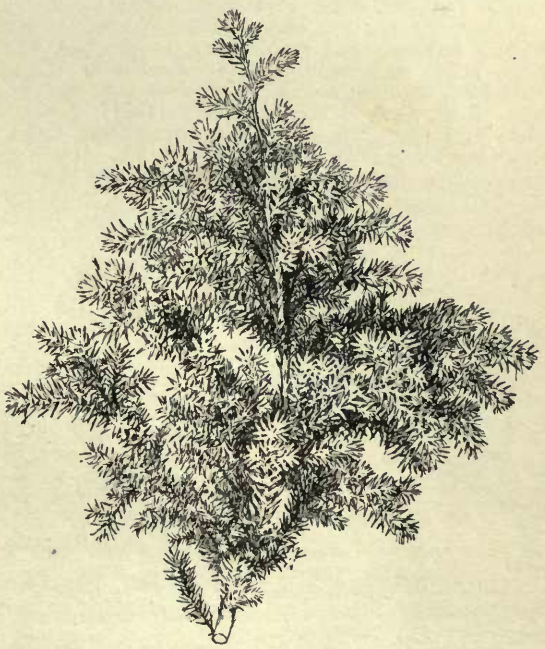
slender habit. Var. **Álumii,** Beissn. Of columnar habit, foliage very glaucous, with a bluish metallic hue. The best blue columnar form. Var. **argéntea,** Beissn. (*Cupréssus Lawsoniàna argéntea,* Gord.). Of slender habit, with very glaucous, almost silvery foliage. Var. **erécta víridis,** Beissn. Dense, columnar habit and bright green foliage. One of the most beautiful varieties, but somewhat tender. G.W. 14, p. 601. M.D.G. 1909:45. G.M. 51: 511. F. 1871, p. 92. Var. **erécta glaùca,** Beissn. Similar in habit, but with glaucous foliage. Var. **filifórmis,** Beissn. Branches elongated, somewhat pendulous, with few lateral branchlets, of low, globular habit. Var. **glaùca,** Beissn. Foliage of metallic glaucous tint. One of the hardier forms. G.M. 53:832. Var. **grácilis,** Beissn. (var. *grácilis péndula,* Hort.). Elegant light green form, with graceful, pendulous branchlets. Var. **intertéxta,** Beissn. Glaucous form, of vigorous growth, with remote, pendulous branches and distant, thickish branchlets. Beissner 550. Var. **lùtea,** Beissn. Of compact habit, young growth clear yellow. G.C. III. 20:721. J.H.S. 1902, p. 426, fig. 110. Var. **nàna,** Beissn. (*C. Boursièri nàna,* Carr.). Dwarf, globose habit (Beissner 553), with some variegated and glaucous forms. Var. **péndula,** Beissn. With pendulous branches. Mn. 1:43. F.E. 27:187. Gt. 1890, p. 449. Var. **pyramidàlis,** P. Smith. Of columnar habit. Var. **pyramidàlis álba,** Beissn. Of columnar habit with the young growth colored white. R.B. 4:281. Var. **Weisseàna,** Hansen. Low dense form of umbrella-like habit with almost horizontally spreading branches and nodding tips. M.D.G. 1890:245. S.M. 1, p. 214. Var. **Yoùngii,** Beissn. Upright form of vigorous growth with thickish dark green branchlets. G. C. III. 1:176, 177.



892. Chamæcyparis pisifera var. plumosa.

obtûsa, Sieb. & Zucc. (*Cupréssus obtùsa,* Koch. *Retinóspora obtùsa,* Sieb. & Zucc.). HINOKI CYPRESS. Tree, to 120 ft., with horizontal branches: branchlets frond-like arranged, flattened, pendulous: lvs. bright green and shining above, with whitish lines beneath, thickish, obtuse, and very closely appressed, with a gland on the back: cones globose, nearly ½in. diam., brown. Japan. S.Z. 121. G.C. II. 5:236. R.H. 1869, p. 97. Gn. W. 20, suppl. April 25. Var. **álbo-spicàta,** Beissn. Tips of branchlets whitish. Var. **aùrea,** Beissn. (*Retinóspora obtùsa aùrea,* Gord.) Golden yellow. Gt. 25:19. Var. **breviràmea,** Beissn. (*C. breviràmea,* Maxim. *Thùja obtùsa* var. *breviràmea,* Mast.). Tree, of narrow pyramidal habit, with short branches: branchlets crowded, glossy green on both sides. Var. **compácta,** Beissn. Of dwarf and dense subglobose habit. Gn. M. 7:76. Var. **ericoìdes,** Boehmer (*Retinóspora Sánderi,* Sander. *Juníperus Sánderi,* Hort.). Of low subglobose habit with bluish gray linear spreading blunt lvs., marked with a green line above. G.C. III. 33:266; 36, suppl. April 25. M.D.G. 1900:589; 1903:291, R.H. 1903, p. 399. Beissner, 556. Var. **filicoìdes.** Beissn. Of slow growth with short and densely frond-like arranged branchlets. G.C. II. 5:235. Var. **filifórmis,** Beissn. (*C. péndula,* Maxim. *Thùja obtùsa péndula,* Mast., not *C. obtùsa péndula,* Beissn.). Branches elongated, thick and thread-like, pendulous, with few distant branchlets. Var. **grácilis aùrea,** Beissn. Graceful form, foliage bright yellow when young, changing later to greenish yellow. Var. **lycopodioìdes,** Carr. Low form, of somewhat irregular habit, with spreading, rigid branches and thick, nearly quadrangular, dark green branchlets. Var. **nàna,** Carr. Low form, of slow growth, with short, deep green branchlets. R.H. 1882:102. Var. **pygmæa,** Carr. (*C. obtùsa breviràmea,* Hort., not Beissn.). Very dwarf form, with horizontal, almost creeping branches, densely frond-like branched. Exceedingly interesting form for rockeries. R.H. 1889, p. 376. Var. **formosàna,** Hayata. Differs in its smaller and finer foliage, and much smaller cones. Formosa. J.C.T. 25, 19, p. 209.

pisífera, Sieb. & Zucc. (*Cupréssus pisífera,* Koch. *Retinóspora pisífera,* Sieb. & Zucc.). SAWARA CYPRESS. Fig. 891. Tree, to 100 ft., with horizontal branches: branchlets flattened, distichously arranged and somewhat pendulous: lvs. ovate-lanceolate, pointed, shining above, with whitish lines beneath: cones globular, ¼–⅓in. diam., brown. S.Z. 122. G.C. II. 5:237. C.L.A. 11:311.—This is, next to *C. thyoides* the hardiest species, and some varieties are much cult., while the type is less planted. Var. **aùrea,** Carr. Yellow foliage. G.W. 1, p. 303. Var. **filífera,** Beissn. (*Retinóspora filífera,* Standish. *C. obtùsa filifera,* Hort.). Branches elongated and slender, threadlike, gracefully pendulous, with distant branchlets and lvs. Very decorative form. G.C. II. 5:237. G.W. 1, p. 301;



893. Chamæcyparis pisifera var. squarrosa.

5, p. 17. Beissner 571, 572. Var. **plumòsa,** Beissn. (*Retinóspora plumòsa,* Veitch). Fig. 892. Of dense, conical habit: branches almost erect, with slender branchlets of feathery appearance: lvs. subulate, pointed and slightly spreading, bright green. Intermediate between the type and var. *squarrosa.* G.C. II. 5:236. Gn. M. 2:27. Beissner 569. Var. **plumòsa**

argéntea, Beissn. Tips of branchlets whitish. Var. **plumòsa aùrea,** Beissn. (*Retinóspora plumòsa aùrea,* Standish). Young growth of golden yellow color. A very showy form. Var. **squarròsa,** Beissn. & Hochst. (*Retinóspora squarròsa,* Sieb. & Zucc. *R. leptoclàda,* Zucc.). Fig. 893. Densely branched, bushy tree or shrub, with spreading, feathery branchlets: lvs. linear, spreading, glaucous above, silvery below. A very distinct and beautiful variety. S.Z. 123. R.H. 1869, p. 95, and 1880, p. 37. Beissner 567. M.D.G. 1909:44. R.B. 2:189.

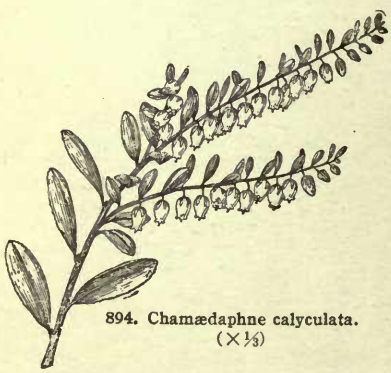
C. formosénsis, Matsum. (Cupressus formosensis, Henry). Allied to C. pisifera. Tree, to nearly 200 ft. and 20 ft. diam.: branchlets dull green on both surfaces or slightly bloomy below: lvs. acute, ovate: cones ovoid, ⅛in. across, with 10 or 11 scales. Formosa. G.C. III. 51:132, 133.—Recently intro. into England, but probably tender.

ALFRED REHDER.

CHAMÆDÁPHNE (*chamai,* dwarf, and *daphne,* the laurel in ancient Greek, alluding to its dwarf habit and evergreen leaves). Syn., *Cassándra. Ericàceæ.* LEATHER-LEAF. Small plant, rarely cultivated for its early white flowers and evergreen foliage.

Low shrub, with evergreen alternate small lvs.: fls. nodding in terminal leafy racemes; calyx small, 5-lobed; corolla urceolate-oblong, 5-lobed, with 5 included stamens; anthers 2-pointed: fr. a depressed-globose, 5-lobed caps. with numerous seeds.—One species in the colder regions of the northern hemisphere. Low, hardy, ornamental shrub, valuable for the earliness of its pretty white fls. It thrives best in a peaty and sandy, moist soil. Prop. by seeds sown in sandy peat, only slightly or not covered, and kept moist and shady; also by layers and suckers and by cuttings from mature wood in late summer under glass.

calyculàta, Mœnch (*Cassándra calyculàta,* Don. *Lyònia calyculàta,* Reichb. *Andrómeda calyculàta,* Linn.). Fig. 894. Bush with spreading or horizontal branches, 1–3 ft.: lvs. short-petioled, oblong, obtuse, slightly serrulate and revolute at the margins, dull green above and rusty-lepidote beneath: fls. short-peduncled, nodding; corolla white, oblong, about ¼in. long. B.M. 1286. L.B.C. 6:530; 15:1464; 16:1582. Mn. N. 1:125. Em. 423. Var. **angustifòlia,** Rehd. (*Andrómeda calyculàta* var. *angustifòlia,* Ait. *A. crispa,* Poir.). Lvs. linear-lanceolate, undulate and crisped at the margin. Var. **nàna,** Rehd. (*Andrómeda calyculàta* var. *nàna,* Lodd. *A. vaccinioìdes,* Hort.). One foot or less high, with horizontal branches. L.B.C. 9:862.—Handsome little shrub, well suited for borders of evergreen shrubberies and for rockeries.



894. Chamædaphne calyculata. (×⅓)

ALFRED REHDER.

CHAMÆDÒREA (Greek, *dwarf* and *gift*). *Palmàceæ.* Spineless, erect, procumbent or rarely climbing usually pinnatisect or pinnate palms.

Trunks solitary or cespitose, slender or reed-like: lvs. simple, bifid at the apex or variously equally-pinnatisect; lobes broad or narrow, straight or oblique, acuminate, plicate-nerved, usually callous at the base, the basal margins folded back or recurved; petiole usually cylindrical; sheath tubular, oblique at the throat: spadices among or below the lvs., simple or paniculately branched; spathes 3 or many, often appearing much below the lvs., alternate, sheathing, elongated, split at the apex, membranous or coriaceous, usually persistent; pistillate fls. very small, solitary, in small pits in the spadix: fr. small, of 1–3 globose or oblong-obtuse carpels, coriaceous or fleshy.—Species about 60. Mex. to Panama. G.C. II. 23:410, and Dammer's articles in G.C.III. 38:42–44 (1905), and 36:202, 245 (1904).

Peat or leaf-mold, loam and sand in equal parts, with a little charcoal added, form the best soil. The species common in cultivation are quick-growing. They are well suited for planting out in greenhouse borders. The sexes are on different plants; therefore several should be planted in a group if the handsomely colored fruit is desired. All of the kinds require warm temperature in winter. Increased from seeds. Of the many species, only a few appear in the American trade. (G. W. Oliver.)



895. Chamædorea glaucifolia.

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Karwinskiana, 7.
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Pringlei, 9.
Sartorii, 4.
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A. *Lvs. simple.*

1. **Érnesti-Augústi,** Wendl. St. 3–4 ft., reedy, erect, radicant at base: blade obovate, cuneate at the base, deeply bifid, coarsely serrate along the margins; petiole shorter than blade; sheath amplexicaul: sterile spadix 8–9 in., the simple branches 6–8 in., attentuate, slender; fertile spadix simple; fls. red. Mex. B.M. 4837. F.S. 13:1357.

AA. *Lvs. pinnate.*

B. *Plant becoming of climbing habit.*

2. **desmoncoìdes,** Wendl. Lvs. 2–3 ft. long, with drooping, narrow lfts. a foot long, and glaucous petiole: plant tending to climb after it becomes a few feet high. Mex.

BB. *Plant not climbing.*

C. *St. or trunk evident.*

D. *Lfts. 40–50, glaucous on both sides.*

3. **glaucifòlia,** Wendl. Fig. 895. St. 20 ft.: lvs. long, pinnate; lfts. 40–50, narrowed, long and slender, dark green, glaucous: fls. on a tall spadix which often exceeds the lvs. and comes out from between them. Guatemala. G.F. 8:507 (adapted in Fig. 895).—Horticulturally one of the best of all chamædoreas.

DD. *Lfts. less than 40, bright green, at least above.*

E. *Spadix appearing among or with the lvs., not conspicuously cauline.*

4. **Sártorii,** Liebm. St. 8–14 ft., ringed, clothed above with lf.-sheaths: lvs. 3–3½ ft. long; petiole terete, sulcate, dilated at the base; sheath, petiole and rachis white on the back; lfts. 12 in. long, 1½–2 in. wide, alternate, falcate, acuminate, narrowed at the base, sometimes almost confluent: spadix among or just below the lvs. Mex.

5. **élegans,** Mart. St. strict, 6 ft. high, scarcely more than 1–1½ in. thick, closely ringed, often sending out

roots from above the base: lvs. 6–8 in a cluster, broadly lanceolate; lfts. about 14, the upper pair sometimes confluent, acuminate, straight: fls. reddish orange: fr. globose. Mex. B.M. 4845.

EE. *Spadix appearing much below the lvs., conspicuously cauline.*

6. **Tepejilòte,** Liebm. St. 10 ft. high, closely ringed, about 1½ in. thick: lvs. 4 ft.; lfts. 20–30, 7-nerved, close alternate, falcate, acute, narrowly lanceolate, 13–15 in. long, 1½ in. wide; rachis convex on the back, canaliculate above: fls. yellow. Mex. B.M. 6030.

7. **elàtior,** Mart. (*C. Karwinskiàna,* Wendl.). St. 20–30 ft., bamboo-like: lvs. 6 ft. long, the sheath 18 in. long; lfts. 15 or 16, the lower very narrow, opposite or nearly so, the upper lanceolate, acuminate at each end; petioles 1½–3 ft. long: spadix simply branched, appearing at least 6 ft. below the lvs.; fls. reddish orange: fr. globose, ovoid. Mex.—Intro. by Franceschi in 1898.

8. **Arenbergiàna,** Wendl. (*C. latifòlia,* Hort.). St. slender, 5–6 ft., green: lvs. usually only 5 or 6, erect-spreading; lfts. 10–15 pairs, alternate and drooping, very long-pointed, plicate and many-ribbed: fls. yellowish white. Guatemala. B.M. 6838.

CC. *St. or trunk none.*

9. **Prínglei,** Wats. Acaulescent or nearly so: lvs. usually rather stiff, erect, pinnate, 3 ft.; lfts. 12–15 on each side, linear-lanceolate, acuminate, 6–8 in. long, ¼–½in. wide; rachis triangular: spadix simple, 8 in. long. San Louis Potosi, Mex.

C. atròvirens, Mart. St. bamboo-like, stiff and simple, about 9 ft. high: lvs. bright green, spreading, about 2½ ft. long. Mex. Not common in the trade but grown in fanciers' collections.—*C. bambusoides,* Hort.. Sts. tufted, thin, reed-like, with feathery light green lvs. Honduras.—*C. formòsa,* Hort. A showy pinnate-lvd. palm of unknown botanical status. G.C. II. 5:724.—*C. geonomæfórmis,* Wendl. St. 4 ft.: lvs. simple, deeply cut, about 9 in. long: spadix from among the lvs. long-pendulous. Guatemala. Gn. 24, p. 244; 30, p. 593.—There are said to be a number of unidentified species scattered about Calif.

JARED G. SMITH.
N. TAYLOR.†

CHAMÆLÍRIUM (*dwarf* or *ground lily,* a Greek combination). *Liliàceæ.* Sometimes spelled *Chamælirion.* Rhizomatous whitish flowered hardy plant, sometimes planted in the herbary.

Erect, tall unbranched herb 2–4 ft. high (or perhaps 2 species), inhabiting low grounds from Mass. to Fla. and W.: rootstock tuberous: diœcious, the sterile plant less leafy than the other: lvs. radical and cauline, the lowermost spatulate, the upper lanceolate, narrowed at the base: fls. small (¼in. across), in a slender terminal raceme; segms. of perianth 6, white, narrow, 1-nerved, withering and persistent; sterile fls. with 6 stamens, and fertile fls. with rudiments of stamens; ovary 3-celled and 3-styled: fr. a 3-valved caps.

lùteum Gray (*C. caroliniànum,* Willd. *Chamælírion carolínia,* Hort.). BLAZING-STAR. DEVIL'S-BIT. Variable as to height (6 in. to 3 ft. or more), with most of the lvs. at the base: raceme spike-like, 4–12 in. long; fls. yellowish white, in effect, fruiting pedicels ½in. or less long.—A good perennial, blooming May–July, thriving in moist shady places.—*C. obovàle,* Small, by some considered not to be distinct, has larger fls. and fruiting pedicels ½in. or more long. L. H. B.

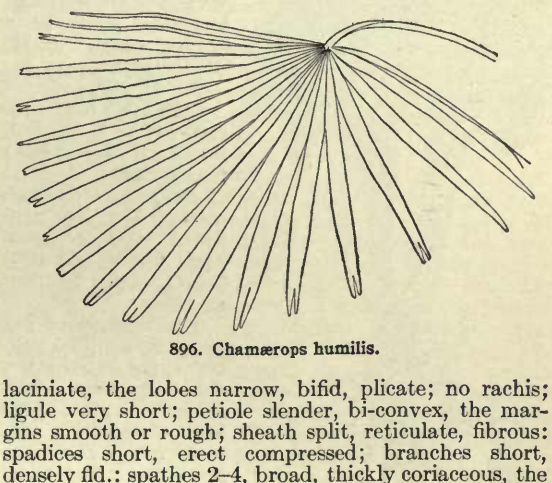
CHAMÆMÈLUM (*small apple,* suggested by the odor of the fls.). *Compósitæ.* Under this name one plant is offered. The genus is by many included in Anthemis, however, the sub-group being distinguished by very short or absent pappus, sometimes making a 1-sided border, ray-fls. fertile, and other minor characters. **C. caucásicum,** Boiss. (*Pyrèthrum caucásicum,* Bieb.), is listed, with white daisy-like fls. about the size of a marguerite, of trailing habit, very free-flowering, recommended for the rockery: perennial, 1–1½ ft., smooth, not strong-scented: st. ascending from a rhizome or procumbent or sub-erect: lvs. oblong, pinnatisect, the segms., cut into linear-subulate parts: fl.-heads large, terminal; involucre-scales oblong-obtuse, margined. High mts. in the Caucasus; variable. L. H. B.

CHAMÆPEÙCE: *Carduus.*

CHAMÆRÁNTHEMUM (*dwarf* and *flower,* from the Greek). *Acanthàceæ.* Three or 4 Brazilian small herbs, allied to Eranthemum, but readily distinguished by the 4 (instead of 2) stamens. Lvs. large and membranaceous, entire, variously marked: fls. showy, white or yellow, in bracteate clusters.—Grown chiefly for the beautiful foliage; greenhouse subjects. **C. ígneum,** Regel (*Eránthemum ígneum,* Lind.), is in the American trade. It is a low spreading warmhouse plant (cult. of Eranthemum and Justicia), with dark green lvs., with the veins and sometimes the margins richly banded with orange or yellow: fls. small. F.S. 17:1722. N. TAYLOR.†

CHAMÆROPS (Greek for *dwarf bush*). *Palmàceæ,* tribe *Sàbaleæ.* Low fan-leaved palms.

Caudices cespitose, branched from the base and clothed with the bases of the lf.-sheaths: lvs. terminal, rigid, semi-orbicular or cuneate-flabellate, deeply



896. Chamærops humilis.

laciniate, the lobes narrow, bifid, plicate; no rachis; ligule very short; petiole slender, bi-convex, the margins smooth or rough; sheath split, reticulate, fibrous: spadices short, erect compressed; branches short, densely fld.: spathes 2–4, broad, thickly coriaceous, the lower ones split, the upper entire; bracts small, subulate; bractlets none: primary spadix branches bracted: fls. small, yellow: fr. globose or ovoid, 3-sided toward the base, brown or yellow.—Species 1 or perhaps 2. Medit. region. From Rhapidophyllum, an American relative, it may be distinguished by its bracted spadix. The common *C. humilis* is widely cult., and very variable. Many of specific-made names represent forms of this species. Of such cases are evidently the garden names *C. arborescens, C. argentea, C. canariensis, C. elata, C. elegans, C. farinosa, C. gracilis, C. littoralis, C. nivea.* G.C. II. 23:410.

The best soil for these palms is fibrous loam two parts, leaf-mold and sand one part, with good drainage. Propagated by suckers and by seeds. These are among the hardiest of all palms, and are well suited to greenhouses where a high temperature is not kept up. (G. W. Oliver.)

hùmilis, Linn. Fig. 896. This is the only palm native to Eu. St. 1–1½ ft. high: lvs. ragged, fibrous; margins of the petioles armed with stout, straight or hooked spines; blade suborbicular, truncate or cuneate at the base, rigid, palmately multifid; segms. acuminate, bifid. Medit. B.M. 2152. R.H. 1892:84 (showing habit and a colored plate of the fr.).—Reaches 20 ft. in a rather arborescent variety. Var. **dactylocárpa,**

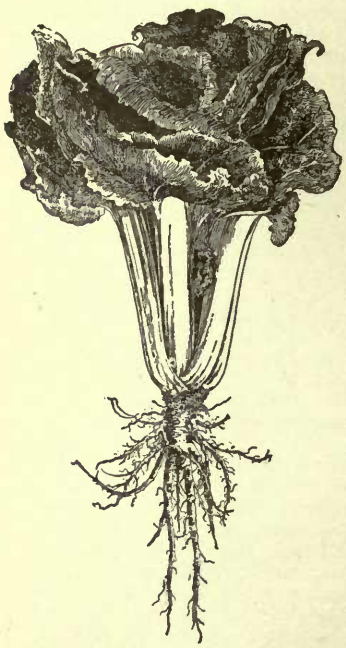
Becc., is interesting for its elongated frs. shaped like a date. Offered by Montarioso Nursery in 1912.

C. Bíroo, Sieb.=Livistona rotundifolia.—*C. Býrrho*, Hort.=Livistona rotundifolia.—*C. excélsa*, Thunb.=Trachycarpus excelsus.—*C. farinòsa*, Hort.=C. humilis, Linn.—*C. Fórtunei*, Hook.=Trachycarpus.—*C. hùmilis* × *hýstrix*, Hort. Said to be a "choice garden hybrid of Florida origin."—*C. hýstrix*, Fraser.=Rhapidophyllum hystrix.—*C. stauracántha*, Hort.=Acanthorhiza aculeata.

JARED G. SMITH.
N. TAYLOR.†

CHAMOMILE: *Anthemis.*

CHAPTÀLIA (J. A. C. Chaptal, 1756–1831, agricultural chemist). *Compósitæ.* Low perennial herbs, with white or purplish fls. on naked scapes, blooming in spring and summer: heads radiate, the ray-fls. pistillate, and the disk-fls. perfect, but some or all of them sterile; involucre campanulate or turbinate, of appressed and imbricated bracts; pappus of soft capillary bristles: achenes oblong or fusiform, narrowed above, 5-nerved. —Twenty-five American species. The only species in the American trade is **C. tomentòsa,** Vent. (*Thyrsánthema semiflosculàre,* Kuntze), of N. C. and south. Of this the scape is 1 ft. or less high, and the heads are purple-rayed: lvs. oblong or oblanceolate, more or less remotely denticulate, rather thick, white-tomentose beneath. Intro. as a border plant. B. M. 2257. N. TAYLOR.†



897. Chard, or sea-kale beet.

CHARD (*ch* pronounced as in *charge*). SWISS CHARD. SEA-KALE BEET. A form of the plant (*Beta vulgaris*) which has produced the common beet; known as *Beta Cicla* (p. 496). See *Beet* and *Beta.*

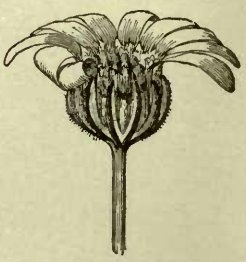
The beet plant has given rise to two general types of varieties: those varieties with thickened roots (the beet of America, the beet-root of European literature); and those with large and pulpy or thickened leaves (but whose roots are small and woody). The latter type is known under the general name of leaf-beets. These leaf-beets may be arranged into two sub-groups: (1) Common or normal leaf-beets, or spinach beets, in which the leaf-blade is large and pulpy, and is used as spinach; chard, in which the petiole and midrib are very broad and thick, is a form of this, although the name is sometimes used as synonymous with the general edible leaf-beet group. (Fig. 897); (2) ornamental beets, of which the foliage is variously colored.

Chard is of the easiest culture. Seed is sown in spring, as for common beets. The broad petioles, or chards, may be gathered from midsummer until frost. These broad white stalks or ribs are used as a pot-herb; and, if desired, the leaf-blades may be cooked with them. The dish is usually more attractive, however, if only the chards are cooked. If cutting of the leaves is carefully performed, a succession may be had till cold weather. Chard is an attractive vegetable when well grown, but is little used in this country.

L. H. B.

CHÁRIEIS (Greek, *elegant,* from the pleasing flowers). *Compósitæ.* Attractive hardy flower-garden annual.

A small, branchy plant, 6–12 in. high, with blue or red aster-like fls., on long sts.: plant pubescent or hispid: lvs. oblong-spatulate or oblong-lanceolate, entire or remotely denticulate: heads many-fld., radiate, the ray-fls. pistillate, the disk-fls. perfect: achene obovate and compressed, those of the disk with plumose pappus: involucre scales in 2 rows.—One species, in the W. Cape region. Known as Kaulfussia in gardens. The genus Kaulfussia was founded by Nees in 1820; in 1817, however, the plant was described by Cassini as *Charieis heterophylla.*



898. Charieis heterophylla. (×1)

heterophýlla, Cass. (*C. Neèsii,* Hort. *Kaulfússia amelloìdes,* Nees). Figs. 898, 899. Rays blue, disk yellow or blue. An excellent subject of easy cult. in any garden soil. Var. **atrovioìàcea,** Hort., has dark violet fls. Var. **kermesìna,** Hort., has violet-red fls. Sow seeds where the plants are to grow; or they may be started indoors and the plants transplanted to the open. L. H. B.

CHARLOCK: *Brassica;* also *Raphanus.*

CHARLWOÒDIA: *Cordyline.*

CHASTE TREE: *Vitex.*

CHAVÌCA, kept distinct in part by recent authors, is accounted for under *Piper.*

CHEAT, or CHESS: *Bromus.*

CHECKERBERRY: *Gaultheria.*

CHEESES: Vernacular for *Malva rotundifolia.*

CHEILÁNTHES (Greek, *lip-flower,* alluding to the indusium). *Polypodiàceæ.* Semi-hardy or hothouse ferns of small size.

Plants often hairy or woolly, with the sori terminal on the veins and covered with a roundish indusium.—Some 60 or 70 species are known, nearly a third of which are natives of the W. and S. W. United States, one species as far east as Conn. They are of easy cult., enjoying a position near the glass, and disliking strong, close heat and syringing or watering overhead. Most of the species grow naturally in dry rocky situations. They are among the few ferns to be found in dry regions. Commercially valuable only from the fern collector's standpoint.



899. Charieis heterophylla.

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A. *Lvs. pentagonal-deltoid, the indusium confined to a single veinlet.*

1. **califórnica,** Mett. (*Hypólepis califórnica,* Hook.). Lvs. densely cespitose from a short creeping rootstock, 2–4 in. each way, on stalks 4–8 in. long, quadripinnatifid; ultimate segms. lanceolate, incised or serrate. Calif.



900. Cheilanthes lanosa. (×⅓)

2. **meifòlia,** D. C. Eaton (*Hypólepis meifòlia,* Baker). Lvs. cespitose, with slender brown stalks 5–7 in. long, the lamina 2–3 in. each way, 3–4-pinnatifid, with finely cut segms. $\frac{1}{10}$in. wide. Mex.

AA. *Lvs. lanceolate or ovate-lanceolate.*

B. *Segms. flat: indusia extending over the apices of several veinlets, but not continuous.*

C. *Surface of lvs. smooth.*

3. **microphýlla,** Swartz. Lvs. 4–10 in. long, on stalks nearly as long, from a short, creeping rootstock, bi-tripinnate: sts. glossy, rusty-pubescent on the upper side. Fla. and New Mex. southward.

CC. *Surface of lvs. viscid-glandular.*

4. **víscida,** Davenport. Lvs. 3–5 in. long, on stalks of the same length, tripinnatifid; segms. toothed, everywhere glandular. Calif.

CCC. *Surface of lvs. hairy, not woolly.*

5. **hírta,** Swartz. Lvs. densely cespitose, with short, scaly stalks which are brownish, like the rachides; pinnæ numerous, rather distant bipinnatifid, the segms. with much incurved margins. The lvs. are usually 6–15 in. long. Cape of Good Hope. Var. **Ellisiàna,** is more commonly cult.

6. **lanòsa,** Wats. (*C. vestìta,* Swartz). Fig. 900. Lvs. cespitose, with stalks 2–4 in. long, slightly hairy, as are the segms., tripinnatifid, 4–10 in. long, 1–2½ in. wide, the pinnæ lanceolate-deltoid: indusia formed of the ends of roundish or oblong lobes. Conn. to Kans. and Ala.—Hardy.

7. **Coòperæ,** D. C. Eaton. Lvs. 3–8 in. long, bipinnate, the stalks covered with nearly white hairs, each tipped with a gland; pinnules roundish ovate, crenate and incised. Calif. to Mex.

BB. *Segms. bead-like, minute: indusia usually continuous.*

C. *Lvs. hairy or woolly beneath, but not scaly.*

D. *Upper surface of segms. smooth.*

8. **gracíllima,** D. C. Eaton. Lace Fern. Lvs. cespitose, 1–4 in. long, borne on the nearly equal dark brown stalks, bipinnate; pinnæ with about 9 pinnules, finally smooth above. Idaho to Calif.—Hardy

9. **Clèvelandii,** D. C. Eaton. Lvs. 4–8 in. long, tripinnate, dark brown beneath, with closely imbricate, ciliate scales, which grow on both the segms. and the rachides; segms. nearly round, the terminal larger. Calif.

DD. *Upper surface of segms. pubescent.*

10. **tomentòsa,** Link. Lvs. 8–15 in. long, on stalks 4–6 in. long, everywhere covered with brownish white hairs, tripinnate; terminal segms. twice as large as the lateral. Va. to Ariz.

CC. *Lvs. covered beneath with scales, but not woolly.*

11. **Féndleri,** Hook. Lvs. 3–6 in. long, borne on the chaffy stalks, rising from tangled, creeping rootstocks, tripinnate; rachis with broadly-ovate white-edged scales, which overlap the subglobose segms. Texas, and Colo. to Calif.

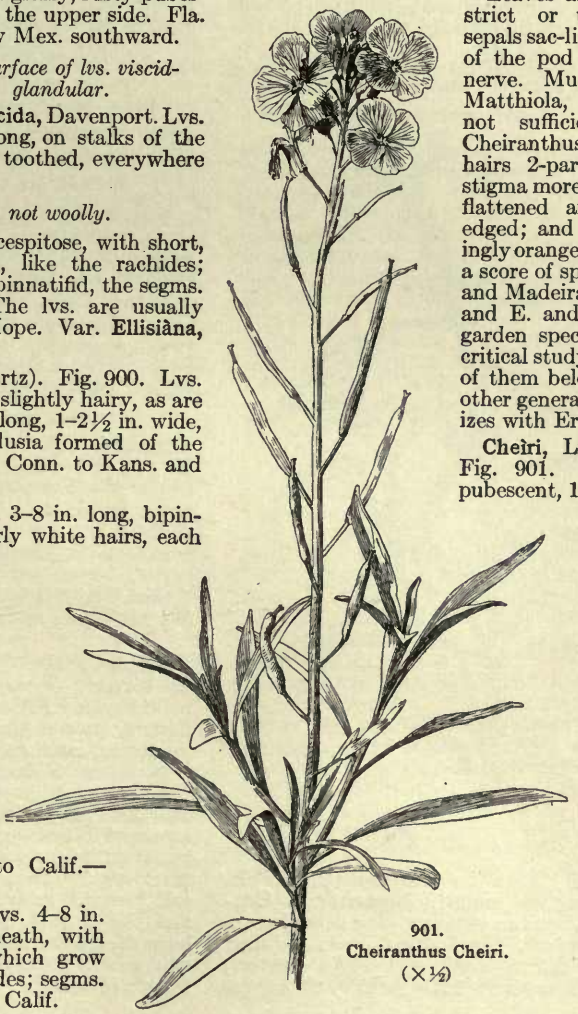
CCC. *Lvs. covered beneath with both scales and wool.*

12. **myriophýlla,** Desv. (*C. élegans,* Desv.). Lvs. densely cespitose from short, erect, scaly rootstocks, 3–9 in. long, borne on the chestnut-colored scaly stalks, triquadripinnatifid; ultimate segms. minute, innumerable. Texas, Ariz. and Trop. Amer.

A native species worthy of cult. is *C. leucópoda,* Link, from Texas, with broadly deltoid-ovate lvs—*C. undulàta,* Hope & Wright. Dark green fronds, softly pubescent. China. G.C. III. 34:397 (desc.)

L. M. Underwood.
R. C. Benedict.†

CHEIRÁNTHUS (derivation in dispute, but probably from Greek for *hand* and *flower*). *Cruciferæ.* Flower-garden perennials, with large purple, brown, orange or yellow fragrant bloom.



901. Cheiranthus Cheiri. (×½)

Leaves alternate, entire, on a strict or upright st.: lateral sepals sac-like at the base: valves of the pod with a strong mid-nerve. Much confounded with Matthiola, and the genera are not sufficiently distinct. In Cheiranthus, the lvs. are acute, hairs 2-parted and appressed, stigma more spreading, pod more flattened and seeds not thin-edged; and the fls. are prevailingly orange or yellow—Probably a score of species, in the Canary and Madeira Isls., Medit. region and E. and in N. Amer. The garden species are confused; a critical study may find that some of them belong to Erysimum or other genera. The genus hybridizes with Erysimum.

Cheìri, Linn. Wallflower. Fig. 901. Perennial, slightly pubescent, 1–2½ ft.: lvs. lanceolate and entire, acute: fls. large, mostly in shades of yellow, in long, terminal racemes, sweet-scented. S. Eu.—An old garden favorite, blooming in spring. Although a woody perennial, it is best to renew the plants from seed, for they begin to fail after having bloomed one or two years. Seedlings should bloom the second year; in England, Christmas bloom is secured from seeds sown in Feb. There are dwarf and double-fld. varieties,

and innumerable forms in various shades of yellow, brownish, and even purple. Not prized so much in Amer. as in Eu. A common plant on walls in England.

alpìnus, Linn. St. strict and simple, 1 ft.: lvs. lanceolate, somewhat dentate, stellate-pubescent: pods spreading on short pedicels: fls. lemon-yellow, spring. Norway, Lapland.

mutábilis, L'Her. More or less woody, 2–3 ft.: lvs. linear-lanceolate and pointed, obscurely serrate: fls. white, cream-colored or yellowish, becoming darker and striped. Madeira. B.M. 195.—It is doubtful whether the plant known in cult. as *C. mutabilis* is this species.

Mârshallii, Hort. Perhaps a hybrid, 1–1½ ft.: lvs. spatulate and crowded below, more scattered and narrower above: fls. orange.

Alliònii, Hort. Said to be a hybrid: 12 in. or less: fls. brilliant orange, profusely produced in spring and summer and sometimes so freely that the plant exhausts itself and becomes practically biennial.

kewénsis, Hort., is valuable as a winter-blooming greenhouse plant, prized for its fragrance and its dark-colored fls. In 1897 at Kew a cross was made between *C. mutabilis* of the Canary Isls. and a yellow wallflower, the cross being known as *C. hybridus;* and this in turn was crossed with a red wallflower, producing the plant known as *C. kewensis.* It has the bushy character of *C. mutabilis;* racemes upright; fls. about 1 in. across, brown in bud, or expanding brownish orange inside and reddish brown outside, all turning pale purple with age. Prop. by cuttings. G.C. III. 35:123. Gn. 65, p. 89.

C. ánnuus, Hort.=Matthiola, but early-blooming forms of C. Cheiri seem to pass under this name.—*C. Ménziesii,* Benth. & Hook.=Parrya.

L. H. B.



902. Chelone glabra. (×¼)

CHELIDÒNIUM (Greek for the *swallow:* the fls. appear when the swallow comes). *Papaveràceæ.* Celandine Poppy. One or two loose-growing herbs, sometimes seen in old gardens. Plant with fl.-buds nodding, and small yellow fls. in small umbel-like clusters; sepals 2; petals 4; stamens 16–24; style very short, the stigma 2-lobed: pod slender, 2-valved, opening first at the bottom. **C. màjus,** Linn., is a European plant, now run wild in waste places, and often seen in old gardens. It is biennial or perennial, with brittle hairy sts. and pinnately-parted lvs., the lobes rounded and toothed (or, in var. *laciniàtum* again dissected). The plant has bright orange juice which has been used for removing warts. Herb an old-time remedy, used for its cathartic and diuretic properties, for promoting perspiration, and as an expectorant. Lvs. light glaucous underneath.

L. H. B.

CHELÒNE (Greek for *tortoise* or *turtle:* the corolla fancied to resemble a reptile's head). *Scrophulariàceæ.* Turtle-Head. Several North American perennial herbs, with showy flowers in short spikes or in panicles, some of which are now sold by dealers in native plants. Allied to Pentstemon.

Upright smooth branching plants: corolla more or less 2-lipped or gaping, white or red, the upper lip arched and conspicuous and notched; anthers 4, woolly, and a rudiment of a fifth stamen: seeds winged: lvs. opposite, serrate.—Four species, in N. Amer.

Half-shaded places are preferable for these easily cultivated plants. Very dry grounds should be avoided, from the fact that they are best in swampy places. In the ordinary border they should have a very liberal mulch of old manure in their growing season: 4–5 in. thick is none too much: the surface roots will feed in this compost, and the plants are not so liable to suffer from drought when thus protected. (J. B. Keller.)

A. *Fls. in terminal and axillary close spikes.*

B. *Lvs. elliptic to broad-ovate, long-petioled.*

Lyònii, Pursh. Plant, 2–3 ft. high: lvs. broad to nearly cordate at base, thin, evenly serrate: fl.-bracts minutely ciliate: fls. rose-purple. Mts., Va. and S.

BB. *Lvs. lanceolate or oblong, short-petioled.*

oblìqua, Linn. Two ft. or less: lvs. 2–8 in. long, broad-lanceolate or oblong, very veiny, sharp- or deep-serrate or cut: fl.-bracts ciliate: fls. deep rose. Damp grounds, Ill., Va., S.

glàbra, Linn. (*C. oblìqua* var. *álba,* Hort.). Fig. 902. One to 2 or more ft. high, more strict: lvs. mostly narrower, acuminate, appressed-serrate, nearly sessile, not very veiny: fl.-bracts not ciliate: fls. white or rose-tinged. Wet grounds: common.

AA. *Fls. in a loose thyrse or panicle.*

nemoròsa, Douglas (*Pentstèmon nemorósus,* Trautv.). Two ft. or less high, of unpleasant odor: lvs. ovate and acute, sharp-dentate, sessile or nearly so: fl.-bracts none; corolla 1 in. long, violet-purple. Calif. and N. B.R. 1211.

C. barbàta of gardens is Pentstemon barbatus.

L. H. B.

CHENILLE PLANT. A proposed name for *Acalypha hispida,* better known as *A. Sanderi.*

CHENOPÒDIUM (*goosefoot,* alluding to the shape of the leaves). *Chenopodiàceæ.* Goosefoot. Widely dispersed weedy herbs, with very inconspicuous greenish flowers, some of which occur in gardens as oddities or for ornament, and others are pot-herbs of very minor importance. Spinach, beet, and orach are allied plants.

Plants of various habit, mostly erect: fls. perfect, bractless, sessile in small masses and these clusters arranged in spikes or panicles; calyx 4–5-parted, petals wanting; stamens usually 5; styles 2 or 3.: seed lenticular: lvs. alternate. The calyx sometimes enlarges and becomes succulent and colored, inclosing the fr., and the glomerules may then look like berries.—Perhaps 60 species in all parts of the globe, annuals and perennials, sometimes woody. Many of them are field and garden weeds. They are mostly mealy or

glandular herbs, often with strong odor. Some of them are used as pot-herbs or "greens."

A. *Fls. in dense heads or glomerules which become berry-like and bright red in fr.*

capitâtum, Aschers. (*Blîtum capitâtum,* Linn.). STRAWBERRY BLITE. Annual, erect and becoming diffuse or spreading, branching, glabrous or nearly so: lvs. soft, hastate-ovate, toothed, stalked: fr.-clusters large and becoming fleshy, in an interrupted spike, the upper part leafless. Eu.—A frequent but not pernicious weed, and sometimes offered as a pot-herb.

AA. *Fls. not in dense separate heads, and the clusters not becoming prominently fleshy or colored.*

B. *Plant shrubby, spinescent.*

nitrariàceum, F. Muell. Rigid, much-branched, often prostrate shrub or undershrub, mealy-white: lvs. linear-oblong or linear-spatulate, obtuse, entire, 1 in. or less long, often clustered: fls. clustered in dense or more or less interrupted spikes and panicles, greenish. Austral.—Offered in Eu.

BB. *Plant herbaceous.*

C. *Species perennial: a pot-herb.*

Bònus-Henrìcus, Linn. (*Blîtum Bònus-Henrìcus,* Reichb.). GOOD KING HENRY. MERCURY (by corruption, Markery). Stout and erect from a thick root-stock, to 2½ ft., glabrous: lvs. broad, triangular-hastate or ovate, with very long wide-spreading basal points, entire or undulate: fls. in paniculate spikes. Eu. —Escaped now and then; and sometimes cult. for "greens."

CC. *Species annual.*

purpurâscens, Jacq. (*C. Atríplicis,* Linn. f.). Vigorous, erect, 3 ft., the young parts and lvs. covered attractively with a rose-violet or violet-purple crystalline pulverulence: lvs. spatulate or rhomboid or oval, obtuse, long-petioled, the lower ones sinuate-dentate and the upper lanceolate and entire: fls. small and numerous, in dense pyramidal leafy reddish clusters. China.—An old garden plant, seldom seen in this country; grown for its colored character in summer. There are different forms, one with variegated foliage.

amarantícolor, Coste & Reyn. Very large, 8 ft., much like the preceding and perhaps derived from it: st. glabrous, striped white and red: lvs. triangular to rhomboid, 4 in. or less long, red-pulverulent: fls. in a long red panicle. S. France.—Differs from *C. purpurascens* in its greater size and its black shining somewhat sharp-edged seeds. The brilliant colors disappear as the plant matures.

Quinòa, Willd. QUINOA. Erect, stout, st. furrowed, 4–5 ft.: lvs. triangular-ovate, sinuate, long-petioled, angulate-pinnatifid, glaucous: fls. small and green, in dense axillary and terminal farinose clusters arranged in panicles: seeds very large. W. slope of the Andes. B.M. 3641.—A very important plant in W. S. Amer., the seeds being used as food. There are white- and red-fruited forms. Sometimes cult. in this country as a curiosity. Allied to *C. album,* the common pigweed.

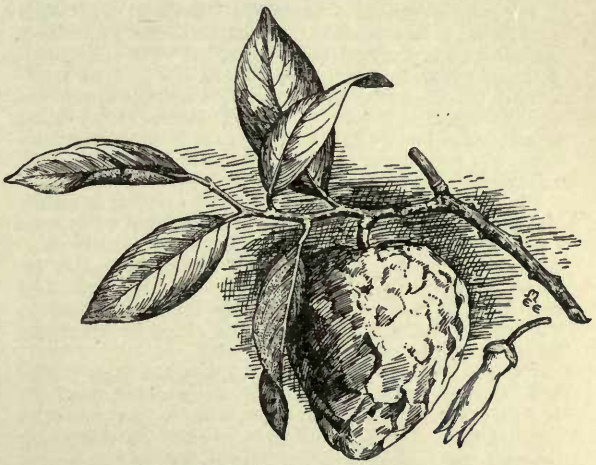
Bòtrys, Linn. FEATHER GERANIUM. JERUSALEM OAK. Erect, glandular-pubescent and viscid, aromatic, 1–3 ft. high, with pinnatifid long-petioled lvs. and long, feather-like, enduring spikes, for which it is used in vases and baskets; pretty. Eu., and widely naturalized although not usually becoming abundant.

Many weedy chenopods invade cult. grounds. *C. álbum,* Linn., the common pigweed or lamb's quarters, is a favorite for "greens." This species runs into many forms. *C. víride,* of Eu. and Asia, has seeds that are said to be edible. *C. Vulvària,* Linn., sparingly intro. from Eu., has the smell of stale fish. *C. ambrosioides,* Linn., Mexican tea, and var. *anthelminticum,* Gray, wormseed, are frequent; they contain strong essential oils. The weedy species are variable, and puzzling to the systematist.

L. H. B.

CHERIMOYA, CHERIMOYER (Quichua language of Peru, *chirimuya,* signifying *cold seeds*). (*Annòna Cherimòla,* Mill.). Figs. 903–905. An important table fruit of warm countries. See p. 293, Vol. I, for botanical description.

The cherimoya is considered by many to be the finest of the subtropical fruits, and that not only by the natives of the countries in which it grows, but also by Europeans. It is somewhat like the pomme-cannelle, or sweet-sop, but differs from it in having a pecuilar acidulous flavor most agreeable and grateful to the taste. For centuries the cherimoya has been cultivated



903. Cherimoya—smooth form. (×¼)

and several distinct varieties have resulted. One of these has smooth fruit devoid of protuberances, which has been confused with the inferior fruits of both *Annona glabra* and *A. reticulata.* The last two species, however, are easily distinguished by their leaves and flowers; *Annona glabra,* commonly known as the alligator apple or mangrove annona, having glossy laurel-like leaves and globose flowers with 6 ovate petals, and *A. reticulata* having long narrow glabrate leaves devoid of the velvety lining which characterizes those of the cherimoya. Both of these species, moreover, are essentially tropical, while the cherimoya is subtropical, growing in tropical countries only at considerable elevations, where the climate is cool and the soil well drained.

The origin of the cherimoya has been much discussed. De Candolle, however, is in all probability correct in attributing it to the mountains of Ecuador and Peru. The common name which it bears, even in Mexico, is of Quichua origin, as explained above; and terra-cotta vases modeled from cherimoya fruits have been dug up repeatedly from prehistoric graves in Peru. It was introduced at a very early date into Central America and Mexico and into Jamaica in 1786 by Hinton East. It is now of spontaneous growth in limited areas both in Central America and the mountains of Jamaica. In Madeira, the cherimoya has taken the place of the grape-vine on many of the estates on the warm southern slopes of the island. Here the cultivation is systematic. The two-year-old seedlings are budded or grafted. The trees are frequently trained on walls or on trellises, so that the fruit may hang in the shade while ripening, and manure is regularly supplied (see *Annona*). The result of careful selection is that there are varieties of fine flavor, comparatively few seeds, and great size, weighing from twelve to sixteen pounds. According to W. Fawcett, ordinary fruits weighing from three to eight pounds, have been sold in the London market at $1.50; large ones at $2.50 and even $3. The cherimoya has been

successfully introduced into southern California where it finds the most favorable conditions in the foot-hills near the coast.

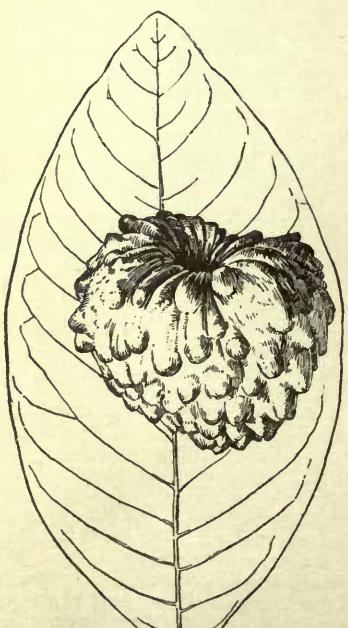
The cherimoya grows in the form of a small tree, usually about 15 or 20 feet high. The flowers are remarkably uniform, but vary somewhat in size. They are often solitary or in two's or three's, while those of the bullock's heart (*Annona reticulata*) and the sugar-apple (*A. squamosa*) are usually clustered. The leaves are always velvety on the lower surface. The following varieties, based upon the form of the fruit, are recognized:

(1) Finger-printed cherimoya (forma *impressa*), known in Costa Rica as "anona de dedos pintados." This form was the first to be figured (Feuillée, Pl. med. Journ. Obs. 3: append. 24, pl. 17, 1725). The fruit, conoid or subglobose in shape, has a smooth surface covered with concave U-shaped areoles resembling finger-prints in soft wax or putty. It is one of the best varieties, with sweet juicy pulp of good flavor, and with relatively few seeds.

(2) Smooth cherimoya (forma *lævis*), called in South America "chirimoya lisa" and in the market of Mexico City, "anon." Fig. 903. It is this form which is so often mistaken for *Annona glabra* and *A. reticulata* on account of the general appearance of the fruit and the common name "anon," which is also applied to the fruit of the last-named species. This is one of the finest of all the cherimoyas.

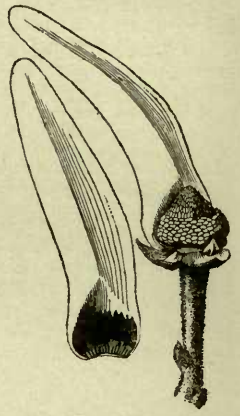
(3) Tuberculate cherimoya (forma *tuberculata*). Fig. 904. One of the commonest forms, in which the fruit is heart-shaped and bears small wart-like tubercles near the rounded apex of each areole. To this group belongs the "golden russet" cherimoya grown in the orchard of C. P. Taft at Orange, California. It is the form most frequently found in the Peruvian markets and is represented in prehistoric pottery from the graves of that country.

(4) Mammillate cherimoya (forma *mamillata*), called in South America, "chirimoya de tetillas." This is the form successfully established on the ranch of Charles F. O'Brien, in the mountains of Santa Monica, southern California. It is also the common form of the Nilgiri Hills of India, and is one of the best forms grown on the Island of Madeira.



904. Cherimoya, tuberculate form. (×⅓)

(5) Umbonate cherimoya (forma *umbonata*), called "chirimoya de puas" and "anona picuda" in Latin America. In this form the skin of the fruit is comparatively thick, the pulp more acid than in other forms, and the seeds more numerous. It has the flavor of pine-apple and is one of the best for producing cooling drinks and sherbets. The fruit is oblong-conical in shape, with the base more or less umbilicate and the surface studded with protuberances, each of which corresponds to a component carpel. To this form should be referred the "Horton" cherimoya, grown in the vicinity of Pasadena, California.



905. Flower of Cherimoya with two outer petals removed to show minute inner petals and essential parts; also an outer petal. (×1½)

Very recently there has been received from Florida an interesting fruit borne by a hybrid, the result of pollinating the stigmas of a cherimoya with the pollen of *Annona squamosa*. The leaves of this plant are very broad, resembling those of *A. Cherimola* in shape, but glabrous like those of *A. squamosa*. The fruit resembles that of *A. Cherimola* in form, but with the protuberences very distinct and covered with a glaucous bloom like that of *A. squamosa*. The seeds are distinct from both species, larger than those of *A. squamosa*, and much darker colored than those of *A. Cherimola;* and the pulp is very juicy, with the fine slightly acidulous flavor of the cherimoya.

For the propagation and culture of cherimoyas, see *Annona*.

W. E. Safford.

CHERLÈRIA: *Arenaria.*

CHERRY. Several kinds or types of small stone-fruits ripening in late spring and in summer, widespread and popular in domestic and commercial use. Figs. 906–910. Plate XXI.

Sweet and sour cherries have been domesticated from two Old World species: cultivated sweet cherries having come from *Prunus avium* and the sour cherries from *Prunus Cerasus*. Varieties of these two species, and hybrids between them, now encircle the globe in the north temperate zone and are being rapidly disseminated throughout the temperate parts of the southern hemisphere. For centuries, probably from the beginnings of agriculture, cherries have been valuable fruit-producing trees in Europe and Asia,—inhabitants of nearly every orchard and garden as well as common roadside trees in temperate climates of both continents.

Coming from the Old World to the New, the cherry has played an important part in the orcharding in temperate regions of the western hemisphere. In North America, varieties of one or the other of the two cultivated species are grown from Newfoundland to Vancouver Island on the north, southward to the Gulf of California, Texas and Florida, probably yielding crops in a greater diversity of soils and climates on this continent than any other tree fruit.

Sour cherries are suited to many environments, thriving in various soils and withstanding rather better than most orchard fruits heat, cold and atmospheric dryness, and though they respond to good care, yet they thrive under neglect better than most other tree fruits. Sour cherries also have fewer insect and fungous troubles than other tree fruits, being practically immune to the dreaded San José scale. Sweet cherries, however, are much less easily grown. Sweet varieties are all somewhat fastidious as to soils, are lacking in hardiness to both heat and cold, are prey to more insects than sour cherries and subject to nearly all of the fungous ills to which stone-fruits are heir, suffering in America in particular from brown-rot and leaf-spot.

Sweet cherries can be grown with commercial success in but few and comparatively limited regions, although the localities adapted to sweet varieties are rather widely distributed.

The cherry is probably the most popular of temperate climate fruits for the home yard, being planted more commonly than any other tree-fruit, in the many regions in which it is grown, in the dooryard, garden and along the roadside. The characters, other than those already named, that commend it for home plantations, are, early bearing after planting, early ripening in the season, regularity in bearing, great fruitfulness and ease of culture. It is more than a home fruit, however, and is largely grown for the markets, for canning and for preserving.



906. Tall erect growth of sweet cherry.

In America, the consumption of cherries is being greatly increased by the fashion of adding them preserved to many ices and drinks. The demand for canned cherries has also increased enormously in this country during the last few years. In Europe, wine is made from cherries, "kirschwasser," a spirit, is distilled from the fermented fruit pulp, and in the Austrian province of Dalmatia a cordial called maraschino is made by a secret process of fermentation and distillation. This liquor is imported to America in considerable quantities to flavor preserved cherries which become the well-known "maraschino cherries" of confection and delicatessen shops.

Other species.

Several species of cherries other than the two named have more or less horticultural value. *Prunus Padus* and *Prunus Mahaleb* of the Old World furnish fruits sometimes used for culinary purposes but much more cultivated, in their various forms, as ornamentals; the latter furnishes a stock upon which orchard varieties are now most commonly budded. *Prunus Besseyi*, *Prunus pumila* and *Prunus pennsylvanica* are species from North America, the first two having varieties cultivated for their fruits and all three being used as ornamentals and for stocks. *Prunus Pseudo-Cerasus* and *Prunus tomentosa* from Asia are much grown in China and Japan as ornamentals, for their fruits and as stocks, and should find favor in Europe and America for these purposes. In recent years many new species of cherries have been discovered in Asia. E. Koehne, one of the best authorities on the genus Prunus, places 120 species, nearly all from Asia, in the subgenus Cerasus to which belong the orchard cherries (Mitt. Deut. Dendrol. Gesell., 1912:168–183). A few of these have already been introduced in America by the United States Department of Agriculture, and from them one is sure to find valuable horticultural species to be used for their fruits, as ornamentals, as stocks, and for hybridization with species already domesticated.



908. Old sweet cherry tree, on the Chesapeake peninsula.

Propagation.

Both orchard and ornamental cherries are commonly propagated in Europe and America by budding on Mazzard or Mahaleb stocks and in Japan, where cherries are much grown, on *Prunus Pseudo-Cerasus*. When exceptional hardiness is required, seedlings of the Russian sour cherries may be used or those of *Prunus Besseyi* or *Prunus pennsylvanica*. Undoubtedly the Mazzard is the best stock for regions in which cherries can be grown commercially. Upon the Mazzard, varieties of either sweet or sour cherries make larger, thriftier, longer-lived and more productive trees.



907. Low-headed and spreading growth of sour cherry.

The Mahaleb, on the other hand, is the best stock from the nurseryman's point of view. It is more easily budded, hardier, freer from insects and fungi as it stands in the nursery before budding, and the buds more quickly develop into salable trees. But the advantages of the Mazzard are so much greater for the fruit-grower that he should accept only trees on this stock unless hardiness be a prime requisite. Cherries are set in the orchard at two years from the bud.

The cultivation and handling.

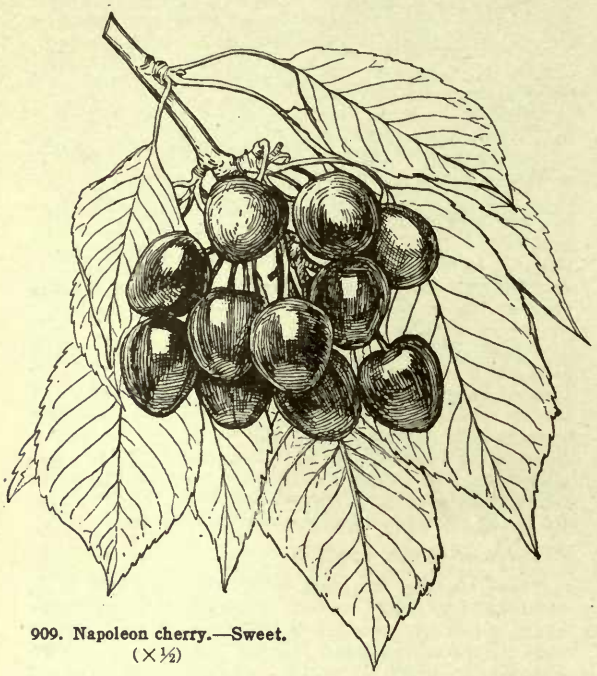
Sweet cherries are most profitably grown on high, comparatively light, sandy, gravelly or even stony loams, while sour cherries do best on somewhat heavier soils. The former are set 22 to 24 feet apart; the latter 16 to 20 feet. Both respond to care in cultivation which, in brief is: early spring plowing, frequent cultivation until the first of August with a cover-crop sown just before the last cultivation. Cover-crops are various—a favorite one in New York and Michigan is a half bushel of oats or barley, and twelve pounds of clover or twenty pounds of winter vetch. In Delaware and New Jersey the cowpea is much liked as a cover-crop.

Cherry trees are usually headed 2 or 3 feet from the ground with a tendency to head them lower—half the above distances; in the lower-headed orchards there seems to be no inconvenience in tilling with modern implements. Nearly all commercial growers form the head with five to seven main branches about a central trunk, but some prefer to remove the central stem, especially in sweet varieties, leaving a vase-formed head. After the head is formed, the subsequent pruning is exceedingly simple, consisting of cutting out an occasional injured or crossed branch and now and then heading-in a long whip-like growth.

In soils well adapted to cherry-growing, commer-

cial fertilizers are little needed. Good cultivation, the yearly cover-crop and an occasional dressing of stable-manure furnish an abundance of food. If, with this treatment, the trees fail to make sufficient growth, and if the drainage be good, the grower should experiment with fertilizers containing potash, phosphoric acid or nitrogen to see which, if any, his trees may need.

Cherries are picked with stems on, the sweet a few days before fully ripe, the sour when practically



909. Napoleon cherry.—Sweet. (×½)

mature. Some growers guard against breaking the fruit-spurs for the next year by using picking scissors. Cherries are variously packed in boxes and baskets but the container is usually a small one and much art may be displayed in placing in layers, facing, and in making the package in all ways attractive. Fruit for canning must be carefully picked but is sent to the cannery in trays holding one or two pecks.

The chief commercial plantations in eastern America are found in New York, New Jersey, Delaware, northern Ohio and western Michigan. Sweet-cherry growing is precarious because of natural obstacles, and sour cherries are so easily grown that through very abundance their sale is often difficult. Yet with both success has been attained by many, the profits ranging as high as $300 to the acre.

Special difficulties.

The cherry is attacked by a dozen or more fungi. Of these, three are serious pests. The brown-rot, *Sclerotinia fructigena*, attacks the flowers, leaves, twigs and most disastrously the fruits at ripening time. Leaf-blight, *Cylindrosporium Padi*, produces diseased spots on the leaves, which for the most part drop out, giving a shot-hole effect and eventually causing the foliage to drop prematurely. A common and striking disease of the cherry is black-knot, *Plowrightia morbosa*, characterized by wart-like excrescences on shoots and branches which at maturity are black; affected parts sooner or later die.

The text-books give no less than forty insect enemies of cherries, of which the plum-curculio, *Conotrachelus nenuphor*, the peach-borer, *Sanninoidea exitiosa*, and the San José scale, *Aspidiotus perniciosus*, on sweet cherries, must be combated. All of the pests named, both fungi and insects, are more destructive to plums and peaches, and the reader is referred to these fruits for treatment which is much the same as for the cherry.

Sweet cherries suffer severely in the South and the Mississippi Valley, and somewhat in the North, from sun-scald, either directly from the sun's rays or from alternate freezing and thawing in winter or spring. The injury is manifested by the bursting of the bark and the exudation of gum on the south and west sides of the tree. Some immunity from such injuries may be obtained by protecting the trunks with boards or other screens. "Gummosis," or a flow of gum from the wood, often follows injuries of various kinds and the work of insects and fungi in both sweet and sour cherries.

Types and varieties.

There are now about 600 varieties of cherries grown in America and Europe, and the names of as many more that have passed from cultivation remain. These are variously grouped, but the following simple classification takes in the common orchard sorts:

A. *Prunus avium*

(1) *The Hearts.*—Large, heart-shaped, soft-fleshed, sweet cherries, light-colored as represented by Governor Wood and dark as in Black Tartarian.

(2) *The Bigarreaus.*—Large, sweet, heart-shaped and colored as in the previous group but with firm, crisp and crackling flesh. Well represented by Napoleon (Fig. 909) and Yellow Spanish as light-colored members of the group, and by Schmidt and Bing as dark sorts.

(3) *The Dukes.*—Somewhat smaller cherries than the Hearts and Bigarreaus, softer in flesh, light-colored and usually sour or nearly so. This group is placed under *Prunus avium*, but there can be no doubt but that the widely varying Dukes are hybrids between *Prunus avium* and *Prunus Cerasus*. May Duke and Reine Hortense serve as illustrations of the group.

AA. *Prunus Cerasus.*

(1) *The Amarelles.*—Rather small, light-colored, sour cherries with colorless or nearly colorless juice, produced on upright trees, represented by Early Richmond and Montmorency (Fig. 910).

(2) *The Morellos.*—Also comparatively small and very sour but dark in color and with dark-colored juice and trees with a drooping habit, represented by English Morello and Louis Philippe.

In spite of the great number of varieties, the cherry, of all stone-fruits, seems most fixed in its characters. Thus, the difference between tree and fruit in the cherries of the several groups is comparatively slight and many of the varieties come nearly true to seed. So, too, cherries, although probably domesticated as long ago as any other of the tree-fruits, are now most of all like their wild progenitors. Notwithstanding this stability, there are probably rich rewards to be secured in breeding cherries by those who will put in practice the discoveries of recent years in plant-breeding, and will hybridize especially the various groups of the two species now cultivated and introduce wholly new blood from wild species. So little effort has been directed toward improving cherries, and the material seems so promising, that it would seem that with proper endeavor the coming generation may have a new and greatly improved cultivated cherry flora.

U. P. Hedrick.

The cherry in California.

In commercial importance, the cherry is least of the fruits of the temperate zone grown in California on a commercial scale—not considering the quince and

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XXVI. Sweet cherry in flower and fruit.

nectarine, of which the product is almost insignificant. This is not because the finest cherries cannot be grown, but because the avenues for the disposition of the product are not so wide as for other leading fruits. Recently there are indications that these avenues will be widened, for, in the year 1912, 244 carloads were profitably shipped in a fresh state to eastern markets, and in 1911 a product equivalent to 243,010 cases (each containing two dozen 2½-pound cans) of canned cherries were disposed of to advantage. In 1910, there was large shipment of barreled cherries in sulfur water to eastern bottlers who put up maraschino cherries in competition with importations, but this business seems to have transgressed the pure food laws and declined. Until it is demonstrated that such distant demands will increase, present plantations will not be largely extended. Cherries are costly in picking and packing, and the chance of low price in a local market, over-supplied whenever the trees do their full duty, the grower does not enjoy. Cherry-drying has never seemed warranted on a large scale, because of the large amount of labor required to the pound of product; and the grower has had no recourse when the canner and local consumer would pay only the cost of picking and boxing. A good shipping demand seems, therefore, the measure of the extension of California's cherry interest, and the early ripening of the fruit, which permits its sale during the blooming season of eastern cherry trees, is the leading surety of such demand. On several occasions early varieties have been shipped from the Vacaville district overland, on March 31, but the usual opening date is about two weeks later, and thence onward later varieties, and from later regions, may be shipped until July, if found profitable.

But, although there is plenty of good land upon which to multiply the present total of three-quarters of a million trees, the cherry regions of California are restricted. It is one of the most exacting of all trees, and is profitable only when its requirements are respected. About one-half of the present acreage lies in valleys opening upon the bay of San Francisco, where deep and moist, but well-drained alluvial soil fosters strong and sound root-growth, and modified atmospheric aridity favors leaf and fruiting. On similar deep and moist soils, however, the sweet cherry enters the hot interior valleys to certain limits, chiefly along the river bottoms. It abhors dry plains. In dry air it usually refuses to fruit, although, if the soil be moist, it may make stalwart tree-growth. In foot-hill valleys it sometimes does admirably, both in growth and fruiting, and in mountain valleys, above an elevation of 2,000 feet, on good soil, and in the greater rainfall, and even with the snow flurries, which are experienced every year at proper elevations, the tree becomes very thrifty and profitable to the limits of local markets. The tree seems to have no geographical limitations in California; wherever suitable soil and weather conditions occur, it accepts the situation—the Dukes and Morellos succeeding under conditions too trying for the Hearts and Bigarreaus, but the latter, only, are of commercial account.



910. Montmorency cherry.—Sour. (×½)

Cherry trees are grown by budding upon Mazzard and Mahaleb seedlings—both being largely imported. It is customary to plant out in orchards at the end of the first year's growth from the bud, though two-year-old cherry trees can be more successfully handled than other two-year-olds. The trees are headed at 1 or 2 feet from the ground, cut back to promote low branching for two years, and then allowed to make long branches, and not usually shortened-in, so long as thrifty and healthy. The tree, in a good environment, is, however, a very hardy tree, and will endure pruning to almost any degree. There are many trees which have made a very broad but not usually high growth, bearing 1,000 pounds of fruit to the tree, and a few others which have even doubled that figure, while others have been dwarfed and trained *en espalier*. The commercial orchards are, however, uniformly of low trees, approximately of vase form in exterior outline, and with branches curving outward without shortening.

The cherry is very readily grafted over by the usual top-grafting methods, and large orchards have been thus transformed into varieties more acceptable for canning or shipping. Comparatively few varieties are grown. Early Purple Guigne, Chapman and Knights Early Black are grown in early-ripening localities. Black Tartarian, Lewelling and Bing are the mainstay for black cherries. The Napoleon Bigarreau (locally known as Royal Ann) is the ideal for a white cherry, and almost excludes all others, although the Rockport Bigarreau has some standing. Of all the varieties grown, the Black Tartarian and Napoleon (Fig. 909) constitute 70 per cent of the crop, and probably 90 per cent of the amount marketed.

California-grown cherries attain large size; the canner's requirement for fancy fruit is a diameter not less than ⅞ of an inch, and for No. 1 not less than ¾ of an inch. Wholesale prices usually range from $40 to $60 a ton for black and $80 to $120 for white, but occasionally canners have paid as high as $160 a ton for white cherries. The higher rates can be expected only in years of short crops.

EDWARD J. WICKSON

CHERVIL. A term applied to two umbelliferous plants that produce edible parts, neither of which is well known in America. The name is sometimes applied, also, to the sweet cicely.

Salad chervil or leaf chervil is *Anthriscus Cerefolium*, Hoffm., a native of Caucasus, southern Russia and western Asia. It is annual, reaching 1½ to 2 feet high. The neat and aromatic leaves are used like parsley, which they much resemble. The leaves are decompound, with oval cut leaflets; and there are varieties with much cut and curled foliage. The cultivation of salad chervil presents no difficulties. Leaves are ready to use in six to ten weeks from seed-sowing, and any good garden soil is congenial. It thrives best in the cooler and moister part of the year. In hot weather, seeds would better be sown in a shaded place.

Tuberous or turnip-rooted chervil is *Chærophyllum bulbosum*, Linn., of southern Europe. (See *Chærophyllum.*) It is biennial or plur-annual, like the radish and carrot. The roots are like small carrots in shape (4 to 5 inches long), but are gray or blackish, and the

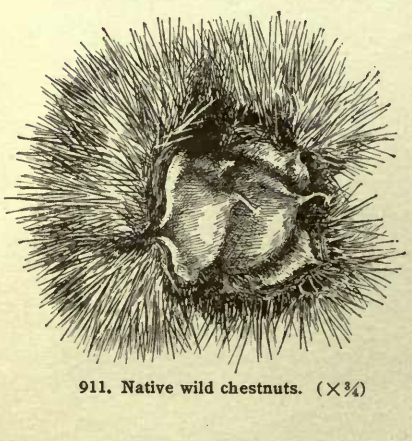
flesh is yellowish white and of different flavor. The roots are eaten as carrots are, either boiled or in stews. The one difficulty in the growing of tuberous chervil is the fact that the seeds germinate very tardily, or even not at all, if kept dry over winter. It is customary, therefore, to sow them in the fall, although they do not germinate until spring. If they are to be reserved for spring-growing, they should be stratified (see *Seedage*) or kept in sand. In four or five months after germination, the roots are fit to use, although they improve in quality by being left in the ground. The roots keep well in winter. L. H. B.

CHESS, or CHEAT: *Bromus.*

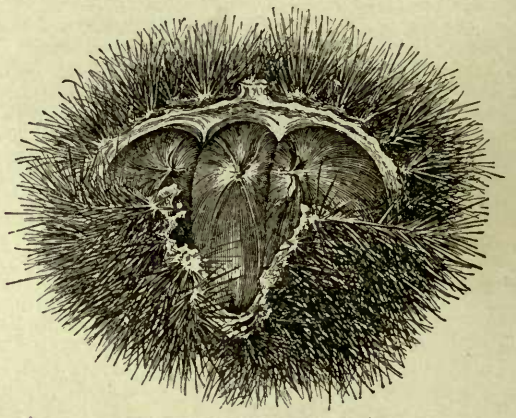
CHESTNUT. Three species of tree or true chestnuts are cultivated in this country for their nuts,—the European *Castanea sativa*, the American *Castanea dentata*, the Japanese *Castanea crenata*. See *Castanea*. The horticultural characters that distinguish these three types are as follows:

European chestnuts.—Tree large, with a spreading but compact head, stocky, smooth-barked twigs and large glossy buds of a yellowish brown color; leaves oblong-lanceolate, abruptly pointed, with coarse sometimes incurved serrations, thick and leathery, generally pubescent beneath when young, but green on both sides when mature. Burs very large, with long branching spines, and a thick velvety lining. Nut larger than American chestnut, sometimes very large, shell dark mahogany-brown, pubescent at tip, thick, tough and leathery; kernel inclosed in a thin tough and astringent skin: quality variable from insipid, astringent to moderately sweet. The leaves remain on the trees until late in autumn, but are more susceptible to the attacks of fungi than the American and Japanese species. At least one variegated and one cut-leaved variety are grown as ornamentals. This species is variously known as European, French, Spanish and Italian chestnut (*Castanea sativa*), and sweet chestnut of English writers. It is an inhabitant of mountain forests in the temperate regions of western Asia, Europe and north Africa, and is esteemed for its nuts in Spain, France and Italy, where they have constituted an important article of food since an early day. Introduced to the United States by Irénée Dupont, at Wilmington, Delaware, in 1803, although recorded by Jefferson, under the designation "French chestnut," as grafted by him on native chestnut near Charlottesville (Monticello), Virginia, in 1773.

American chestnut (*Castanea dentata*).—Fig. 911. A tall straight columnar tree, in forests reaching a height of 100 feet and a diameter of 3 to 4 feet; when grown in the open, forming a low round-topped head of slightly pendulous branches. Leaves thinner than in *C. sativa*, oblong-lanceolate, acute, long-pointed at the apex, coarsely serrate except toward the wedge-shaped base, green and glabrous on both surfaces, changing to bright clear yellow later in autumn. The staminate flowers open in June or July after leaves have attained full size, and exhale a sweet, heavy odor, disagreeable to many persons, and sometimes causing symptoms of hay-fever. The two- or three-flowered involucres of pistillate flowers are on short stout peduncles at the bases of androgynous aments which bear toward their tips scattered clusters of staminate flowers. Burs smaller and spines sharper than in *C. sativa*. The nuts, usually two or three, rarely five to seven, are usually broader than long, and much compressed by crowding, although sometimes nearly oblong and approaching cylindrical.



911. Native wild chestnuts. (×¾)



912. Japanese chestnuts. (×½)

They are of a bright brown color, covered at the apex with thick pale tomentum, which sometimes extends nearly to the base of the nut. The nuts are sweet and agreeable in flavor, the best among chestnuts, and are marketed in large quantities from the forests of the Appalachian region. Occurs in eastern North America, Maine to Georgia, westward to Michigan, Mississippi and Louisiana. Gradually receding from its southern areas from causes not yet understood. A few selected forms have been propagated by grafting.

Japanese chestnut (*C. crenata*).—Fig. 912. A dwarfish close-headed tree of slender growth, said to attain a height of 50 feet in Japan, with small buds: leaves smaller than other chestnuts, lanceolate-oblong, usually pointed, with a truncate or cordate base, finely serrated, with shallow sharp-pointed indentations, whitish tomentose beneath, pale green above, less subject to injury by fungi than other species. Burs small, with a thin papery lining and short widely branching spines. Nuts large to very large, glossy, usually three, sometimes five or seven in a bur, usually inferior to the other chestnuts in quality, although good when cooked, and in a few varieties excellent in the fresh state. Many cultural varieties are recognized. Introduced to the United States in 1876 by S. B. Parsons, Flushing, New York.

Aside from these three types, there are certain dwarf and small-fruited castaneas known as chinquapins. The two native chinquapins may be contrasted as follows (page 682):

Common or tree chinquapin (*C. pumila*).—Fig. 913. A shrub 4 or 5 feet tall, rarely a tree, attaining a height of 50 feet, with slender branchlets marked with numerous minute lenticels, and coated with a pale tomentum, which disappears during the first winter. Leaves oblong, acute and coarsely serrate at apex, bright yellowish green, changing to dull yellow before falling in autumn. Flowers strong-smelling, the catkins of staminate ones appearing with the unfolding leaves in May or June, the spicate androgynous aments later, with pistillate flowers in spiny involucres, producing solitary cylindrical nuts ¾ to 1 inch in length and ½ inch in diameter, with sweet seeds. This species occurs in dry lands from southern Pennsylvania to Florida and Texas, and its nuts, which ripen earlier than the American chestnut, are esteemed for

food and marketed in considerable quantities. The species is sparingly introduced to cultivation and in its native region is being somewhat grafted upon in place with the choicer varieties of chestnuts. It has some promise as a dwarfing stock but is subject to the troublesome fault of suckering rather abundantly. Two named varieties, the Fuller and the Rush, have been published and somewhat propagated. (Upper part of Fig. 913 illustrates common chinquapin bur, and nut in natural size.) Apparent intermediates between this species and the American chestnut, probably of hybrid origin, are found in various localities from Pennsylvania southward and westward to southern Arkansas and eastern Texas, in some localities attaining truly arborescent proportions. (Lower figure in Fig. 913 illustrates bur of hybrid chinquapin.)

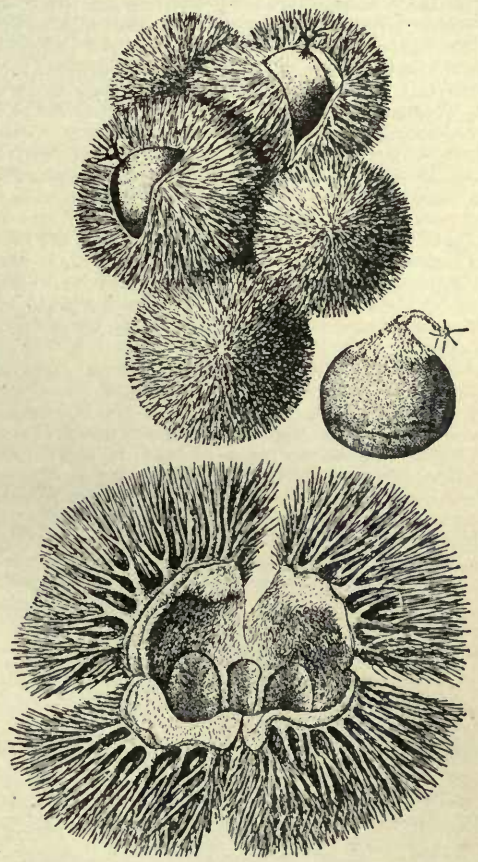
Bush chinquapin (*C. alnifolia*).—A shrub, rarely more than 3 feet in height, forming small thickets, by means of stolons, in sandy barrens. South Atlantic states, westward to Louisiana and Arkansas. Distinguished from *C. pumila* by larger, oval-lanceolate, mostly obtuse leaves, which are but slightly tomentose beneath, and by its larger nuts, which ripen earlier.

The cultural range of Castanea in America is not well defined, but extends from Florida and Texas to Massachusetts and Wisconsin, and on the Pacific slope. The three species cultivated in America thrive best on dry, rocky or gravelly ridges or silicious uplands, failing on heavy clays and on limestone soils unless deep, dry and rich.

Propagation of chestnuts.

Propagation of species is by seeds. Certain types reproduce their striking characteristics in their seedlings, but varieties are perpetuated by grafting, occasionally by budding. Seeds for planting should be free from insect larvæ, and should not be allowed to dry out before planting. They may be planted in drills in fall on deep and well-drained loam, or, to avoid damage by rodents, may be stratified in damp sand until spring. Nuts held in cold storage at 15° F. from October to April have germinated well at Washington, D. C. Young trees destined for removal to orchard should be transplanted in nursery at one year old, to promote symmetrical development of root system. Grafting may be done on any of the species of Castanea, and on some of the oaks, notably the chestnut oak, *Quercus Prinos*, though the durability of grafts on the oak is questionable. Where the chestnut is indigenous, bearing orchards of improved varieties are quickly secured by cutting down and removing the timber, and grafting the young sprouts which spring up in abundance about the chestnut stumps (Fig. 914). Recently the chinquapin has been similarly used with good success where chestnut does not occur. Grafting may be by splice method on one-year-old seedling roots; by splice or cleft at crown on two- or three-year trees in place; or by veneer, splice or cleft methods on one- to three-year-old sprouts or branches. Top-working of old trees is uncertain and practised only in special cases. Cions should be dormant, and work may be done at any time after freezing ceases, but in trunk- and branch-grafting best results are secured by most grafters if work is done after leaves begin to unfold. Two- or three-bud scions are preferred. The fitting of cion to cleft or splice and the waxing should be carefully done. If strips of waxed muslin are wrapped about the stubs, the danger of loss by summer cracking of wax is lessened. In cleft-grafting young sprouts or seedlings, the stub should be cut 2 or 3 inches above the departure of a branch, to prevent too deep splitting of cleft. Two or three weeks after growth begins the waxing should be inspected and repaired if cracked. If grafts make rank and brittle growth they should be checked by pinching, and if in exposed situations, tied to stakes to prevent breaking out of cions. Budding is sometimes practised, usually by use of dormant buds inserted in shoots of previous year, when the bark "slips" after growth has begun in spring. There is a growing conviction in the minds of close observers that certain of the popular varieties, especially Paragon, under certain conditions do not find the American chestnut a congenial stock. In several orchards, Paragon, when grafted on native sprouts, although apparently making a good union at the start, has within eight to ten years developed weakness at the point of union, followed by loss of vigor and death of the top without other apparent cause than lack of congeniality of cion to stock. For this variety, at least, the grafting upon seedling stocks grown from nuts of the variety appears advisable.

The chestnut is admirably adapted to ornamental planting, either singly or in groups on suitable soils.



913. Chinquapin. (Nut and bur natural size.)

The native species is successfully used as a roadside tree in many sections outside of its natural range. It requires a space of at least 40 feet for development when thus used, the European species 30 feet, and the Japanese 20 feet. If in orchard, the last-mentioned may be planted as close as 20 feet, and thinned when the trees begin to crowd, thus securing several crops of nuts from land otherwise unoccupied.

Care of chestnut orchards.

Planted orchards are yet few in America, most of the extensive commercial efforts having consisted in the grafting of sprouts on rough lands where the American chestnut is indigenous. On such lands no cultivation is attempted, the brambles and undesired sprouts being held in check by occasional cutting in summer, or by pasturing with sheep. Much care is necessary

to protect against damage of the sprouts by fire on such land. Clean cultivation, at least during the first few years, is probably best in planted orchards, although heavy mulching may be found a satisfactory substitute. The Japanese and some of the American varieties of the European species require thinning of the burs on young trees to avoid over-bearing, with its consequent injury to the vitality of the tree.

Special difficulties.

Leaf diseases are apparently subject to control by bordeaux mixture, but for the weevils, which damage the nuts previous to maturity, no satisfactory remedy has yet been discovered except the yarding of poultry in sufficient numbers to destroy the adult insects and their larvæ when they reach the ground.

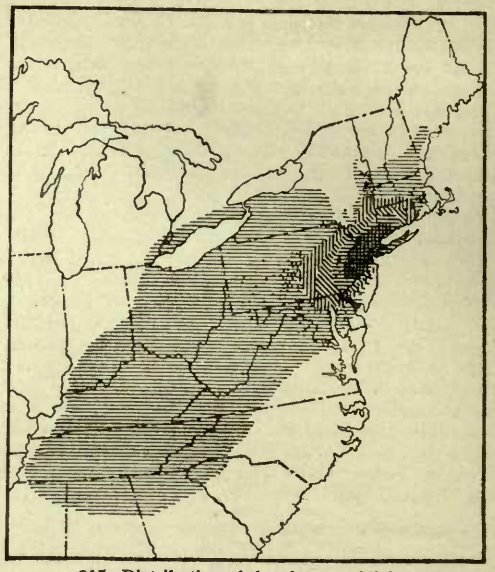
The most serious difficulty confronting the present or prospective chestnut-grower in North America is the chestnut-bark disease which, during the last decade, has worked havoc in the native chestnut forests throughout a region of country extending from central Connecticut through southeastern New York, New Jersey, and eastern Pennsylvania into northern Delaware, northeastern Maryland and northern Virginia. As this region contains most of the commercial plantings of improved chestnuts they have also suffered severely, especially since about 1908. The distribution of the native chestnut, together with the known distribution of the disease February 1, 1912, is shown on the accompanying map (Fig. 915), which was prepared by Metcalf to accompany a special report on the disease in response to a resolution of the United States Senate.

This disease, caused by a parasitic fungus (*Diaporthe* or *Endothia parasitica*), attacks trees of all ages and kills by girdling at various points. It is known to attack all species of chestnut and chinquapin grown in this country, although some, at least, of the Japanese varieties, are practically resistant, so far as observed. A few cases of the disease have also been found on living trees of the chestnut oak in Pennsylvania, though with less evidence of destructive effect than on chestnut.



914. Chestnut sprouts two years grafted. The cion was inserted where branching begins.

The disease is spread by the spores of the fungus, which are sticky, and are carried by rain, insects, and man, and probably by birds and small mammals. It is known to have been carried on nursery stock for long distances and is easily transported on newly cut



915. Distribution of the chestnut blight.

timber and cordwood from which the bark has not been removed. Infection frequently occurs through wounds made by bark-borers.

Although first attracting attention in New York City in 1904, it appears certain that it had secured a firm foothold in southeastern New York, including Long Island and adjacent portions of Connecticut and New Jersey, prior to that time, there being some indication that it was introduced from Japan, although satisfactory evidence of this is still lacking. The presence of the disease in chestnut forests in China was discovered by Meyer in 1913, where, upon an unidentified species of chestnut, it is reported to be less virulent than in American chestnut forests.

For several years after publication of the cause of the disease by Murrill, in 1906, little effort was made in a systematic way to accomplish its control until 1911, when the legislature of Pennsylvania appropriated $275,000 for this purpose and inaugurated a state-wide, two-year campaign of eradication. The work is being done in coöperation with the Federal Department of Agriculture which, since 1907, has been investigating the disease with a view to developing effective methods of controlling it. Several other chestnut-producing states are also giving more or less attention to the problem. Up to the present time, systematic cutting out of infected trees coupled with destruction of their bark by fire has proved the only practicable control method. This is being vigorously applied in Pennsylvania and those portions of Maryland, West Virginia, and Virginia in which the disease has appeared.

In forests, the disease is exceedingly difficult to eradicate after it has once gained a foothold, owing to the minute examination of the entire tree which is required to locate infections in their early stages. In any district in which there is a general infection of the forests, the only practicable course is to clear off the timber while it is sufficiently sound to be merchantable.

The relative disease-resistance of the Japanese chestnuts, coupled with their precocity and productiveness, renders them now the most promising sorts for the American chestnut-grower. Planted in sections

outside of the native range of the American chestnut, they may reasonably be expected to remain practically free from the disease, especially if care is exercised to prevent its introduction from infested regions on nursery stock or cions. The poor flavor and eating quality of most of these varieties is their worst fault, but in view of their wide range of variation in this respect, the problem of producing resistant varieties of good quality appears relatively simple. The few trees of Korean and Chinese chestnuts thus far grown in the eastern United States are apparently quite resistant to the disease and therefore of much interest to the tree breeder as parents of possible resistant forms. Systematic work on the breeding of resistant varieties is being prosecuted in the Bureau of Plant Industry.







916. Successive stages in the ravages of the chestnut blight. 1909, 1910, 1911.

Varieties of chestnuts.

The varieties of the three species, although possessing many points in common, differ sufficiently in important characteristics to justify separate grouping for cultural discussion. As chestnut-culture is new in this country, it seems best to append descriptions of all the varieties which are in the American trade. For fuller discussion of cultivated chestnuts, see Nut Culture in the United States (Bull. Div. of Pomology, U. S. Dept. of Agric.), from which Fig. 913 is adapted; Nut Culturist, A. S. Fuller, 1896; European and Japanese Chestnuts in Eastern United States, G. Harold Powell (Bull. Del. Exp. Station), 1898; Nut Culture for Profit, Jno. R. Parry, 1897.

American Group.—Although the wild nuts exhibit wide variations in size, form, quality, productiveness, and season of ripening, but few varieties have been dignified by names and propagated. Solitary trees are frequently sterile, although producing both staminate and pistillate flowers, apparently requiring cross-fertilization to insure fruitfulness. This is especially true of planted trees of this species on the Pacific slope, where productive trees are reported to be rare. The susceptibility of the species to injury by leaf diseases, as pointed out by Powell, and the injury to nuts by larvæ of weevils, are drawbacks to its extensive culture.

The following varieties are propagated to some extent:

Dulaney.— Bowling Green, Ky. Large, and of fine quality. Original tree productive, though isolated.

Griffin.—Griffin, Ga. A large, very downy nut, of good quality.

Hathaway.—Little Prairie Ronde, Mich. A large, light-colored, sweet nut, annually productive, frequently having five to seven nuts to the bur.

Ketcham.— Mountainville, N. Y. Above medium in size, oblong, tomentose, sweet. Tree productive and vigorous in heavy sod at fifty years of age.

Murrell.—Coleman's Falls, Va. A large, high-flavored nut, bearing three nuts to the bur.

Otto.—Otto, Tenn. Large, oblong, very downy at tip, very sweet, and rich.

Rochester.—Rochester, N. Y. First fruited at Alton, Ill. Nuts medium to large; somewhat rounded, usually three in a bur; of dull brown color, downy at tip; quality excellent. Tree a very rapid grower and a heavy bearer; ripens late.

Watson.—Fay, Pa. Medium to large, slightly downy, compressed, very good.

European Group.—It is a significant fact that, during the century that has elapsed since the introduction of this species, the imported named varieties of Europe have not found favor in eastern America. Seedling trees have been found productive and profitable at many points in New Jersey, Pennsylvania, Delaware, and Maryland, however, and these form the basis of the culture of the species east of the continental divide. West of the Rocky Mountains, several of the choice French "Marrons" are reported to succeed in California and Oregon. Among the more important varieties of the European group in America, are the following:

Anderson.—Flushing, N. J. Bur medium to small; nuts of medium size, bright reddish brown, pubescent at the tip and over half of the nut. Tree a strong grower, with medium to small leathery leaves. Very productive.

Bartram.—Milltown, Pa. Bur medium to small; nut medium, thickly pubescent at tip, dark reddish mahogany color; three in a bur; unusually free from insect attack; quality good. Tree vigorous, spreading, with large leaves; productive.

Combale (Marron Combale).—France. A large and handsome, bright brown striped nut, with but little tomentum at tip; usually two, sometimes but one in a bur. Somewhat grown in California, where it was introduced from France about 1870.

Chalon (syn., Marron Chalon Early).—France. Sparingly grown in California. Nut of medium size, early, productive, precocious.

Corson.— Plymouth Meeting, Pa. Bur large, with thin husk; nuts large, usually three in a bur; dark brown, ridged, heavily pubescent at tip; quality very good. Tree vigorous, spreading, very productive.

Dager.—Camden, Del. Bur medium; nut medium to large, dark brown, thickly tomentose, usually three in a bur; quality good. Tree vigorous, spreading, productive; a seedling of Ridgely.

Darlington.—Wilmington, Del. Bur medium to small; nut medium to large, usually three in a bur; dark, distinctly striped, thickly tomentose at tip; sweet, good. Tree vigorous. One of the earliest to ripen of this group.

Lyon (Marron de Lyon).—France. A large, round nut of fair quality, grown in a small way in California, but less productive than Combale, which it resembles.

Marron.—This term is used by the French to designate the larger cultivated chestnuts, most of which have relatively few nuts, often only one in a bur.

Moncur.—Dover, Del. A seedling of Ridgely. Bur medium; nuts medium, of light color, heavily tomentose. Tree vigorous, spreading, very productive.

Nouzillard.—France. A large, handsome variety from central France, and there considered very productive and valuable. Has been tested in New Jersey, Pennsylvania and California without marked success in any locality.

Numbo.— Morrisville, Pa. Bur medium conical; nut large, from two to three in a bur; bright brown striped, thinly tomentose, of good quality. Tree compact and drooping, rather uncertain in bearing.

Paragon (syn., Great American; Sobers Paragon).—Germantown, Philadelphia, Pa. Bur very large; nut large, usually three in a bur, broad, plump, thickly tomentose at the tip, and thinly over two-thirds of surface, color dull brown, quality very good. Tree hardy, spreading, vigorous, with narrow, coarsely serrate leaves having a narrow base; subject to leaf-blight, but very productive. The most widely planted and most uniformly successful variety of chestnut yet cultivated in the United States. Possibly a hybrid with C. dentata.

Quercy (syn., Marron Quercy).—France. A beautiful, medium-sized nut, commended in portions of California for precocity, earliness, productiveness and quality.

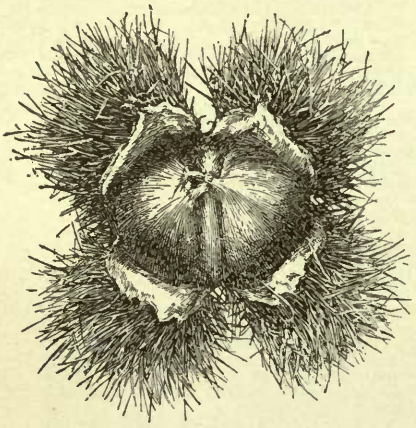
Ridgely (syn., Du Pont).—Dover, Del. Bur medium; nut medium to large, moderately tomentose, dark, of very good quality. Tree vigorous, with narrow leaves free from blight, spreading, very productive, hardy.

Scott.—Burlington, N. J. Bur medium; nut medium, slightly pointed, usually three in a bur; glossy, dark brown, slightly tomentose at the tip. Tree open, spreading, very productive; said to be comparatively free from attacks of weevil.

Styer.—Concordville, Pa. Bur medium; nut medium pointed, dark brown, striped, tomentose at tip, 1 to 3 in a bur. Tree very vigorous, upright, with large, dark green leaves; free from disease.

Japanese Group.—Though most of the imported Japanese chestnuts have been found of poor quality for eating in the fresh state, the product of many imported seedling trees, and of a number of American-grown seedlings of this type, is equal to the European nut in this respect. The Japanese varieties in general have the advantage, also, of greater precocity and productiveness, larger size and earlier maturity of nut, greater freedom from injury

by leaf diseases and nut-eating insect larvæ. As productiveness and earliness are the most important points in chestnut-culture at the present time, this type is the most important to commercial nut-growers. Because of the ease with which chestnuts hybridize, the disease-resistance of varieties that have originated from seed produced within the habitat of the American chestnut must be regarded as doubtful until thoroughly tested. Information as to the place of production of the seed from which the several varieties originated is therefore of importance in selecting varieties for planting. The more important named varieties are as follows:



917. Boone chestnut.

Alpha.—New Jersey. Bur medium; nuts medium to large, generally three in a bur, dark, of fair quality, ripening very early. Tree upright, very vigorous and productive. Originated in New Jersey from seed of Parry.

Beta.—New Jersey. Bur small; nut medium, light brown, smooth, slightly tomentose at tip, good; ripening just after Alpha. Seedling of Parry.

Biddle.—New Jersey. First fruited in Maryland. Bur medium; nut large, bright brown, broad, rather thickly tomentose, two to five in a bur; of medium season and fair quality. Tree regular, round-headed, vigorous. Grown from imported seed.

Black (syn., Dr. Black).—New Jersey. First fruited in Maryland. Bur large; nut medium to large; three to seven in a bur, consequently irregular in shape; dark brown, slightly tomentose, very early and of good quality. Tree round, close-headed, vigorous, productive. Grown from imported seed.

Boone.—Villa Ridge, Ill. Fig. 917. A hybrid between Giant and a native chestnut. Bur of medium size; nuts large, usually three in a bur; of light brown color, rather heavily tomentose; quality very good. Tree vigorous, precocious and productive, nuts ripening early. Considered difficult to propagate.

Coe.—California. A large, very sweet variety, but recently disseminated. Tree upright, somewhat spreading. Grown from imported seed.

Felton.—New Jersey. First fruited in Delaware. Bur small; nut medium, dark brown, slightly tomentose, rather early and of excellent quality. Tree round-headed and fairly productive. Grown from seed of an imported tree.

Giant.—Japan. A trade name, under which a number of varieties have been imported from Japan. See Parry.

Hale (syn., Eighteen Months).—California. A newly introduced variety, having a large, dark brown nut of excellent quality. Very precocious. Grown from imported seed.

Kent (syn., Extra Early).—New Jersey. First fruited in Delaware. Bur small, nut medium to large, dark, usually three in a bur; very early, of good quality. Tree round-headed, precocious, productive. Grown from seed of an imported tree.

Kerr.—New Jersey. First fruited in Maryland. Bur small; nut medium to large, dark brown, broad, three in a bur, early, and of excellent quality. Tree vigorous, symmetrical, round-headed, very productive. Grown from imported seed.

Killen.—New Jersey. First fruited in Delaware. Bur very large; nut very large, broad, light brown, slightly ridged, of excellent quality, midseason. Tree upright, open, spreading, moderately vigorous, productive. The largest chestnut yet brought to notice. Grown from seed of an imported tree.

Mammoth.—A trade name for the imported Japanese nuts and trees, not restricted to any particular variety.

Martin (syn., Col. Martin).—New Jersey. First fruited in Maryland. Bur large; nut large to very large, broad, bright reddish brown, slightly tomentose, three to five nuts in a bur. Midseason; of good quality for cooking. Tree vigorous, open, spreading, productive. Grown from imported seed.

McFarland.—California. Bur very large; nut large, and of fine quality; early. Tree spreading, very productive. A newly disseminated variety of great promise. Grown from imported seed.

Parry.—Japan. Bur very large; nut very large, one to three in a bur, broad, with apex sometimes depressed; dark brown, ridged, of fair quality. Tree moderately vigorous, open, spreading, with large leaves. One of the largest and most beautiful of this group. Selected for propagation as the best of 1,000 imported grafted Japanese chestnuts.

Prolific.—Japan. Bur small; nut medium, rather long, striped, three in a bur; early. Tree vigorous, compact, with small narrow leaves.

Reliance.—New Jersey. Bur medium; nut medium to large, rather long, light brown, ridged; midseason, and of fair quality. Tree dwarfish, spreading, drooping, very precocious and productive; inclined to overbear, and needs thinning. Seedling of Parry.

Success.—New Jersey. Bur very large; nut very large, usually three in a bur; midseason; of rather poor quality until cooked. Seedling of Parry. Tree upright, productive.

Superb.—New Jersey. Bur large; nut large, broad, brown, usually three in a bur, early, and of fair quality. Tree vigorous and very productive. Seedling of Parry.

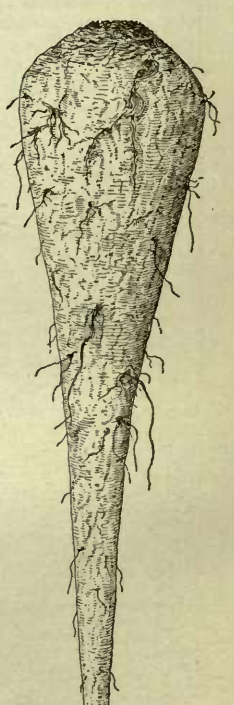
Wm. A. Taylor.

CHEVALIÈRA, CHEVALIÈRIA, CHEVALLIÈRA, CHEVALLIÈRIA. The species in the American trade are Æchmeas.

CHICK-PEA: *Cicer.*

CHICKWEED: *Cerastium* and *Stellaria.*

CHICORY, or SUCCORY (*Cichòrium Intybus*, Linn.). *Compósitæ* Fig. 918. A native of Europe, naturalized in America and familiar to many as a weed, is a pot-herb, a salad, and the leading adulterant of coffee It came prominently before the public in the late nineties and the early years of this century as an American farm crop. Prior to that year, its cultivation as an adulterant and substitute for coffee was largely prevented by the prejudice of the principal consumers, our foreign-born population, who insisted that American was inferior to European root, and also by the low tariff, which allowed the root to enter duty free, or with a very small impost. During 1898 and 1899 advantage was taken of a protective duty, and several factories were erected, for which farmers grew the roots. For a few years our home market was supplied from American fields in part. But even the substitution of horse-power for manual labor, improved plows and cultivating implements for crude ones, machine-digging of the roots for hand-digging, efficient slicing machines, and improved evaporating kilns did not make the business satisfactory. There was not enough money in it either to growers or to manufacturers, so it has been abandoned.



918. Improved chicory root. (×¼)

Chicory will probably succeed wherever the sugar beet is grown in this country, the climatic requirements being similar. In general, it may be said to thrive upon all stone-free soils that will produce paying staple crops, except clays, lightest sands and mucks. The first are too hard, the second too dry, the third too rich in nitrogen and too sour. The surface layer of soil should be deep, the subsoil open and well drained. If the water-supply be sufficient, high land is as good as low land of the same texture, though if too dry for profitable grain-growing, the former may yet be made to produce chicory; but if too wet for cereals, the latter will generally be found unsuitable for this root. The fertilizing of the land should be the same as for other root-crops, nitrogen being used sparingly, potash and phosphoric acid rather freely—one and one-fourth to one and one-half times as much of the former and two and one-half times the latter as has been removed by the preceding crop. It is best to apply these fertilizers to preceding crops that do not make heavy demands upon them. In rotation, chicory is classed with root-crops, and should be preceded by a small grain, since this is harvested in time for fall plowing. Clover should not immediately precede, since it leaves too much nitrogen in the soil. The ground being warm, fairly moist, thoroughly

prepared by deep plowing, harrowing and scarifying with a weeder, the seed, which must be fresh and clean, is sown rather thickly but covered thinly, in drills 18 inches apart.

There are but few well-defined varieties of this plant used for field culture, and even the garden sorts are not so stable as could be desired. Of the former group, Magdeburg, Brunswick and Schlesische are the principal; of the latter, Witloof (so-called), Red Italian, Broad-leaved, Improved Variegated and Curled-leaved are best known. Witloof and Barbe de Capucin can be produced from any variety, the difference being brought about by the method of growing.

Chicory has no specific enemies in this country, and is troubled by only a few of the general-feeding insects, such as cut-worms and wire-worms.

From six to ten tons is the general acre yield, although with good management fifteen tons may be produced. The cost of growing and the returns are about as follows: Rent, wear of tools, etc., $5; preparation of land, $4.50; seed, 75 cents; cultivating and tending, $15; harvesting and delivering, $12; total, $37.25. Average price the ton, $7.

From a purely horticultural standpoint, chicory is of interest as a root, a pot-herb, and a salad plant. The young tender roots are occasionally boiled and served with butter, pepper and salt, like young carrots, but they have never become widely popular in this form. As a pot-herb, the young leaves are equal to those of dandelion. They are cut when 6 to 8 inches long, boiled in two waters to remove the bitter flavor, and served like spinach. As a salad, chicory is famous in three forms: Common Blanched, Barbe de Capucin and Witloof. Barbe de Capucin is comprised of small blanched leaves. Witloof is a more solid head. The pink, red and curled varieties make a very pretty appearance, and, if well grown and served fresh, are delicious, there being only a slightly bitter flavor. The method of growing for salads is the same as for endive.

For Barbe and Witloof, well-grown roots are dug in October, trimmed of unnecessary roots and of all but an inch of top. For Barbe, the roots are laid horizontally in tiers in moist earth, the whole forming a sloping heap, the crowns of the roots protruding an inch or so. Since darkness is essential, a warm vegetable cellar is the usual place selected to grow this vegetable, which requires three or four weeks to produce its fine white leaves. These are cut when about 6 inches long, eaten as a salad, boiled like kale or cut up like slaw. If undisturbed, the roots will continue to produce for several weeks. The most rapid way to produce Witloof is to plunge the roots (shortened to 5 inches) in spent tanbark, or such material, and cover with 2 feet or more of manure, the space under a greenhouse bench being used. In about two weeks, heads resembling cos lettuce may be dug up, boiled like brussels sprouts, or served as salad. If the roots be left in place, protected from the light, but uncovered, a crop of leaves resembling Barbe may be gathered. Sowing and other cultural management is the same as for other garden roots, as beets and carrots. It is a pity that these vegetables are so little known in this country. Witloof is a popular winter vegetable in the larger cities of the East. Much of it is imported from Europe.

Chicory has run wild along roadsides and in dry fields in many parts of the country, and is considered to be a bad weed. However, the handsome sky-blue flowers (Fig. 962), which open only in sunshine, are very attractive.

M. G. KAINS.

CHÌLDSIA WÉRCKLEI: *Hidalgoa.*

CHILIÁNTHUS (*a thousand flowers*). *Loganiàceæ.* Four or 5 S. African trees or shrubs, very closely allied to Buddleia, from which it differs in having stamens exserted from the short tube: lvs. opposite, entire or dentate, nearly always tomentose or scaly: fls. very numerous, in dense terminal cymes or panicles; calyx and corolla deeply 4-parted, the latter usually yellowish. Unknown to the American trade. The plants known as *Buddleia salicifolia*, Jacq., and *B. saligna*, Willd., are *Chilianthus arboreus*, Benth. (which is probably identical with *C. oleaceus*, Burch.).

CHILÓPSIS (Greek, *lip-like*). *Bignoniàceæ.* One deciduous shrub or low tree, often planted in southern California and other parts.

Allied to Catalpa: differs in having 4 anther-bearing stamens and 1 rudiment, a more trumpet-shaped corolla and with jagged lobes, and lvs. linear and often not opposite.

lineàris, DC (*C. saligna*, Don). Slender-branched, 10–20 ft.: fls. handsome, bignonia-like, in a short terminal raceme; corolla 1–2 in. long, 5-lobed and crimped, the tube and throat lilac, and 2 yellow stripes inside. Dry districts from S. Texas to Calif., and in Mex.—From its narrow-lanceolate or linear lvs., it is known as desert willow; also called flowering willow and mimbres. There is a white-fld. form.

L. H. B.

CHIMÁPHILA (Greek, *winter-loving;* green in winter). *Ericàceæ.* PIPSISSEWA. Perennial small plants, interesting for the white or pinkish flowers and the evergreen foliage, but little cultivated.

Half shrubby or herbaceous, with creeping st.: lvs. evergreen, serrate, in irregular whorls: fls. nodding, forming a terminal, few-fld. umbel, on a long naked peduncle; petals 5, spreading; stamens 10, the anthers opening with 2 pores at the apex, the filaments short, dilated; style short, with a peltate stigma.: fr. a dehiscent, deeply furrowed, 5-celled caps. with numerous minute seeds.—Four species in N. Amer., Eu., and N. Asia to Japan; formerly united with Pyrola. Low evergreen plants, with pretty white or reddish fls. in summer. They grow best in a light, sandy soil, mixed with peat or leaf-mold, and prefer a half-shady position. Prop. by division of the creeping rootstock. Useful in wild borders.



919. Chimaphila maculata. (×⅔)

A. *Lvs. broadest above the middle.*

umbellàta, Nutt. (*C. corymbòsa*, Pursh). Five to 12 in.: lvs. 3–6 in a whorl, short-petioled, cuneate-lanceolate to oblong-obovate, sharply serrate, dark green and shining above, 1–2 in. long: fls. 4–7, white or reddish, ½–¾in. wide. N. Amer., from Canada to Mex., Eu., Japan. B.M. 778. L.B.C. 5:463. Mn. 7:161.—Lvs. said to be employed in rheumatic and kidney affections.

AA. *Lvs. broadest below the middle.*

maculàta, Pursh. Fig. 919. Lower and less branched than the foregoing: lvs. usually in 3's, ovate or oblong-

lanceolate, sparsely and sharply serrate, variegated with white along the nerves, 1–2 in. long: fls. 2–5, white, ¾in. wide. From Canada to Ga. and Miss. B.M. 897. Mn. 9:1. G.C. III. 32:318.

Ménziesii, Spreng. Slender plant, 3–8 in. high: lvs. alternate or in 3's, ovate to oblong-lanceolate, acute at both ends, ¾–1¾ in. long, sharply serrate, sometimes variegated: fls. 1–3, white, ½in. across; filaments with a round dilated portion in the middle. Brit. Col. to Calif. ALFRED REHDER.

CHIMONÁNTHUS: *Meratia.*

CHINA ASTER: *Aster.*

CHINA-TREE: *Melia.*

CHINA WOOD-OIL: *Aleurites Fordii.*

CHINESE LANTERN PLANT: *Physalis.*

CHINESE LAUREL: *Antidesma.*

CHINESE SACRED LILY: *Narcissus.*

CHINKAPIN, CHINQUAPIN: *Chestnut* and *Castanea.*

CHIOCÓCCA. *Rubiàceæ.* SNOWBERRY (which the name means in Greek). Shrubs, mostly climbing or trailing, of Trop. Amer. (a half-dozen or so species), and 3 in extreme S. Fla. Fls. in axillary panicles, the corolla funnelform and 5-parted; stamens 5, inserted on the base of the corolla, the filaments cohering at base; style filiform, the stigma club-shaped; ovary 2–3-loculed, becoming a small globular 2-seeded drupe. **C. racemòsa,** Linn., of the Fla. Keys and S., is sometimes cult. in hothouses for its panicles of yellowish white fls. and the white frs.: lvs. ovate to lanceolate, thick and shining, entire: drupes ¼in. diam.: twining, glabrous. **C. anguífuga,** Mart. (*C. brachiàta,* Ruiz & Pav.), of S. Amer., the root affording a native snake-bite remedy, has appeared in cult. (under the name var. *acutifòlia*): woody, with erect branches: lvs. ovate, 3 in. or less long, sharp-acuminate: fls. ¼in. long with recurved lobes, in axillary panicles shorter than the lvs.—In S. Fla. or on the Keys, 2 other species occur, but they apparently are not in cult.: *C. álba,* Hitchcock. Large, erect or reclining: lvs. elliptic to ovate: fls. white, often becoming yellow. *C. pinetòrum,* Brit. Small, trailing: lvs. mostly elliptic to oblong: corolla always white. L. H. B.

CHIÓGENES (Greek, *snow, offspring;* referring to the snow-white berries). *Ericàceæ.* SNOWBERRY. Creeping plant, rarely grown in rockeries for the carpeting effect of the evergreen foliage and for the attractive white berries; with small alternate 2-ranked lvs. and inconspicuous axillary fls.; corolla short-campanulate, 4-cleft; stamens 8, included, with short filaments, anthers opening by a slit: berry white, many-seeded.—Two species in the colder regions of N. Amer. and Japan. Slender trailing evergreens, in appearance much like the cranberry; rarely cult. Thriving best in moist and peaty soil, in a shaded position, creeping amongst growing moss. Prop. by seeds, by division or by cuttings in Aug. under glass. The American species, **C. hispídula,** Torr. & Gray (*C. serpyllifòlia,* Salisb.), has hirsute branches and ovate or oval, ¼–⅓in.-long ciliate lvs., greenish white fls. and white berries, ¼in. across, usually hirsute. ALFRED REHDER.

CHIONÁNTHUS (Greek for *snow* and *flower;* alluding to the abundance of snow-white fls.). *Oleàceæ.* FRINGE TREE. Woody plants grown for their profusely produced white flowers.

Shrubs or low trees, with deciduous, opposite and entire lvs.: fls. in loose panicles from lateral buds at the end of last year's branches, white, dicœcious or only functionally dicœcious; calyx 4-cleft; corolla divided nearly to the base in 4 narrow petals; stamens 2, short; ovary superior, 2-celled; style very short with a 2-lobed stigma: fr. a 1-seeded oval drupe.—Two species in E. N. Amer. and China. Ornamental shrubs, with large, dark green foliage, and very showy white fls. in early summer. The American species is almost hardy N., but requires a somewhat sheltered position; the Chinese may be more tender, but has proved hardy at the Arnold Arboretum. They thrive best in a somewhat moist and sandy loam, and in a sunny position. Prop. by seeds sown in fall or stratified; increased also by layers and by grafting under glass or budding in the open air on ash seedlings (in Europe, *Fraxinus Ornus* is preferred); sometimes by cuttings from forced plants in early spring.

virgínica, Linn. Fig. 920. Large shrub or slender tree, to 30 ft.: lvs. oval or oblong, acuminate, pubescent beneath when young, mostly glabrous at length, 4–8 in. long: panicles 4–6 in. long, pendulous; fls. functionally dicœcious; petals 1 in. long: fr. dark blue, ovoid, ¾in. long. May, June. From Pa. to Fla. and Texas. L.B.C. 13:1264. Gt. 16:564. Mn. 2:154. G. F. 7:325. A.G. 22:362. F.E. 29:733. Gng. 16:306. G.M. 31:527. V. 10:227. G.W. 8, p. 293. M.D.G. 1899:412, 413; 1900: 413; 1907:73, 337.—Variable in shape and pubescence of the lvs., and several varieties have been distinguished, but none of them sufficiently distinct for horticultural purposes. The staminate plants are showier in flower on account of their larger panicles and broader petals, but lack the attractive pendulous blue frs. in autumn. Root-bark tonic, febrifuge, laxative; reputed narcotic.



920. Chionanthus virginica. (×½)

retûsa, Lindl. (*C. chinénsis,* Maxim.). Shrub, with spreading branches, or small tree, to 20 ft.: lvs. obovate or oval to oval-oblong, acute or obtuse, sometimes emarginate, pubescent on the veins beneath, at least when young, and reticulate; petioles densely pubescent: fls. dicœcious, fragrant, in panicles 2–4 in. long; petals about ½in. long; narrow oblong: drupe ovoid, dark blue, ½in. long, China. P.F.G. 3, p. 85. G.C. II. 23:821; III. 47:328, 329. Gt. 35, p. 667. A.G. 13:374; 20:107; 22:363. Mn. 2:157. G.F. 7:327. G. 29:347; 33:521. Gn. W. 8:453.—Young plants have the lvs. serrulate. ALFRED REHDER.

CHIONODÓXA (Greek, *snow* and *glory*). *Liliàceæ.* GLORY-OF-THE-SNOW. Very early-blooming hardy bulbs, flowers and leaves appearing together.

Closely allied to Scilla, but differs, among other characters, in having a short tube to the corolla: fls. blue (running into white and red forms), with recurved-spreading acute segms., dilated filaments, and small or capitate stigma.—Four species, Crete to Asia Minor.

These are among the best of early-flowering plants, blooming in February, March and April, according to the locality, with the early snowdrops and scillas. Since their introduction to cultivation by Maw in 1877, they have been widely cultivated under the popular name of "glory-of-the-snow," in allusion to their early-blooming habit. *C. Luciliæ* is the most widely cultivated species. This varies much in color, the type having flowers whose petals are more or less deeply tipped with blue, shading to white at their bases. *C. Luciliæ* also occurs with pure white flowers, and in reddish and pink forms. *C. sardensis* has smaller flowers of a deeper tone of blue and without the white markings of the petals. There are two varieties of this, one with white

and the other with black stamens. *C. grandiflora* is the largest-flowered of the group, the type being slaty blue with dark lines down the center of the segments; however, like others of the genus, there are pink and white forms sometimes found in collected bulbs, although somewhat rare. *C. Tmolusii*, one of the kinds sent out by Whittall of Smyrna some years ago, is very like *C. Luciliæ* in form but of a deeper blue and a distinctly later flowering habit. Chionodoxas hybridize with Scilla, and the hybrids are sometimes known as chionoscillas.—Chionodoxas thrive in any fertile soil, well drained and not too heavy, and in any exposure, the main requisite for growth being that they have light and an adequate supply of moisture while growing and until the foliage is ripened. The bulbs should be planted about 3 inches deep, and closely, say an inch or less apart. Lift and replant about the third year. They need no winter covering. They flower well in pots in winter in a coolhouse temperature. Must be forced only gently, and given abundance of air, light and moisture. They are increased by offsets and seeds, which they produce freely. Under favorable conditions they increase rapidly by self-sown seeds. Preferably, seeds should be sown in a frame, and may be expected to germinate the following winter. Under ordinary conditions, self-sown seeds germinate early in the year, or late winter. (J. N. Gerard.)

Lucíliæ, Boiss. Fig. 921. Bulb ovoid, brown-coated: lvs. long and narrow, 2 or 3 with each st.: scape 3–6 in. high, bearing a dozen or less bright blue, more or less hanging, white-centered fls. Asia Minor and Crete. B.M. 6433. Gn. 28, p. 179.—Runs into many forms, one of which has white fls. **C. gigantèa,** Hort., is a larger form of it, distinct in habit. **C. grandiflòra,** Hort., is a large garden form, with fls. violet-blue and white in the throat. Var. **Fórbesii,** Hort., somewhat taller and bearing more fls. **C. amábilis Leìchtlinii,** Hort., is a very handsome form, 2 weeks later than the others: fls. 1¾ in. across, with broad full segms. of soft creamy white shaded rose-purple. **C. Tmolûsii,** Hort., is a late-blooming form, bright blue and white, apparently a variant of *C. Luciliæ.*



921. Chionodoxa Luciliæ. (×½)

sardénsis, Drude. Fls. 2–6, smaller, much darker blue with no white in the eye, the perianth-limb twice longer than the tube: lvs. channeled. Sardis. Gn. 28:178.—Probably a form of *C. Luciliæ.*

crética, Boiss. & Held. Slender: fls. smaller and fewer (1–2 on a scape) than *C. Luciliæ,* white or very pale blue. Crete.—Of little horticultural value.

Állenii, Hort. (*Chionoscílla Allenii,* Hort.). Perianth segms. cut to the base: habit of *C. Luciliæ,* but the white eye is indistinct. Supposed natural hybrid of *Scilla bifolia* and *Chionodoxa Luciliæ.* G.C. III. 21:191. There is said to be another *C. Allenii* that is a direct selection probably from *C. Luciliæ,* very like var. *grandiflora. Chionoscilla Penryi* is another Chionodoxa× Scilla hybrid, the exact parentage not being stated. L. H. B.

CHIONOSCILLA: Hybrids of Chionodoxa and Scilla; consult these genera.

CHIRANTHODÉNDRON (Greek, signifying *handflower-tree*). *Sterculiàceæ.* Odd-flowered ornamental tree of Mexico and to be expected in West Indies and elsewhere in cultivation.

A monotypic genus, which together with the Californian Fremontodendron forms the remarkable group Fremontieæ. The fls. are devoid of a corolla, but in its place have a large deeply 5-parted cup-shaped calyx, concave at the base, in which there are 5 glands which secrete an abundance of honey; stamens united together for about one-third their length, above which they separate into 5 rays bearing linear anthers which dehisce by a longitudinal groove; style issuing from the center of the stamens and terminating in a pointed stigma: fr. a woody caps. with 5 valvate dehiscent lobes: foliage linden-like and densely clothed with stellate hairs.



922. Chiranthodendron platanoides. The hand-flower. (×⅛)

platanoìdes, Baill. (*Cheirostèmon platanoìdes,* Humb. & Bonpl.). The celebrated Macpalxochiquahuitl, or Handflower Tree of the Mexicans; also called Mano de Mico, Monkey's Hand, and Devil's Hand. Fig. 922. The remarkable feature of the fl. is the form of the bright red stamens, which resemble the fingers of a human hand and are tipped with appendages like claws; from the base of the fingers issues the style which is more or less like a thumb. A single tree growing near the city of Toluca was known to the ancient Mexicans, who regarded it with superstitious veneration. It was of great age and was supposed to be the only tree of its kind in the world. But an entire grove of the trees was discovered in Guatemala on the slope of the Volcano de Agua, near the town of Antigua, whence in pre-Columbian times the specimen had been brought. This established itself on the slope of the volcano of Toluca, where the conditions of soil and climate were similar to those of its original habitat. W. E. Safford.

CHIRÌTA (Hindostani name). *Gesneràceæ.* Plants much like gloxinias and streptocarpuses. A genus of 100 species, none of which is in the American trade. They are natives of E. Asia and are herbs or low undershrubs with opposite, often unequal lvs.: fls. in shades of purple and blue, tubular, in clusters on the tops of short scapes. For cult., see *Gloxinia.*

C. barbàta, Sprague. Perennial: fls. pedicellate; corolla funnel-shaped, bluish lilac, with yellow band in front. India. B.M. 8200.—*C. rupéstris,* Ridl. Bushy, compact annual. Malay Peninsula. B.M. 8333.—*C. sinénsis,* Lindl., is the best known

species and is well worth cult. It has bright green lvs. and scapose cymes of blue and white fls., the yellow anthers of which add attractiveness. B.R. 30:59.—A variegated form is known.

N. TAYLOR.†

CHIRÒNIA (classical mythological name). *Gentianàceæ.* A dozen or so soft perennial herbs or shrubs of Afr., rarely seen in collections of greenhouse material. Fls. in shades of red and purple, terminal, with a salver-form corolla and short tube: lvs. opposite, sessile, on single or branching sts. Most of them are from the Cape region.

CHIVE, or CHIVES (written also Cive). *Allium Schœnóprasum,* Linn., a perennial plant native to Europe and the northern borders of the United States and northward. See *Allium.* The leaves of chive are used green as seasoning in soups, salads and stews. Chive grows 6 to 8 inches high, making dense mats of narrow hollow leaves, and blooming freely in violet-colored heads, which scarcely overtop the foliage; bulbs small, oval. The plant makes an excellent permanent edging, and is worth growing for this purpose alone. It is easily propagated by dividing the clumps; but, like other tufted plants, it profits by having the stools broken up and replanted every few years. It rarely seeds. It thrives in any garden soil. The leaves may be cut freely, for they quickly grow again.

L. H. B.

CHLIDÁNTHUS (*delicate flower,* from the Greek). *Amaryllidàceæ.* Tropical American summer-flowering bulbs. Allied to Zephyranthes.

Flowers erect, yellow, fragrant, in a small 2-bracted umbel, terminating a solid scape, long-tubed, with wide-spreading segms.; stamens 6, inserted at the throat, the filaments unequal and dilated at base: fr. a 3-valved caps.: lvs. long and strap-shaped: bulb tunicate.—Three or four species. Mex., and S. Amer.

Chlidanthuses are increased by offsets or by seeds. The bulbs should be kept dry and cool during winter and in spring started in a moderately warm house. After flowering, care must be taken to have the bulbs make their annual growth. They may either be grown in pots plunged in ashes, or planted out where they can be watered occasionally during dry weather. Like other similar plants, they will benefit by a mulching of spent hops or rotted manure. (G. W. Oliver.)

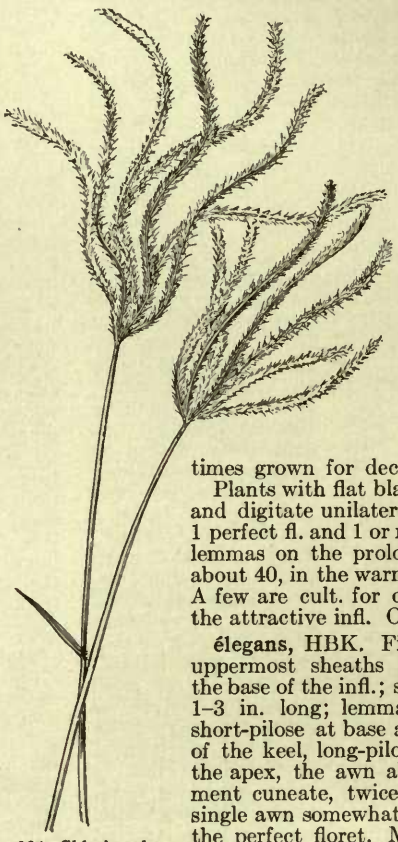
fràgrans, Herb. (*C. lùteus,* Voss). Bulb large and ovoid: lvs. about 6, appearing in spring or early summer with the fls., narrow, glaucous, obtuse: fls. 4 or less in each umbel, 3 in. or less long, nearly sessile, erect, on a 2-edged scape or peduncle 10 in. or less high. Andes. B.R. 640. F.S. 4:326.—A good summer-blooming plant.

Éhrenbergii, Kunth. Somewhat taller: fls. yellow, nearly horizontal, distinctly stalked, the 3 outer segms. wider than the inner. Mex.—Perhaps a form of the above.

L. H. B.



923. Chloris elegans. (×⅓)



924. Chloris polydactyla. (×⅓)

CHLORÁNTHUS (*green flower*). *Chloranthàceæ.* Tropical herbs, shrubs or trees, one of which is sometimes grown under glass in the North.

Perennial aromatic herbs or evergreen shrubs, with jointed sts. opposite simple lvs., and small, inconspicuous fls., in slender terminal spikes: perianth represented by a single scale, in the axil of which is the 1-loculed ovary and mostly 3 united stamens (the side stamens sometimes obsolete).—Some 10 species in the eastern tropics. Two other genera (Ascarina and Hedyosmum) comprise the family Chloranthaceæ, of the pepper-like series of plants.

brachýstachys, Blume. Shrub used for pot-growing, reaching a height of 1–2 ft., bearing glossy foliage and small yellow berries: stamen single in each fl.: lvs. long-lanceolate, acuminate, serrate.—Tropics and subtropics, Ceylon eastward. There is a variegated-leaved form.

L. H. B.

CHLÒRIS (the goddess of flowers). *Gramíneæ.* FINGER-GRASS. Annual or usually perennial grasses, sometimes grown for decoration.

Plants with flat blades, compressed sheaths and digitate unilateral spikes: spikelets with 1 perfect fl. and 1 or more rudimentary sterile lemmas on the prolonged rachilla.—Species about 40, in the warmer regions of the world. A few are cult. for ornament on account of the attractive infl. Of simple treatment.

élegans, HBK. Fig. 923. Annual, 1–3 ft.: uppermost sheaths usually inflated around the base of the infl.; spikes 6–12, pale or dark, 1–3 in. long; lemma fusiform, 1 line long, short-pilose at base and along the lower half of the keel, long-pilose on the margins near the apex, the awn about 5 lines long; rudiment cuneate, twice as long as broad, the single awn somewhat shorter than the awn of the perfect floret. Mex. Dept. Agric., Div. Agrost., 7:192; 20:102.

polydáctyla, Swartz (*C. barbàta,* Nash). Fig. 924. Perennial, 1–3 ft.: spikes several; awns 2–3 lines; rudiment triangular-truncate, the 2 awns about as long as the awn of the perfect floret. Tropics of both hemispheres.

verticillàta, Nutt. WINDMILL-GRASS. Perennial, 4–15 in.: spikes several, slender, in 1–3 whorls, 2–4 in. long; awns 2–3 lines; lemma 1 line long, nearly glabrous; rudiment oblong-truncate, 1-awned. Dept. Agric., Div. Agrost. 7:191. Kan. to Texas.

radiàta, Swartz. Perennial, 2–3 ft.: spikes several, about 3 in. long; spikelets slender; lemma slightly ciliate on callus and near apex, the awn 6 lines long; rudiment narrow, acute, the single awn about half as long as the awn of the perfect floret. W. Indies.

gayàna, Kunth. RHODES-GRASS. Robust perennial, with abundant foliage and terminal umbels of 6–15 spikes.—An African species at present under experimentation in U. S. in dry regions. Cult. in Austral. (See Agr. Gaz. New S. Wales 19:19, 118, 389 [1908]).

truncàta, R. Br. (*C. barbàta vèra,* Host., not *C. barbàta,* Swartz or Nash). STAR-GRASS. A stoloniferous perennial, with erect culms 1–3 ft.: spikes 6–10, 3–6 in., becoming horizontal or reflexed; spikelets 1½ lines, dark at maturity, the awns 3–6 lines long. Austral. Turner, Austr. Grasses 1:17.—Cult. for ornament.

C. grácilis, Dur.=Leptochloa virgata, Beauv. This has been recommended as an ornamental.—*C. petræa,* Swartz, and *C. glaùca,* Vasey, both handsome species from Fla., have been recommended for cult. as ornamentals. A. S. HITCHCOCK.

CHLORÓCODON (Greek for *green* and *bell,* alluding to the flowers). *Asclepiadàceæ.* Twiners, one of which is planted far South.

Large plants with opposite cordate entire heavy lvs., notched stipules and purplish or greenish fls. in axillary panicles: calyx 5-parted; corolla deeply 5-lobed; corona of 5 lobes coming from the base of the filaments, the lobes obcordate or broader, sometimes with an erect or incurved projection or horn on the back; pollen granular.—Two species in Trop. and S. Afr. *C. ecornutus,* N. E. Br., is apparently not in cult.

Whiteii, Hook. f. Strong woody twiner, with large opposite cordate-ovate thick lvs. and axillary clusters of odd fls. ¾–1 in. diam.; corolla rotate-bell-shaped, thick; segms. ovate and acute, purple and with margins and central stripe green, and bearing long-notched lobes; corona-lobes horned; anthers connivent over the capitate stigma. Guinea to Natal. B.M. 5898. G.C. III. 18:243.—It is now cult. in S. Fla. and S. Calif. The roots are used medicinally in Natal, under the name of mundi. The plant is an interesting greenhouse climber, but not handsome. L. H. B.

CHLORÓGALUM (*green* and *milk,* from the Greek, referring to the juice of the plant). *Liliàceæ.* Hardy West American bulbs, allied to Camassia.

Tall plants with a tunicated bulb: lvs. at base of st. long-linear, wavy-margined, those on the st. very small: fls. white or pink, in a panicle terminating a nearly leafless st., on jointed pedicels; segms. of perianth 6, 3-nerved, at length twisting over the ovary; stamens 6, not exceeding segms.; style long and deciduous. Plants of easy cult., to be treated like camassias or ornithogalums. Three species, in Calif.

A. *Pedicels nearly as long as the fls.: segms. spreading from near the base.*

pomeridiànum, Kunth (*Anthéricum califórnicum,* Hort.). SOAP-PLANT. AMOLE. St. reaching 5 ft., many-branched, from a very large bulb: fls. small (1 in. or less long) and star-like, numerous, white with purple veins, on spreading pedicels, opening in the afternoon (hence the specific name: *pomeridianus, post-meridian*). —Bulb used by Indians and Mexicans for soap-making. Has been catalogued as *Anthericum californicum.* Bulb 4 in. long and half as thick, covered with coarse brown fibers.

AA. *Pedicels very short: segms. spreading from above the base.*

parviflòrum, Wats. Bulb small (1 in. diam.): st. 1–3 ft., slender-branched: lvs. narrow and grass-like: fls. pinkish, ¼in. long; ovary broad and acute.

angustifòlium, Kellogg. Low, about 1½ ft. Resembles the last, but fls. white and green-lined and somewhat larger, the ovary acute above; perianth funnel-form campanulate, the segms. narrow-oblong.

C. Leichtlinii, Baker=Camassia Leichtlinii. L. H. B.

CHLORÓPHORA (Greek, referring to the fact that the fustic-tree bears a green dye). *Moràceæ.* Two milky-juiced alternate-leaved trees, one in Trop. Afr. and one in Trop. Amer. Lvs. entire or toothed: diœcious; male fls. in cylindrical spikes, the females in nearly globular or oblong heads, these clusters solitary in the axils; perianth of male fls. 4-parted, the segms. broad and obtuse; stamens 4; ovary a minute rudiment in the males; perianth of female fls. 4-parted or -divided, the segms. concave-thickened at the apex; style lateral on the oblique-ovoid ovary: achene equaling the perianth or somewhat exserted, covering the receptacle. *C. tinctòria,* Gaud. (*Maclùra tinctòria,* Don) is the fustic of the W. Indies. It reaches a height of 50 ft., and a diam. of trunk of 2 ft.: usually not thorny: lvs. nearly entire, oblong, acuminate. Variable. The handsome yellow wood yields a yellow dye, which is used also in the making of browns and greens; it is also a strong and resistant timber. L. H. B.

CHLORÓPHYTUM (name means, in Greek, *green plant*). *Liliàceæ.* Rhizomatous herbaceous plants, one of which is familiar in greenhouses.

Very like Anthericum, but differing in the thickened filaments of the stamens and the 3-angled or 3-winged caps.: infl. often denser: lvs. broader, often oblanceolate and petiolate: seed disk-like.—Some 60 or more species, in warm parts of Asia, Afr., and Amer. Consult *Anthericum* and *Paradisea.*

elàtum, R. Br. (*Anthéricum variegàtum, A. vittàtum, A. picturàtum, A. Williamsii,* Hort.). Root fleshy and white: lvs. freely produced from the crown, often 1 in. wide, flattish and bright green, or in the garden varieties with white lines along the margins, and often (var. *picturatum*) also with a yellow band down the center: scape terete and glabrous, 2–3 ft. high, branched; fls. white, ½in. long, with revolute oblanceolate segms., which are obscurely 3-nerved on the back. S. Afr. F.S. 21: 2240–1.—A valuable and common plant for vases and pots, and sometimes used in summer borders.

Three species that recently have been mentioned in horticultural literature are: *C. amaniénse,* Engler, from German E. Afr.; 10 in.: lvs. lanceolate-acuminate, 16 in. long and 3½ in. or less broad, somewhat fleshy, bronze, with white margin: fls. greenish white, in cluster 6 in. long.—*C. comòsum,* Wood (Natal Plants, fig. 279), from Lake Albert, Cent. Afr.; proliferous: lvs. radical, linear, deep green, 2 ft. long: fls. small, white, soon fading, usually in 4's, in a branched cluster 3 ft. long.—*C. Hùyghei,* DeWild, Congo; lvs. in a basal tuft, lanceolate, petioled, about 18–20 in. long, 2–2½ in. broad: fls. greenish white, about ¼in. long, in a bracted raceme 2–3 ft. long. L. H. B.

CHLORÓPSIS BLANCHARDIÀNA: *Trichloris.*

CHLORÓXYLON (*green wood:* Greek). *Rutàceæ.* One species of moderate-sized tree of India, slightly intro. in this country, **C. Swietênia,** DC. (*Swietènia Chloróxylon,* Roxbg.). Young parts gray-puberulent: lvs. abruptly pinnate, the lfts. 20–40, oblique and obtuse and entire: fls. small, 5-merous in terminal and axillary pubescent panicles; calyx deeply lobed; petals clawed, spreading; stamens 10; disk a 10-lobed pubescent body, in which the stamens are inserted: fr. a coriaceous 3-celled caps. Heartwood fragrant, with a beautiful satiny luster, whence the name "Indian Satin-wood." An interesting tree for trial on the southern borders of the U. S. L. H. B.

CHOCOLATE: *Theobroma.*

CHOÍSYA (J. D. Choisy, Swiss botanist, 1799–1859). *Rutàceæ.* One Mexican shrub, **C. ternàta,** HBK., grown in S. Calif. and S. Fla., and sometimes under glass. It grows 4–8 ft. high, making a compact free-blooming bush, with opposite ternate lvs., the lfts. lance-obovate or oblong, thick and entire, with pellucid dots: fls. in a terminal, forking cluster; white, fragrant, orange-like (whence the vernacular name "Mexican orange"), 1 in. across, with pellucid dots. R.H. 1869:330. Gn. 50, p. 203. J.H. III. 34:253.—A handsome shrub, worthy of greater popularity. It will endure several degrees of frost, and should succeed in the open in many of the southern states. Blossoms in S. Calif. at different seasons; it can be made to bloom, it is said, every two months by withholding water and then watering liberally, as is done with roses in S. France. Hardy against a wall in parts of S. England. L. H. B.

CHOKE-CHERRY: *Prunus demissa* (West) and *P. virginiana* (East).

CHONDROBÓLLEA (compounded from Chondrorhyncha and Bollea). A genus established to contain hybrids between these genera. See also *Bolleo-Chondrorhyncha.*

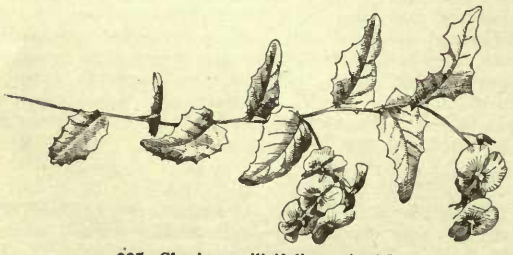
CHONDROPÉTALUM: hybrids of Chondrorhyncha and Zygopetalum; see those genera.

CHONDRORHÝNCHA (*cartilage* and *beak*). *Orchidàceæ.* Three species of S. American epiphytal orchids, practically unknown in the American trade. Cult. as for *Odontoglossum crispum.* They are short-stemmed herbs without pseudobulbs, and oblong, plicate, petioled lvs., the simple scape bearing a single large, odd, yellowish fl. *C. Chéstertonii,* Reichb. f. (O.R. 11:305; 16:57), *C. fimbriàta,* Reichb. f., and *C. ròsea,* Lindl., are the species. Keep cool and moist. A garden hybrid is reported between *C. Chestertonii* and *Zygopetalum Mackayi* under the name of *Chondropetalum Fletcheri.* O.R. 1908, 56, f. 8. GEORGE V. NASH.

CHORÍSIA (Ludwig Choris, born 1795, artist of Kotzebue's expedition). *Bombacàceæ.* Spiny trees of S. Amer. (3 species), one of which is somewhat cult. Lvs. alternate, digitate, of 5–7 entire or serrate lfts.: fls. large, with 5 linear or oblong petals, the peduncles axillary or racemose; staminal tube double, the outer one short and with sterile anthers; ovary 5-loculed and many-ovuled: fr. a pear-shaped caps. with many silky seeds. **C. speciòsa,** St. Hil., of Brazil, the "floss silk tree," is cult. in S. Calif., and is adapted to warm glasshouses. It is a medium-sized tree, allied to Ceiba and Bombax. Lfts. lanceolate, acuminate, dentate: calyx irregular, shining outside, but silky inside; petals obtuse, yellowish and brown-striped at the base, pubescent on the back. The soft silk or cotton of the seed-pods is used for pillows and cushions. L. H. B.

CHORÍZEMA (fanciful Greek name). Sometimes spelled *Chorozema. Leguminòsæ.* Evergreen coolhouse small shrubs grown for the showy pea-like yellow orange and red, usually racemose flowers; spring- and summer-blooming.

Woody plants of diffuse or half-climbing habit, with thick and shining simple often spiny-toothed lvs. and pea-like red or yellow fls.: calyx-lobes 5, the 2 upper ones mostly broader; petals clawed, the standard very broad, keel short; stamens not united: pod short, not constricted.—About 15 species, in Austral., 3 of which



925. Chorizema ilicifolium. (×⅓)

appear to be chiefly concerned in the garden forms. Handsome plants for the cool greenhouse, less popular in this country than abroad. When not grown too soft, they will stand slight frost at times. Grown in the open in S. Calif. and S. Fla. They are grown in a rather peaty soil, after the manner of azaleas, and usually rested in the open in summer. They are excellent for training on pillars and rafters.

Chorizemas are among the most attractive spring-flowering plants, and they are not difficult to grow. Cuttings should be secured in March from medium-ripened wood and may be either potted singly in small pots, or several placed together in larger pots. The former method has the advantage, because when cuttings are well rooted in the small pots, they may be shifted along without so much disturbance to the roots. The cuttings root readily in a mixture of two parts sharp sand and one of peat, sifted through a fine sieve. They should be placed in a tight case or covered with a bell-glass in a temperature of 58° to 60° by night. A rise of 10° in the day will be sufficient. The inclosure that protects them from drafts should be opened a few minutes now and then to change the air. For potting chorizemas in the early stages, equal parts of good peat and sharp sand is about right. When a 5- or 6-inch pot is reached, much less sand should be used,—just enough to give the earth a gritty feeling and the peat may be in a rather rough state, just small enough to be conveniently used in potting. The potting should be firm, as loose potting is bad for all kinds of hardwood plants. Keep the plants shaded from the sun during the hot months, and use the syringe freely. Also pinching must be attended to from their early stages to insure a good bushy plant. It is best not to stop the plants after August, as they will begin then to set buds. A plant in a 5- or 6-inch pot may be grown the first year if properly attended to. The plants should be wintered in a night temperature of 40° with a rise of 10° or 15° during the day. The second summer, and from that on as long as the plants are kept, they do better if plunged in a bed of clean coal-ashes out-of-doors, provided there is no danger from frost; by so doing, a much shorter-jointed growth will be the result. Plants well established in their pots may be fed with liquid manure until they set buds. A 3-inch potful of cow- or horse-urine to two and one half or three gallons of water, will be sufficient, and for a change a handful of soft-coal soot to the same amount of water; but always water twice with clean water between applications. Brown scale sometimes gets a foothold on chorizemas and it may be eradicated by fumigation with cyanide of potassium. Red-spider may be kept down with the syringe. (George F. Stewart.)

vàrium, Benth. (*C. élegans,* Hort.). The common cult. species, in several forms: erect, 4–6 ft., pubescent on under side of lvs. and on branches: lvs. cordate-ovate, undulate and prickly-toothed, 2 in. or less long: fls. in many pubescent racemes; standard light orange, wings and keel handsome purple-red. B.R. 25:49.—Garden forms are *C. Chándleri,* with yellow-red standard, and blood-red wings, the fls. large and numerous; and such names as *grandiflorum, macrophyllum, latifolium, floribundum, multiflorum. C. Lówii,* Hort., is a form of this species, with larger and brighter-colored fls.

cordàtum, Lindl. (*C. supérbum,* Lem.). Tall slender glabrous shrub (7–10 ft.), with weak branches: lvs. cordate-ovate to ovate-lanceolate, 2 in. or less long, small-toothed and more or less prickly: fls. many; standard scarlet-red, wings and keel purple-red. B.R. 24:10. I.H. :29. Var. *rotundifòlium,* Hort., has roundish lvs. Var. *spléndens,* Hort., is offered.

ilicifòlium, Labill. Fig. 925. Low and diffuse, weak, glabrous, the branches slender and erect or drooping: lvs. ovate to lanceolate, 1 in. long, often cordate at base, thick, coarsely veined, strongly undulate and with prickly teeth or lobes: fls. in few-fld. loose racemes, orange-red in spring and summer. B.M. 1032 (as *C. nanum*). B.R. 1513 (as *C. triangulare*). L. H. B.

CHRISTMAS FLOWER: *Euphorbia pulcherrima.*

CHROSPÉRMA: *Zygadenus.*

CHROZÓPHORA (Greek, *color-bearing,* on account of their use). *Euphorbiàceæ.* Dye-yielding herbs. Lvs. alternate, stellate hairy: fls. monœcious; staminate calyx 5-parted, valvate; petals free; styles biparted;

ovary 3-celled, 3-ovuled.—Nine, species chiefly of Old World deserts. **C. tinctòria,** Juss. (*Cròton tinctòrius,* Linn.), TURNSOLE, a Medit. annual, formerly used for its blue dye, is listed in some European catalogues.

CHRYSALIDOCÁRPUS (Greek for *golden fruit*). *Palmàceæ,* tribe *Arèceæ.* Spineless stoloniferous fan palms, with medium fasciculate ringed stems.

Leaves pinnatisect, long-acuminate; segms. about 100, bifid at the apex, the lateral nerves remote from the midrib: fr. usually violet or almost black.—Species 1, which is a popular florist's plant. Madagascar. Treated



926. Chrysalidocarpus lutescens.

as a part of Hyophorbe by Engler and Prantl, but here kept distinct, as it is commonly known as Chrysalidocarpus by cultivators.

lutéscens, Wendl. (*Hyophórbe índica,* Gaertn. *H. Commersoniàna,* Mart. *Arèca lutéscens,* Bory). Fig. 926. St. 30 ft. high, 4–6 in. diam., cylindrical, smooth, thickened at the base: lvs. very long; segms. almost opposite, lanceolate, 2 ft. long, 2½ in. wide, acute, with 3 prominent primary nerves, which are convex below and acutely 2-faced above. Bourbon. A.G. 13: 141. A.F. 4:566.—In growing *Chrysalidocarpus* (or *Areca*) *lutescens* in quantity, it will be found a good plan to sow the seeds either on a bench, in boxes or seed-pans, so prepared that the seedlings will remain in the soil in which they germinate until they have made 2 or more lvs. The first lf. made above the soil is small, and if plants are potted off at this stage they must be very carefully watered in order not to sour the soil. In the preparation of the receptacles for the seed, a little gravel in the bottom will be found good, as the roots work very freely through it, and when the time comes to separate the plants previous to potting, it is an easy matter to disentangle the roots without bruising them. Probably the plan which works best is to wash the soil and gravel entirely from among the roots. Pot in soil not too dry, and for the next few days keep the house extra warm and humid, and the plants shaded from the sun without any moisture applied to the soil.

JARED G. SMITH and G. W. OLIVER.

CHRYSÁNTHEMUM (Greek, *golden flower*). Including *Pyrèthrum. Compósitæ.* Plate XXX. A diverse group of herbaceous and sub-shrubby plants, mostly hardy, and typically with white or yellow single flowers, but the more important kinds greatly modified in form and color, grown in the open or flowered under glass in fall.

Annual or perennial herbs, sometimes partly woody, glabrous or loosely pubescent or rarely viscid, usually heavy-scented: lvs. alternate, various, from nearly or quite entire to much dissected: heads many-fld., terminating long peduncles or disposed in corymbose clusters, radiate (rays sometimes wanting); disk-fls. perfect and mostly fertile; ray-fls. pistillate, mostly fertile, the ray white, yellow, rose-colored, toothed or entire; receptacle naked, flat or convex; involucre-scales imbricated and appressed, mostly in several series, the margins usually scarious: achene of disk- and ray-fls. similar, striate or angled or terete or more or less ribbed, those of the ray-fls. often 3-angled; pappus 0, or a scale-like cup or raised border.—Probably nearly 150 recognizable species, in temperate and boreal regions in many parts of the globe, but mostly in the Old World.

The genus Chrysanthemum, as now accepted by botanists, includes many diverse species so far as general appearance is concerned, but nevertheless well agreeing within themselves in systematic marks and by these same marks being separated from related groups. The marks are in large part set forth in the preceding paragraph. Bentham and Hooker make twenty-two sub-groups (of which about six include the garden forms), based chiefly on the way in which the seeds are ribbed, cornered, or winged, and the form of the pappus. The garden pyrethrums cannot be kept distinct from chrysanthemums by garden characters. The garden conception of Pyrethrum is a group of hardy herbaceous plants with mostly single flowers, as opposed to the florists' or autumn chrysanthemums, which reach perfection only under glass, and the familiar annual kinds which are commonly called summer chrysanthemums. When the gardener speaks of pyrethrums, he usually means *P. roseum.* Many of the species described below have been called pyrethrums at various times, but they all have the same specific name under the genus Chrysanthemum, except the most important of all garden pyrethrums, viz., *P. roseum,* which is *C. coccineum.* The feverfew and golden feather are still sold as pyrethrums, and there are other garden species of less importance. The botanical conception of Pyrethrum is variously defined; the presence of a rather marked pappus-border on the achene is one of the distinctions; the pyrethrums are mostly plants with large and broad heads either solitary or in loose corymbose clusters, the rays usually conspicuous and commonly not yellow, and the fruits five- to ten-ribbed. Hoffmann, in Engler & Prantl "Natürlichen Pflanzenfamilien," adopts eight sections, one of them being Tanacetum (tansy) which most botanists prefer to keep distinct.

Although the genus is large and widespread, the number of plants of interest to the cultivator is relatively few. Of course the common garden chrysanthemum, derived apparently from two species, is the most useful. The insect powder known as "pyrethrum," is produced from the dried flowers of *C. cinerariæfolium* and *C. coccineum.* The former species grows wild in Dalmatia, a long narrow mountainous tract of the Austrian empire. "Dalmatian insect powder" is one of the commonest insecticides, especially for household pests. *C. cinerariæfolium* is largely cultivated in France. *C. coccineum* is cultivated in California, and the product is known as buhach.

There are over one hundred books about the garden chrysanthemum, and its magazine literature is probably exceeded in bulk only by that of the rose. It is the flower of the East, as the rose is the flower of the West.

Aside from oriental literature, there were eighty-three books mentioned by C. Harman Payne, in the Catalogue of the National Chrysanthemum Society for 1896. Most of these are cheap cultural guides, circulated by the dealers. The botany of the two common species has been monographed by W. B. Hemsley in the Gardeners' Chronicle, series III, vol. 6, pp. 521, 555, 585, 652, and in the Journal of the Royal Horticultural Society, vol. 12, part I. The great repositories of information regarding the history of the chrysanthemum, from the garden point of view, are the scattered writings of C. Harman Payne, his "Short History of the Chrysanthemum," London, 1885, and the older books of F. W. Burbidge and John Salter. For information about varieties, see the Catalogues of the National Chrysanthemum Society (England) and the Liste Descriptive, and supplements thereto, by O. Meulenaere, Ghent, Belgium. There are a number of rather expensive art works, among which one of the most delightful is the "Golden Flower: Chrysanthemum," edited by F. Schuyler Mathews, Prang, Boston, 1890. "Chrysanthemum Culture for America," by James Morton, Clarksville, Tenn., published in New York in 1891, was the first authentic American work. Within the past few years have appeared "The Chrysanthemum," by Arthur Herrington, "Smith's Chrysanthemum Manual," by Elmer D. Smith, and recently "Chrysanthemums and How to Grow Them," by I. L. Powell.



927. Chrysanthemum carinatum, the form sold as C. Burridgeanum. (×⅓)

Aside from the florist's chrysanthemum (*C. hortorum*), no particular skill is required in the growing of these plants, although great perfection is attained by some gardeners in the handling of individual plants of the marguerites (*C. frutescens*). The hardy border perennial chrysanthemums may be either small-flowered rugged forms of *C. hortorum*, as the "hardy pompons" and also the "artemisias" of old gardens, or they may be other species. Some of these other species are the "pyrethrums" of gardens, and some (as the *C. maximum* and *C. uliginosum* class) are the "moon daisies" and "moonpenny daisies" of the hardy perennial plantation. Some of the very dwarf tufted kinds (as *C. Tchihatchewii*) make excellent edging plants. The moon daisies deserve to be better known for mass planting and bold lines when a great display of heavy white bloom is wanted. Most of them bloom the first season from early-sown seed. The Shasta daisy and its derivatives are of the moon daisy group. They all profit by a covering of coarse mulch in the fall. See *Pyrethrum* and *Marguerite*.

The annual chrysanthemums are easily grown flower-garden subjects, suitable for a bold late display in places where delicate and soft effects are not desired. *C. carinàtum*, *C. coronarium* and *C. segetum* are the common sources of these annuals. They are hardy and rugged; and they need much room.

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A. *Plant annual (at least so treated in cult.): the "summer chrysanthemums."*

B. *Rays typically white.*

1. carinàtum, Schousb. (*C. tricolor*, Andr. *C. matricaroìdes*, Hort.). Fig. 927. Glabrous annual, 2–3 ft. high: st. much branched: lvs. rather fleshy, pinnatifid: fls. in solitary heads which are nearly 2 in. across, with typically white rays and a yellow ring at the base; involucral bracts carinate (keeled). Summer. The two colors, together with the dark purple disk, gave rise to the name "tricolor." The typical form, intro. into England from Morocco in 1798, was pictured in B.M. 508 (1799). By 1856 signs of doubling appeared (F.S. 11:1099). In 1858 shades of red in the rays appeared in a strain intro. by F. K. Burridge, of Colchester, England, and known as *C. Burridgeànum*, Hort. (see B.M. 5095, which shows a ring of red on the rays, adding a fourth color to this remarkably brilliant and varied fl., and F.S. 13:1313, which also shows *C. venùstum*, Hort., in which the rays are entirely red, except the original yellow circle at the base). G. 2:307. Gn.W. 24:675. *C. annulàtum*, Hort., is a name for the kinds with circular bands of red, maroon, or purple. R.H. 1869:450. *C. Dúnnetti*, Hort., is another seed-grower's strain. There are full double forms in yellow margined red, and white margined red, the fls. 3 in. across (see R.H. 1874:410), under many names. See, also, Gn. 26, p. 440; 10, p. 213; 21:22. R.H. 1874, p. 412. S.H. 2:477. G.W. 14, p. 99.—The commonest and gaudiest of annual chrysanthemums, distinguished by the keeled or ridged scales of involucre and the dark purple disk.

BB. *Rays typically light yellow.*

2. coronàrium, Linn. (*Ánthemis coronària*, Hort.), Annual, 3–4 ft.: lvs. bipinnately parted, somewhat clasping or eared at the base, glabrous, the segms. closer together than in *C. carinatum*: involucral scales broad, scarious; rays lemon-colored or nearly white. July–Sept. Medit. Gn. 26:440. G.C. II. 19:541.—The full double forms, with rays reflexed and imbricated, are more popular than the single forms. This and *C. carinatum* are the common "summer chrysanthemums." This is common in old gardens, and is also somewhat used for bedding and for pot culture.

BBB. *Rays typically golden yellow.*

3. ségetum, Linn. Corn Marigold. Annual, 1–1½ ft.: lvs. sparse, clasping, oblong to oblanceolate, variable, the lower petioled and the upper clasping, incisions coarse or fine, deep or shallow, but usually only coarsely serrate, with few and distant teeth, the lower ones less cut: bracts of involucre broad, obtuse; rays obovate and emarginate, golden yellow. June–Aug. Eu., N. Afr., W. Asia. Escaped in waste places. Gn. 18, p. 195. R.H. 1895, pp. 448, 449. Var. **grandiflòrum,** Hort., is a larger-fld. form of this weed, which is com-

mon in the English grain fields. Forms of the plant are cult.; the var. Cloth of Gold, J.H. III. 12:445, is one of the best. Var. **pùmilum,** Hort., very compact, 8 in. high. This species is much less popular than *P. carinatum* and *P. coronarium.* It is forced to a slight extent for winter bloom.

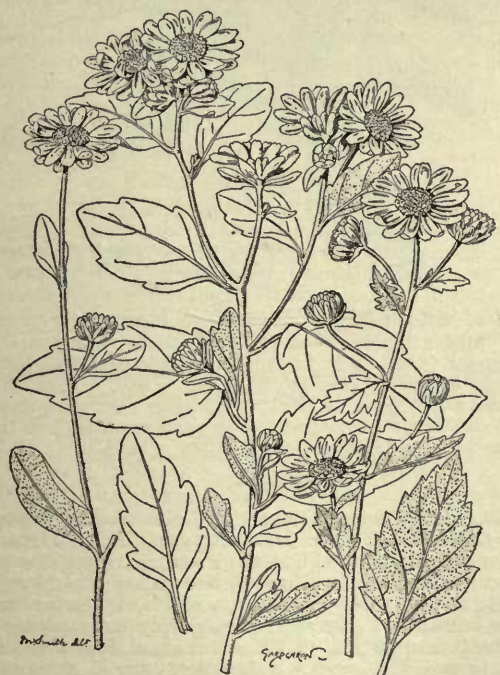
4. **multicaûle,** Desf. Glabrous and glaucous annual, 6–12 in. high: sts. numerous, simple or branched, stout, terete: lvs. fleshy, variable, usually linear-spatulate, 1–3 in. long and ½–¾in. broad, very coarsely toothed or lobed, sometimes shorter, with few narrow-linear, acute, entire segms. about 1 line broad: rays much shorter and rounder than in *C. segetum,* golden yellow. Algeria. B.M. 6930.—Rarer in cult. than the last. Said to be useless as a cut-fl.

AA. *Plant perennial.*

B. *The florist's chrysanthemum, and wild progenitors or near relatives, grown as pot or bench subjects because the seasons are not long enough, in the N., for full maturity in the open: rays of many forms and colors in cult.; heads often double: lvs. usually lobed or strongly notched.*

5. **morifòlium,** Ram. (*C. sinénse,* Sabine). Fig. 928. Perennial, one of the sources (with *C. indicum*) of the large florist's chrysanthemums: wild plant shrubby, erect and rigid, 2–3 ft., branching, few-lvd.: lvs. thick and stiff, 2 in. long, densely white-tomentose beneath, variable in shape from ovate to lanceolate, cuneate at base, margin entire or coarsely toothed: outer bracts of involucre thick, linear, acute, white-tomentose; fl.-heads small, with yellow disk and white rays somewhat exceeding the disk. China. G.C. III. 31:302 (adapted in Fig. 928). Var. **grâcile,** Hemsl. Lvs. thin or only moderately thick, palmately lobed or pinnately lobed, dentate, the teeth often mucronate: outer involucral bracts herbaceous, linear and acute, varying in pubescence; rays white, pink or lilac, equaling or exceeding the disk. China, Mongolia, Japan.

6. **índicum,** Linn. Fig. 929. Much like the last, but lvs. thin and flaccid, pinnately parted, with acute or



928. Wild form of Chrysanthemum morifolium, as grown in England.



929. Wild form of Chrysanthemum indicum, as grown in England.

mucronate teeth: outer involucral bracts broad and scarious except the herbaceous midnerve; rays yellow, shorter than diam. of the disk. China and Japan. B.M. 7874. G.C. III. 8:565; 28:342; 31:303 (adapted in Fig. 929).—This species is not native to India, and therefore Linnæus' name is inappropriate. Abroad, *C. indicum* is often used in a wide sense, to include *C. morifolium.* In recent years, both *C. morifolium* and *C. indicum* have been grown in England from wild stock, and from such studies of them the present descriptions and figures are drawn. From these plants it is supposed, by endless variation and by hybridization, the highly developed glasshouse or florist's chrysanthemums have come, a group that may be distinguished as **C. hortòrum,** Figs. 938–50.

7. **ornàtum,** Hemsl. (*C. marginàtum,* Hort.). Allied to the above two species, and perhaps a form of *C. morifolium:* bushy plant, 3–4 ft.: lvs. palmately lobed, ovate in outline, white-tomentose beneath and on the margin, 1½–2 in. long: fl.-heads loosely corymbose, 2 in. or less across, the disk yellow and rays white and broad; bracts of involucre in about 3 series, all similar, white in center, purple-brown on margin: achenes small, oblique, glabrous. B.M. 7965. G.C. III. 35:51. Gn. 71, p. 53; 73, p. 90.—A recent introduction; grows well in the open in England, but does not bloom unless taken indoors.

BB. *The garden pyrethrums and others; heads usually not highly doubled and modified.*

C. *Lvs. cut to the midrib or nearly so.*

D. *Heads borne in corymbs, i.e., flat-topped, dense clusters.*

E. *Rays yellow.*

8. **achilleæfòlium,** DC. (*Achillèa aùrea,* Lam.). Perennial, 2 ft.: st. usually unbranched, except along the creeping and rooting base: sts. and lvs. covered with fine soft grayish white hairs, oblong in outline, about 1 in. long, ¼in. wide, finely cut: rays 7–8, short, a little longer than the involucre. Siberia, Caucasus.—Rare in cult. Less popular than the achilleas, with larger fl.-clusters.

EE. *Rays white.*

9. **corymbòsum,** Linn. (*Pyrèthrum corymbòsum,* Willd.). Robust perennial, 1–4 ft.: st. branched at the apex: lvs. sometimes 6 in. long, 3 in. wide, widest at middle and tapering both ways, cut to the very midrib, the segms. alternating along the midrib. Eu., N. Afr., Caucasus. G.C. II. 20:201.—Rare in cult. Segms. may be coarsely or finely cut, and lvs. glabrous or villous beneath.

10. **Parthènium,** Pers. (*Pyrèthrum Parthènium,* Smith. *Parthènium Matricària,* Gueld.). FEVERFEW. Fig. 930. Glabrous strong-scented perennial, 1–3 ft., much branched in the taller forms: lvs. ovate or oblong-ovate in outline, pinnatisect or bi-pinnatisect, smooth or lightly pubescent; segms. oblong or elliptic-oblong, pinnatifid or cut, the uppermost more or less confluent.: fl.-heads small, many, stalked, corymbose; disk yellow; rays white, oblong, equaling or exceeding the disk. Eu. to the Caucasus.—Some authors regard this as one widely variable species; others make at least two species, one of them (*C. præaltum,* Vent.) being the Caucasian form, distinguished by more deeply cut lvs., longer-peduncled heads, and rays longer than the disk rather than equaling it (as in *C. Parthenium* type).—There are double-fld. and also discoid forms. Var. **aùreum,** Hort. (*P. aùreum,* Hort.), is the GOLDEN FEATHER commonly used for carpet-bedding. It has yellow foliage, which becomes green later in the season, especially if fls. are allowed to form. It is used for edgings and cover. Var. **aùreum crìspum,** Hort., is dwarf, compact, with foliage curled like parsley. Var. **selaginoìdes,** and var. **laciniàtum,** Hort., are distinct horticultural forms. Var. **glaùcum,** Hort., has dusty white foliage, and does not bloom until the second year. Intro. by Damman & Co., 1895. All these varieties are prop. by seeds. The feverfew is common about old yards, and is much employed in home gardens as edging. In its undeveloped and prevailing forms, it is one of the "old-fashioned" plants.



930. Chrysanthemum Parthenium. Feverfew. (×½)

DD. *Heads borne singly on the branches or sts. (or at least not definitely clustered).*

E. *Height less than 1 ft.*

11. **Tchihátchewii,** Hort. (*C. Tchihátcheffii,* Hort.). TURFING DAISY. Densely tufted perennial for carpeting dry, waste places; height 2–9 in.: sts. very numerous, rooting at the base: foliage handsome dark green, finely cut, the segms. linear, persisting into winter: fl.-heads solitary on axillary peduncles, borne profusely for several weeks; rays white, disk yellow. Asia Minor. R.H. 1869, p. 380, desc., and 1897, p. 470. Gn. 26, p. 443.—Prop. by division of roots or simply by cutting the rooted sts., but chiefly by seeds. Highly recommended abroad for spring and early summer bloom in edgings and low formal plantings. Said to thrive in dry places and under trees.

EE. *Height more than 1 ft.*

F. *Group of greenhouse plants (at the N.), shrubby at the base: sts branched at the top: rays white or lemon.*

G. *Foliage not glaucous.*

12. **frutéscens,** Linn. MARGUERITE. PARIS DAISY. Figs. 931, 932. Usually glabrous, 3 ft. high, perennial: lvs. fleshy, green: heads numerous, always single; rays typically white, with a lemon-colored (never pure yellow or golden) form. Canaries. G.C. II. 13:561; III. 35:216. Gn. 12, p. 255; 17, p. 5; 26, p. 445; 70, p. 310. —Intro. into England. 1699. This is the popular florists' Marguerite, which can be had in flower the year round, but is especially grown for winter bloom. Var. **grandiflòrum,** Hort., is the large-fld. prevailing form. The lemon-colored form seems to have originated about 1880. Under this name an entirely distinct species has also been passing, yet it has never been advertised separately in the American trade. See No. 13.



931. Chrysanthemum frutescens. The Marguerite or Paris daisy. (×½)

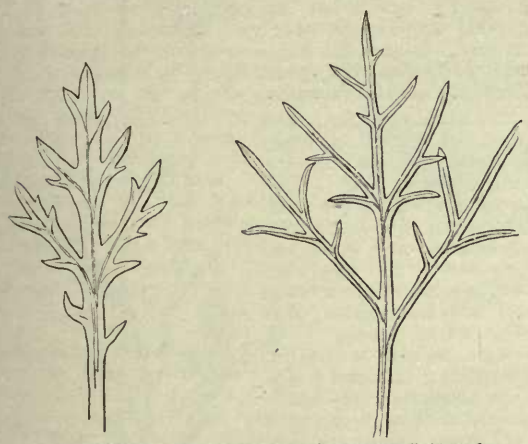
GG. *Foliage glaucous.*

13. **anethifòlium,** Brouss. (*C. fœniculàceum,* Steud. *P. fœniculàceum* var. *bipinnatífidum,* DC.). GLAUCOUS MARGUERITE. Fig. 932. Perennial: rarer in cult. than *C. frutescens* (which see), but distinguished by its glaucous hue, and by the way in which the lvs. are cut. The segms. are narrower, more deeply cut, and more distant than in No. 12. The lvs. are shorter petioled. Canaries.—This species is doubtless cult. in American greenhouses as *C. frutescens.* A lemon-fld. form is shown in R.H. 1845:61 but called *C. frutescens.*

FF. *Group of hardy outdoor herbs: sts. usually unbranched: rays white or red, never yellow.*

G. *Foliage not glaucous: fls. sometimes double.*

14. **coccíneum,** Willd. (*Pyrèthrum ròseum,* Bieb., not Web. & Mohr. *P. hýbridum,* Hort.). Fig. 933. Glabrous perennial, 1–2 ft. high: st. usually unbranched,



932. Leaves of Chrysanthemum frutescens (left) and C. anethifolium (right). (×1)

rarely branched at the top: lvs. thin, dark green, or in dried specimens dark brown: involucral scales with a brown margin; rays white or red in such shades as pink, carmine, rose, lilac, and crimson, and sometimes tipped yellow, but never wholly yellow. Caucasus, Persia. F.S. 9:917. Gn. 26, pp. 440, 443. Gng. 2:7; 5:309. R.H. 1897, p. 521. Not B.M. 1080, which is *C coronopifolium.* The first picture of a full double form is R. H. 1864:71.—This species is the most important and variable of all the hardy herbaceous kinds. There have been perhaps 700 named horticultural varieties. There is an anemone-fld. form with a high disk. The species is also cult. in Calif. and France for insect powder. *C. atrosanguíneum,* Hort., is said to be a good horticultural variety with dark crimson fls. The *C. roseum* of Weber & Mohr being a tenable name, Hoffmann proposes Ascherson's name, *C. Marschallii,* for the *P. roseum* of Bieberstein; but Willdenow's *C. coccineum* is here retained.

GG. *Foliage glaucous: fls. never double.*

15. **cinerariæfòlium,** Vis. Glaucous perennial, slender, 12–15 in. high: sts. unbranched, with a few short, scattered hairs below the fl.: lvs. long-petioled, silky beneath, with distant segms.: involucral scales scarious and whitish at the apex. Dalmatia. B.M. 6781.—Said to be chief source of Dalmatian insect powder. Rarely cult. as border plant. Common in botanic gardens.

CC. *Lvs. not cut to the midrib, pinnatifid or coarsely toothed (except perhaps in No. 22).*

D. *Heads borne in clusters, mostly flat-topped*

16. **Balsámita,** Linn. (*Tanacètum Balsámita,* Linn. *Pyrèthrum Balsámita,* Willd. *Balsámita vulgàris,* Willd.). Costmary. Mint Geranium. Sometimes erroneously called "lavender," from its sweet agreeable odor. Tall and stout perennial: lvs. sweet-scented, oval or oblong, obtuse, margined with blunt or sharp teeth, lower ones petioled, upper ones almost sessile, the largest lvs. 5–11 in. long, 1½–2 in. wide: pappus a short crown. W. Asia.—Typically with short white rays, but when they are absent the plant is var. **tanacetoides,** Boiss. Fig. 934. Rayless. This has escaped in a few places from old gardens: it seems to be the prevailing garden form.

DD. *Heads borne singly on the branches or sts., or at least not in definite clusters; rays large, white.*

17. **lacústre,** Brot. (*C. latifòlium,* DC.). Fig. 935. Perennial; endlessly confused with *C. maximum* in gardens, and the two species are very variable and difficult to distinguish; the fls. can hardly be told apart. *C. lacustre* is a taller and more vigorous plant, and sometimes it is branched at the top, bearing 3 heads, while *C. maximum* is always 1-headed, and the lvs. in that species are much narrower. Height 3–6 ft.: st. sparsely branched: lvs. partly clasping, ovate-lanceolate, with coarse, hard teeth: rays about 1 in. long; pappus of the ray 2–3-eared. Portugal, along rivers, swamps and lakes. R.H. 1857, p. 456.

18. **máximum,** Ramond. Fig. 936. This perennial species has narrower lvs. than *C. lacustre,* and they are narrowed at the base: height 1 ft.: st. more angled than the above, simple or branched at the very base, always 1-headed and leafless for 3–4 in. below the head: lower lvs. petioled, wedge-shaped at the base, or long-oblanceolate; the upper lvs. becoming few, lanceolate but usually not very prominently pointed, the teeth not very large or striking: pappus none: involucral scales narrower and longer, whitish-transparent at the margin, while those of *C. lacustre* are broader, more rounded at the apex, and with a light brown scarious margin. Pyrenees. J.H. III. 5:251. Gn. 26, p. 437; 73, p. 567. G. 5:445. G.M. 46:676. Var. **Róbinsonii,** Hort., has finely cut or fringed rays, giving the bloom the appearance of a Japanese chrysanthemum. R. H. 1904:515. Var. **Dàvidsii,** Hort., has sts. of great length, suitable for cutting. Var. **filifórme,** Hort., has deeply serrate long and drooping rays. There are many other forms, differing in time of bloom as well as in habit and in form of fl. The **Shasta daisy** (said to be a

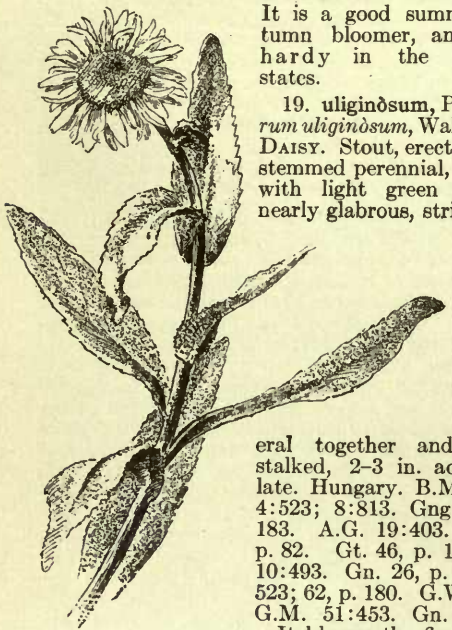


933. Chrysanthemum coccineum. The Pyrethrum roseum of gardens. (×½)



934. Chrysanthemum Balsamita var. tanacetoides. Costmary or mint geranium. (×½)

hybrid) is an early-flowering very floriferous race, with several strains of fls., mostly large and pure white, although in one form the buds are reported as lemon-yellow but opening white; various sub-varieties are now offered. It is a good summer and autumn bloomer, and usually hardy in the northeastern states.



935. Chrysanthemum lacustre. A short-rayed form. (×⅓)

19. **uliginòsum,** Pers. (*Pyrèthrum uliginòsum,* Waldst.). GIANT DAISY. Stout, erect bushy leafy-stemmed perennial, 4–7 ft. high, with light green foliage: st. nearly glabrous, striate, branching above, roughish: lvs. long-lanceolate, prominently pointed, with large coarse sharp teeth: heads often several together and not long-stalked, 2–3 in. across, white, late. Hungary. B.M. 2706. A.F. 4:523; 8:813. Gng. 2:375; 5: 183. A.G. 19:403. R.H. 1894, p. 82. Gt. 46, p. 103. G.C.II. 10:493. Gn. 26, p. 442; 38, p. 523; 62, p. 180. G.W.15, p. 316. G.M. 51:453. Gn. W. 23:415. —It blooms the first year from seed or division, and has been forced for Easter somewhat as *Hydrangea paniculata* can be treated. Excellent for cut-fls. The blossoms should be cut soon after opening, as the disks darken with age. The plant needs a rich moist soil; it deserves a greater popularity.

20. **Leucánthemum,** Linn. (*Leucánthemum vulgàre,* Lam.). WHITEWEED. OX-EYE DAISY. Fig. 937. Glabrous perennial erect weed, 1–2 ft. high: root-lvs. long-petioled, with a large, oval blade and coarse, rounded notches; st.-lvs. lanceolate, becoming narrower toward the top, serrate, with few distant and sharper teeth. (Var. *pinnatifidum,* Lec. & Lam., has more divided lvs.): heads terminal, showy white. June, July. Eu., N. Asia. Gn. 70, p. 176. —One of the commonest weeds in the eastern states, being characteristic of worn-out meadows. The daisies are not cult., but they are often gathered for decoration, and make excellent cut-fls. The plant is very variable, and forms adapted to fl.-garden uses will probably be developed. Rayless plants are sometimes found.

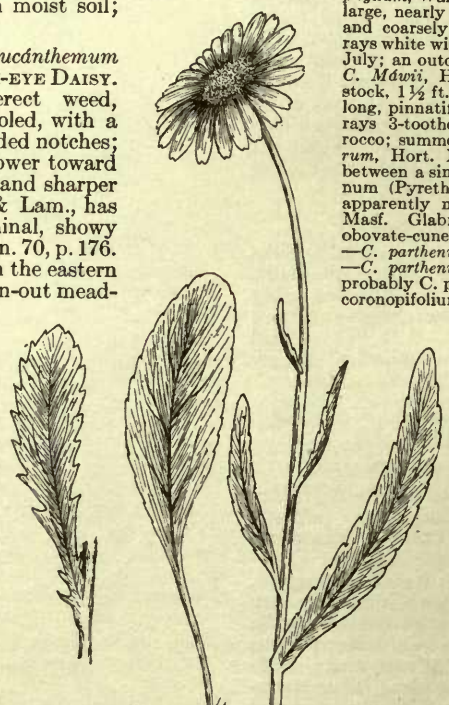
21. **nippónicum,** Hort. (*Leucánthemum nippónicum,* Franch.). Differs from others of this set in being shrubby at base and lvs. broadest above the middle: to 2 ft., the sts. strong, simple, few-fld.: lvs. thick, oblong-spatulate to oblanceolate, sessile, irregularly denticulate but entire at base, 3–4 in. long, pale beneath: fl.-heads 2–3½ in. across, with a hemispherical involucre of oval obtuse bracts; rays bright white, linear, minutely 5-toothed; disk pale greenish yellow. Japan. B.M. 7660. R.H. 1905, p. 47. F. E. 20: 434.—Hardy in the N., in the root, but the sts. killed down by frost; has the general appearance of *C. lacustre.* A beautiful large-fld. species, producing its large blooms in late autumn.

22. **árcticum,** Linn. Low perennial, 3–15 in., glabrous or nearly so: lvs. cuneate, long-tapering at base, toothed or cut at the apex, sometimes 3–5-lobed, the uppermost ones small and very narrow and nearly entire: involucre-bracts broad and brown-margined; rays clear white, about 1 in. long: pappus wanting. Arctic Eu., Asia and Amer. —An attractive very hardy species, making a clump of dark green foliage and producing in autumn many large white fls., sometimes tinged lilac or rose.



937. Chrysanthemum Leucanthemum. Ox-eye daisy, or whiteweed. (×½)

C. coronopifòlium, Willd. = C. roseum. — *C. grânde,* Hook. f. (Plagius grandiflorus, L'Her.). Stout erect perennial of Algeria, 2–3 ft.: lvs. oblong to linear-oblong, often lyrate, coarsely toothed: fl.-heads large, solitary, rayless, golden yellow, to 2 in. across. B.M. 7886.—*C. grandiflòrum,* Willd. Shrubby, smooth, from the Canaries, with cuneate lobed lvs., the parts lanceolate or linear and toothed or entire: fl.-heads solitary, the rays white and disk yellow: allied to C. frutescens; variable.—*C. inodòrum,* Linn. = Matricaria inodora.—*C. macrophýllum,* Waldst. & Kit. Perennial herb, 3 ft.: lvs. very large, nearly sessile, pinnatisect, the lobes lanceolate and coarsely toothed: heads very many, corymbed; rays white with yellowish tinge, the disk yellow. June, July; an outdoor plant. Hungary. G.W. 12, p. 410.—*C. Mâwii,* Hook. f. Herbaceous, with woody root-stock, 1½ ft.: lvs. about 1 in. long, triangular to oblong, pinnatifid: fl.-heads 1½ in. diam., long-stalked; rays 3-toothed, white with reddish backs. Mts. Morocco; summer in the open. B.M. 5997.—*C. multiflòrum,* Hort. Fls. greenish white: said to be a cross between a single-fld. chrysanthemum and C. Pallasianum (Pyrethrum Pallasianum, Maxim., of N. Asia, apparently not a garden species).—*C. ochroleùcum,* Masf. Glabrous undershrub of the Canaries: lvs. obovate-cuneate, coarsely toothed: rays pale yellow. —*C. parthenifòlium,* Willd., a form of C. Parthenium. —*C. partheniòdes,* Voss. One of the feverfew forms; probably C. præaltum.—*C. rôseum,* Web. & Mohr. (C. coronopifolium, Willd., not Vill.), not Bieb. Perennial herb, 2½ ft.: lvs. once-pinnate: fl.-heads solitary; rays rose-red or flesh-color. Caucasus.—*C. tomentòsum,* Loisel. An alpine Corsican species: tufted, 2 in. high when in bloom: lvs. pinnatifid, densely tomentose: fl.-heads ¾ in. across, white-rayed, on sts. 1 in. long.—*C. viscòsum,* Desf. Annual: disk orange-yellow, rays sulfur-yellow. Medit.—*C. vulgàre,* Bernh. = Tanacetum vulgare. —*C. Zawádskii,* Herbich, of Gallicia, is a tufted plant with rose-tinted fls. all summer.



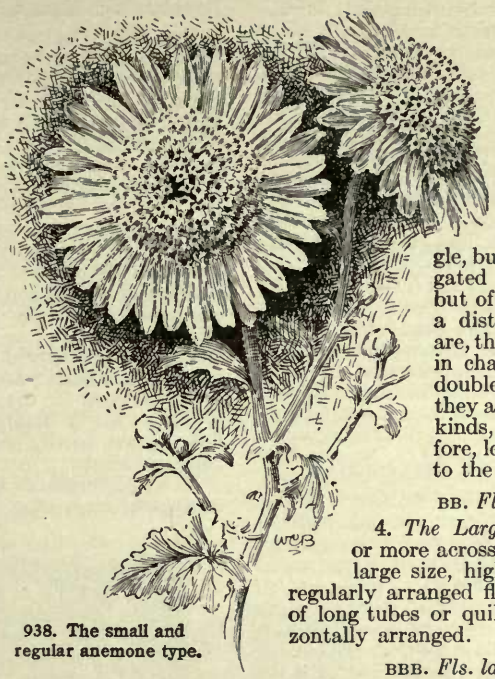
936. Chrysanthemum maximum. (×⅓)

WILHELM MILLER.
L. H. B.†

Types of the common chrysanthemum.

The common chrysanthemums of the florists (*C. hortorum*) are often called "large-flowering," and "autumn chrysanthemums," to distinguish them from the hardy outdoor kinds, although

neither of these popular names is entirely accurate or distinctive. They are the blended product of *C. indicum* and *C. morifolium*, two species of plants that grow wild in China and Japan. The outdoor or hardy chrysanthemums are derived from the same species, being less developed forms. The florist's chrysanthemum is not necessarily a glasshouse subject; but it is bloomed under glass for protection and to secure a longer season. Ten to fifteen dominant types of chrysanthemums have been recognized by the National Chrysanthemum Society of England. The words "types," "races," and "sections," have always been used by horticulturists to express much the same thing, but types can always be defined clearly, while sections cannot, and the word race should be restricted to cultivated varieties that reproduce their character by seed, which is not the case with the large-flowering chrysanthemums. The following explanation and scheme, it is hoped, will clearly set forth the main types, and explain some of the many terms that confuse the beginner. The horticultural sections are wholly arbitrary, being chiefly for the convenience of competitors at exhibitions, and therefore changing with the fashions. The present classification is based on the form of the flower, as each type can be had in any color found in the whole genus.



938. The small and regular anemone type.

A. *Single forms: rays in 1 series, or few series: disk low and flat.*

1. *The Small Single Type.*—Fig. 950. Fls. about 2 in. across, star-like, i. e., with the rays arranged in one series around the yellow disk. "Single," however, is a relative term, and in Fig. 950 there is more than one series of rays, but this does not destroy the "singleness" of effect. All fls. are either single, semi-double, or double, but all the intermediate forms between the two extremes of singleness and doubleness tend to disappear, as they are not desired.



939. Japanese anemone chrysanthemum when fully expanded.

2. *The Large Single Type.*—Like the preceding, but the fls. 4 in. or more across, and fewer. The large and small single types are practically never grown outdoors and are best suited for pot culture, each specimen bearing 20–80 fls. They are also grown by florists in considerable quantity for cutting.

AA. *Anemone-fld. forms: rays as in* A: *disk high and rounded.*

B. *Fls. (florets) small, numerous, regular.*

3. *The Small Anemone Type.*—Commonly called "Pompon Anemone." Fig. 938. Fls. 2–3 in. across, and usually more numerous than in the large anemone type. All the anemone forms are essentially single, but the raised disk, with its elongated tubular fls., usually yellow but often of other colors, gives them a distinct artistic effect, and they are, therefore, treated as intermediates in character between the single and double forms. Like the single forms, they are less popular than the double kinds, and the varieties are, therefore, less numerous and more subject to the caprices of fashion.

BB. *Fls. large, fewer, regular.*

4. *The Large Anemone Type.*—Fls. 4 in or more across and fewer. Heads must have large size, high neatly formed centers, and regularly arranged florets, the disk being composed of long tubes or quills and the rays flat and horizontally arranged.

BBB. *Fls. large, few, irregular.*

5. *The Japanese Anemone Type.*—Fig. 939. Fls. 4 in. or more across, and irregular in outline; fantastic and extreme anemone forms.

AAA. *Double-fld. forms: rays in many series: disk absent or nearly so.*

B. *Fls. small; rays short.*

6. *The Pompon Type.*—Figs. 940, 949. Fls. 1–2 in. across. The outdoor kinds are likely to be small, flat and buttonlike, while those cult. indoors are usually larger and nearly globular. Fig. 940 shows the former condition. It is from one of the old hardy kinds long cult. in the gardens as "Chinese" or "small-flowered" chrysanthemums, and commonly supposed to be the product of *C. indicum*, as opposed to the "Japanese" or "large-flowered" kinds intro. in 1862, which marked a new era by being less formal and more fanciful than any of the preceding kinds. Pompons are little cult. under glass in Amer., being regarded mostly as outdoor subjects.

BB. *Fls. large.*

C. *Blossoms hairy.*

7. *The Hairy Type.*—Fig. 941. Also called "Ostrich Plume" and "Japanese Hairy." The famous prototype is the variety Mrs. Alpheus Hardy, pictured in Gn. 35, p. 307, which was sold for $1,500 in 1888, and started the American chrysanthemum craze. White fls. with long hairs are very delicate and pretty, but the hairs are often minute, and on many of the colored fls. they are



940. Type of pompon chrysanthemum. Grown outdoors, with no special care.

considered more curious and interesting than beautiful. So far, nearly all hairy chrysanthemums are of the Japanese Incurved type. Since the hairs are on the backs of the florets, they show best in incurved types.



941. Hairy type.

CC. *Blossoms not hairy.*

D. *Rays reflexed.*

8. *The Reflexed Type.*—Also called "Recurved." Fig. 942. The reflexed forms can be easily broken up into 3 types. (*a*) the small and regular, (*b*) the large and regular, and (*c*) the large and irregular types. The latest standard requires that reflexed flowers have hemispheroidal heads, with no trace of thinness in the center, and broad overlapping florets.

DD. *Rays incurved.*

E. *Form absolutely regular.*

9. *The Incurved Type.*—Fig. 943 shows the general idea, but such a fl. would hardly win a prize at an English show, where anything short of absolute regularity is relegated to the "Japanese Incurved" section (No. 10). This form is by far the most clear-cut ideal of any of these types, and for many years this ideal of the florists so completely dominated the English chrysanthemum shows that the incurved section came to be known there as the "exhibition" or "show type." In America the Japanese types, which are less formal and fanciful, early prevailed, but in England this has been the most important section of all.

EE. *Form more or less irregular.*

10. *The Japanese Incurved Type.*—This section and the next have been the most important in America. There are many variations of this type. It often happens that the outer 4 or 5 series of rays gradually become reflexed, but if most of the rays are incurved, the variety may be exhibited in this section. Fig. 943.

DDD. *Rays of various shapes: forms diverse.*

11. *The Japanese Types.*—The word "Japanese" was originally used to designate the large-fld. fantastic kinds, intro. by Robert Fortune from Japan in 1862. It has never been restricted to varieties imported directly from Japan, but has always included seedlings raised in the western world. Before 1862, all florists' fls. in England were relatively formal and small. The informal, loose, grotesque, Japanese chrysanthemums, intro. by Fortune broke up the conventional era, and the demand for large specimen blooms that resulted in fl.-shows all over the world reached Amer. in 1889. The "Japanese section" now means little more than "Miscellaneous." The 10 types previously mentioned can be rather accurately defined, but the Japanese section is purposely left undefined to include everything else. All the tubular and quilled sorts are now included in it, although formerly kept distinct.

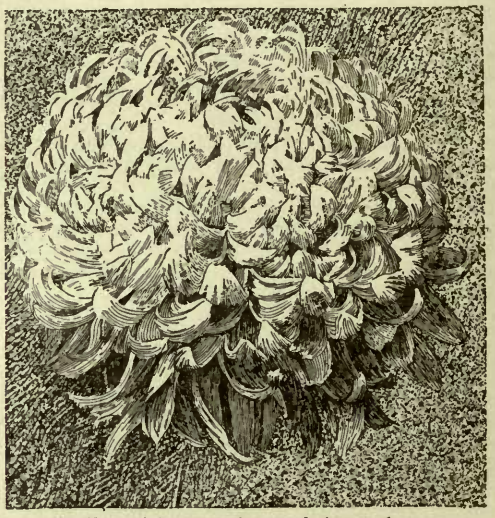


942. Reflexed type.

Relative importance and uses of the foregoing types.—

In general, the large-flowered forms are more popular than the small-flowered forms, especially at exhibitions, where great size is often the greatest factor in prize-winning. Types 9, 10 and 11 are the most important in America, especially the Japanese section. The flowers of types 9 and 10 are likely to be more compact and globular, and hence better for long shipments than the looser and more fanciful types. Types 9, 10 and 11 are those to which most care is given, especially in disbudding and training. They are the ones most commonly grown by the florists for cut-flowers, and whenever one large flower on a long stem is desired. The anemone-flowered forms are all usually considered as curiosities, especially the Japanese anemones, which are often exhibited as freaks and oddities. The single and anemone-flowered forms are used chiefly for specimens in pots with many small flowers, but all the other types are used for the same purpose. For outdoor culture, the hardy pompons, with their numerous small flowers, are usually better than the large-flowering or Japanese kinds.

As an indication of the constant change in standards of appreciation, may be cited the present popularity



943. Type of Japanese incurved chrysanthemum.

of short-stemmed chrysanthemums (Fig. 944) as distinguished from the greatly elongated stem that was exclusively desired some years ago; and also the demand for bushy many-flowered plants, producing small bloom as compared with the former excessively large detached flowers.

The current English classification.

The Floral Committee of the National Chrysanthemum Society (of England) in 1912 published the following "new classification of Chrysanthemums" (published also in American Florist, Sept. 21, 1912, by Elmer D. Smith):

SECTION I. INCURVED (Fig. 945).

The distinguishing characteristics of this section are the globular form and regular outline of the blooms. The flower should be as nearly a globe as possible, as depth is an important point in estimating its value. The florets ought to be smooth, rounded, or somewhat pointed at the tip, of sufficient length to form a graceful curve, and be regularly arranged. A hollow center or prominent eye are serious defects, as also are a roughness in the blooms, unevenness of outline and a want of freshness in the outer florets.

The section is now subdivided into:

Sub-section (*a*).—Large-flowered varieties.

Sub-section (*b*).—Medium- and small-flowered varieties.



944. New type with short stem, which is becoming very popular with commercial growers.

Section II. Japanese (Fig. 946).

Japanese varieties include a wide range of form, size and color. Their florets may be either flat, fluted, quilled or tubulated, of varying length, from short, straight, spreading florets, to long, drooping, twisted or irregularly incurved. In breadth the florets may vary greatly, ranging from those an inch in width to others scarcely broader than a stout thread. Some also either have the tips of the florets cupped, hollowed, curved or reflexed.

Sub-section I. Japanese.
- (*a*) Large-flowered varieties.
- (*b*) Medium-flowered varieties.
- (*c*) Small-flowered varieties.

Sub-section II. Incurved Japanese.
- (*a*) Large-flowered varieties.
- (*b*) Medium- and small-flowered.

Sub-section III. Hairy Japanese.

Reflexed section to be deleted as these varieties are now referred to other sections.

Section III. Anemones (Figs. 947 and 948; also Figs. 938, 939).

The distinctive characteristics of anemone varieties are their high, neatly formed centers and regularly arranged ray-florets. There are two distinct sets of florets, one quilled and forming the center or disk, and the other flat and more or less horizontally arranged, forming the border or ray. The flowers may have the ray or guard florets broad or twisted, or narrow, and forming a fringe, but should be so regularly arranged as to form a circle round the center, the latter should be a hemispheroidal disk, with no trace of hollowness and every floret in its place.
- (*a*) Large-flowered, i. e., with a diameter of 3 inches and upwards.
- (*b*) Small-flowered, i. e., with a diameter of less than 3 inches.

Section IV. Pompons (Fig. 949; also Fig. 940).

Pompon varieties have blooms that may be somewhat flat or nearly globular, very neat and compact, formed of short, flat, fluted or quilled florets, regularly spreading or erect, the florets of each bloom being of one character.
- (*a*) Large-flowered, i. e., with a diameter of 2 inches and upwards.
- (*b*) Small-flowered, i. e., with a diameter of less than 2 inches.

Section V. Singles (Fig. 950).

Single varieties may be of any size and form; but the florets, whether short and rigid or long and drooping, should be arranged sufficiently close together to form a regular fringe.

Sub-section I. Varieties with one or two rows of ray florets.
- (*a*) Large-flowered, i. e., with a diameter of 3 inches and upwards.
- (*b*) Medium and small-flowered, i. e., with a diameter of less than 3 inches.

Sub-section II. Varieties with three to five rows of ray florets.
- (*a*) Large-flowered, i. e., with a diameter of 3 inches and upwards.
- (*b*) Medium and small-flowered, i. e., with a diameter of less than 3 inches.

Sub-section III. Anemone-centered varieties.



946. Japanese type.

Section VI. Spidery, Plumed and Feathery.

Varieties in this section have small or medium-sized flowers of eccentric shape, but most frequently of a light and graceful character; some have threadlike florets, and some have broader florets, but they may be either erect, horizontal or drooping and of various shapes and colors.

Market, Decorative and Early-flowering varieties will be deleted as such, but lists will be drawn up under each heading for general guidance.

Wilhelm Miller.



945. Incurved type.



947. Japanese anemone type.

Culture of the florist's chrysanthemum (C. hortorum)

The first step towards success in chrysanthemum-culture is good healthy cuttings, and as they become established plants they should receive generous culture throughout their entire growing season. This requires close attention to watering, airing, repotting, and a liberal supply of nutriment.

Chrysanthemums are propagated in four ways,—by cuttings, division, seeds, and grafting. By far the most important is the first, because it is the most rapid. It is the method of the florists. In localities in which the plants can remain outdoors over winter without injury, they may be increased by division. This system is practised more by amateurs than florists, being the easiest method for the home garden but not rapid enough for the florist. Propagation by seeds is employed only to produce new varieties, and is discussed at length elsewhere (page 764). Grafting is seldom practised. Skilful gardeners sometimes graft a dozen or more varieties on a large plant, and the sight of many different colored fls. on the same plant is always interesting at exhibitions.

Section I.—Culture of chrysanthemums for cut-flowers.

This account is intended to describe the method chiefly employed by florists, the plants being grown in benches under glass.

1. *Propagation by cuttings.*—Plants of the preceding year afford stock from which to propagate the following season. They produce quantities of stools or suckers, which form excellent material for the cuttings. These are usually taken from 1½ to 3 inches in length, the lower leaves removed, also the tips of the broad leaves, then placed in propagating-beds close together, where they are kept continually wet until rooted. To insure a large percentage, the condition of the cuttings should be moderately soft. If the stock plants are allowed to become excessively dry, the cuttings are likely to harden, and thus be very slow in producing roots. Single-eye cuttings may be used of new and scarce varieties when necessary. These are fastened to a tooth-pick with fine stemming wire, allowing half of the tooth-pick to extend below the end of the



948. Pompon anemone type.

cutting, and when inserted in the cutting-bed the end of the cutting should rest upon the sand. It requires more time to produce good plants by this system than when fair-sized cuttings can be taken, but it is often of service when stock is limited. The propagating-house should be well aired, and it is advisable to change the sand after the second or third batch of cuttings has been removed, to avoid what is termed cutting-bench fungus. The cuttings should never be allowed to wilt, and this is avoided by giving abundance of air, and when the temperature reaches over 70° from sun heat, by shading with some material, either cloth or paper. Fig. 951 shows a good form of chrysanthemum cutting.



949. A pompon chrysanthemum. (×⅛)

2. *Planting.*—Cuttings should not be allowed to remain in the cutting-bench after the roots are ½ inch in length, or they will become hardened, which will check the growth. As soon as rooted, they should be potted into 2- or 2½-inch pots, using good mellow soil, with a slight admixture of decomposed manure. Most of the large flowers are produced under glass, and the bench system is generally employed, which consists of 4 or 5 inches of soil placed upon benches. In these benches the small plants are planted 8 to 12 inches apart each way, from the latter part of May to the middle of July. Those planted at the first date usually give the best results. The soil should be pounded rather firm either before planting or after the plants have become established.

3. *Soil.*—There are many ideas as to what soil is best suited for the chrysanthemum, but good blooms may be grown on clay or light sandy loam, provided the cultivator is a close observer and considers the condition of the soil in which they are growing. Clay soil, being more retentive of moisture, will require less water and feeding than soil of a more porous nature. The chrysanthemum is a gross feeder, and, therefore, the fertility of the soil is very important in the production of fine blooms. Each expert has a way of his own in preparing the soil, but as equally good results have been secured under varied conditions, it is safe to conclude that the method of preparing the soil has little to do with the results, provided there is sufficient food within their reach. All concede that fresh-cut sod, piled late the preceding fall or in early spring, with one-fourth to one-fifth its bulk of half-decomposed manure, forms an excellent compost. Many use 1 or 2 inches of manure as a mulch after the plants have become established. Others place an inch of half-decomposed manure in the bottom of the bench. This the roots find as soon as they require it. Good blooms have been grown by planting on decomposed sod and relying on liquid applications of chemicals.

4. *Feeding.*—No definite rule can be given for this work, as so much depends on the amount of food incorporated in the soil. If the soil be very rich, the liquid applications should be only occasional and very dilute. There is more danger of overfeeding by the use of liquids than by using excessively rich soil. Each grower must depend on his own judgment as to the requirements, being guided by the appearance of the plants. When the leaves become dark-colored and very brittle, it is safe to consider that the limit in feeding has been reached. Some varieties refuse to bud when overfed, making a mass of leaves instead. Others show very contorted petals, giving a rough unfinished bloom. Still others, particularly the red varieties, are likely to be ruined by decomposition of the petals, called "burning," especially if the atmosphere is allowed to become hot and stuffy. The same result will follow in dark weather, or when the nights become cool, if the moisture of the house is allowed to fall upon the blooms. Under such conditions, the ventilation should remain on during the night, or heat be turned in according to the outside temperature.



950. Single type.

5. *Watering and shading.*—Let the foliage be the index to watering. If it appears yellow and sickly, use less water, and see that the drainage is perfect. There is little danger of over-watering as long as the foliage is bright green. A little shading at planting time is not objectionable, but it should be removed as soon as the plants are established. It is often necessary to shade the pink and red flowers, if the weather continues bright for some time, to prevent their fading.

6. *Training.*—When the plants are 8 inches high, they should be tied either to stakes or to jute twine. In the former system, use one horizontal wire over each row, tying the stake to this after the bottom has been inserted into the ground. Two wires will be necessary when twine is used, one above the plants and the other a few inches above the soil to which the twine is fastened. From the first of August until the flowers are in color, all lateral growths should be removed as soon as they appear, allowing only the shoots intended for flowers to remain. The above remarks refer to the training of benched chrysanthemums as grown by florists for cut-flowers. Other kinds of training are described under Section II, pages 763–4.



951. One kind of chrysanthemum cutting.

7. *Disbudding.*—No special date can be given for this work, as much depends on the season and the earliness or lateness of the variety to be treated. Buds usually begin to form on the early sorts about August 15, or soon after, and some of the late varieties are not in condition before October 10. Golden Glow and Smith Advance among the large-flowering, and several of the early-flowering of the hardy varieties, are exceptions to the foregoing, as they will set buds in June and July that will develop very good blooms during the month of August and later. The advent of these kinds has advanced the flowering season four to six weeks. The object of removing the weak and small buds and retaining the best is to con-

centrate the whole energy of the plant and thereby increase the size of the flower.

There are two forms of buds, crowns and terminals. A crown bud (Fig. 952) is formed first, never coming with other flower-buds, and is provided with lateral growths which, if allowed to remain, will continue their growth and produce terminal buds later. Terminal buds come later, always in clusters (Fig. 954), are never associated with lateral growths, and terminate the plant's growth for that season. If the crown bud is to be saved, remove the lateral growths as shown by Figs. 952, 953, and the operation is complete. If the terminal bud is desired, remove the crown and allow one, two or three (according to the vigor of the plant) of the growths to remain. In a few weeks these will show a cluster of buds, and, when well advanced, it will be noticed that the largest is at the apex of the growth (the one saved, if perfect, as it usually is), and one at each of the leaf axils (see Fig. 955). The rejected buds are easiest and safest removed with the thumb and forefinger. Fig. 956. Should the bud appear to be one-sided or otherwise imperfect, remove it and retain the next best. In removing the buds, begin at the top and work down. By so doing there are buds in reserve, in case the best one should accidentally be broken, while if the reverse course were taken, and the best bud broken at the completion of the work, all the labor would be lost. A few hours' disbudding will teach the operator how far the buds should be advanced to disbud easily. Early and late in the day, when the growths are brittle, are the best times for the work. Some growers speak of first, second and third buds. The first is a crown, and usually appears on early-propagated plants from July 15 to August 15. If removed, the lateral growths push forward, forming another bud. In many cases in which the crowns are removed early, the next bud is not a terminal, but a second crown, which is termed the second bud. Remove this, and the third bud will be the terminal. Plants propagated in May and June usually give the second and third bud, not forming the typical crown. Those struck in July and planted late give the terminal only. Most of the best blooms are from second crown and terminal. Pink, bronze and red flowers from first crowns are much lighter in color than those from later buds. They are large, but very often abnormal to such an extent as to be decidedly inferior. This is doubtless due to the large amount of food utilized in their construction, owing to the long time consumed in development. The hot weather of September and October must have a detrimental effect upon the color.

Enemies.—Green aphis (*Aphis rufomaculata*) and the black aphis (*Macrosiphum sanboni*) are sometimes very troublesome. They may be controlled by spraying with "Black Leaf 40" tobacco extract, one part to 800 parts water with soap added. Fumigation with hydrocyanic acid gas is also widely practised by commercial growers. In moderately tight greenhouses, use one ounce potassium cyanide for each 3,500 cubic feet of space for all-night fumigation. For details, see *Fumigation*. Red Spider (*Tetranychus bimaculatus*) becomes injurious if neglected. It may be easily controlled by spraying with water, using much force and little water to avoid drenching the beds. The use of sulfur has also a beneficial effect.

Thrips. (See Carnation).

Leaf-tyer (*Phlyctænia ferrugalis*) is frequently very abundant in some parts of the country. It is essentially a greenhouse pest although it can live out-of-doors. The greenish whitish striped caterpillars, ¾inch in length when full grown, feed on the under side of the leaves which they roll or tie together. The moth is pale brownish with an expanse of about ¾inch. The leaf-tyer is most destructive during the summer months when the temperature is highest. It can be controlled by spraying with arsenate of lead. It is advisable to begin the work early in the season when the insects are less numerous and the plants are small. Care should be taken to hit the under surface of the leaves.

The tarnished plant-bug (*Lygus pratensis*) often injures the blossom buds by its feeding punctures. This causes wilting and blind growths. The bugs may be excluded from greenhouses with screens. Out-of-doors no satisfactory means of control has been devised. But it has been noticed that plants growing in partial shade are less subject to injury.

Grasshoppers are sometimes injurious. They may be controlled by the use of arsenate of lead or by hand-picking.



952. The crown bud.

Diseases.—Damping-off in the cutting-benches is not uncommon. See *Damping-off*, page 961. Rust (*Puccinia chrysanthemi*) is the only serious fungous disease of the chrysanthemum. It is characterized by the reddish brown pulverulent masses on the foliage consisting of the spores of the fungus. The disease is usually not destructive but may make the foliage unsightly. Any leaves appearing diseased should be removed promptly. In watering care should be taken not to wet the foliage, as moisture on the leaves allows new infections. Leaf-blight (Cylindrosporium) and leaf-spot (Septoria) occur on mature or languishing foliage and usually do little damage.

Section II.—Culture of chrysanthemums in pots.

The same principles are employed in pot culture as when planted upon the bench, with the exception that the plants are generally allowed to produce more blooms. The most popular type of pot-plant for home growing, or for sale by florists and intended for home use, is a compact, bushy plant, 1½ to 2 feet high, branched at the base, and bearing four to twenty flowers averaging 3 to 4 inches across. They are here called "market plants." "Single-stem plants" are also popular. Great quantities of large flowers (say twenty to one hundred) are rarely grown on a potted plant, except for exhibitions. Such plants are commonly called "specimens," and the three leading forms are the bush, the standard and the pyramid, the first mentioned being the most popular.



953. Crown bud after it has been selected or taken.

1. *Market plants.*—Dwarf plants of symmetrical form, with foliage down to the pots, are the most salable, and when thus grown require constant attention as to watering and stopping, allowing each plant plenty of room to keep the lower leaves in a healthy condition. Cuttings taken June 1 and grown in pots, or

planted on old carnation benches or in spent hotbeds (light soil preferable), and lifted by August 15, will make very good plants 1 to 1½ feet high. The reason for lifting early is to have them well established in their flowering pots before the buds are formed.

2. *Single-stem plants.*—Same culture as market plants, except that they are restricted to one stem and flower. Those from 1 to 2 feet in height are more effective and useful than tall ones. For this reason, many prefer plunging the pots out-of-doors where they have the full benefit of the sun and air, making them more dwarf than when grown under glass.



954. The terminal bud.

3. *Pot-plants for cut-flowers.*—Culture same as for specimen plants, except that the nipping should be discontinued July 1 to give sufficient length to the stems. If large flowers are desired, restrict the plants to eight or ten growths. Such plants can be accommodated in less space than specimens, when the chief object is symmetry.

4. *Bush plants.*—For large bush plants, the cuttings should be struck early in February, and grown along in a cool airy house, giving attention to repotting as often as necessary. The final potting into 10- or 12-inch pots generally takes place in June. They are potted moderately firm, and watered sparingly until well rooted. As soon as the plants are 5 or 6 inches high the tips should be pinched out, to induce several growths to start. As the season advances and the plants make rapid growth, pinching must be attended to every day up to the latter part of July, to give as many breaks as possible and keep them in symmetrical form. By the middle of August (if not previously attended to), staking and getting the plants in shape will be a very important detail. If stakes are used, they must be continually tied-out, as the stems soon begin to harden, and this work can be best accomplished by looking them over daily. Light stakes of any material may be used. Many other methods are in use, such as wire hoops and wire framework, to which the growths are securely tied.

5. *Standards* differ from bush plants in having one stout self-supporting stem, instead of many stems. They require the same culture as bush plants, with the exception that they are not stopped, but allowed to make one continuous growth until 3, 4 or 5 feet high, and are then treated the same as bush plants. They require the same attention as to stopping and tying to secure symmetrical heads.

6. *Pyramids* are only another form of bush plants, and it is optional with the grower which form he prefers.

Section III.—Culture of chrysanthemums for the production of new varieties.

The object of seed-saving is the improvement of existing varieties. It is not conclusive, however, that all seedlings will be improvements; in fact, it is far from this, as the greater proportion are inferior to their antecedents. Only those who give the most careful consideration to cross-fertilization are certain of marked success. Hand-hybridized seeds possess value over those haphazardly pollinated by wind and insects only according to the degree of intelligence employed in the selection of parents. What the result will be when a white flower is fertilized with a yellow one, the operator cannot determine at the outset. It may be either white, yellow, intermediate, or partake of some antecedent, and thus be distinct from either. Improvements in color can be secured only by the union of colors, bearing in mind the laws of nature in uniting two to make the third. Red upon yellow, or vice-versa, may intensify the red or yellow—give orange or bronze, as nature may see fit. The operator is more certain of improving along other lines, such as sturdiness or dwarfness of growth, earliness or lateness of bloom, or doubleness of flowers. The selection of those most perfect in these particulars is very sure to give similar or improved results. Always keep a record of this work showing the parents of a seedling. The satisfaction of knowing how a meritorious variety was produced more than pays for the trouble, and may lead to further improvements along certain lines.—The operation begins when the flower is half open, cutting the petals off close to their base with a pair of scissors, until the style is exposed. Should the flower show signs of having disk or staminate florets, remove these with the points of the scissors and thus avoid self-fertilization. When the styles are fully grown and developed, the upper surface or stigma is in condition to receive the pollen. By pushing aside (with the thumb) the ray-florets of the flower desired for pollen, the disk-florets which produce the pollen will become visible. The pollen may be collected on a camel's-hair pencil or toothpick and applied to the stigma of the flower previously prepared. If a toothpick be used, never use it for more than one kind of pollen. By allowing the camel's-hair pencil to stand in an open-mouthed vial of alcohol a few moments after using, it may be again used, when dry, upon another variety without fear of the pollen of the former operation affecting the present.—Cuttings struck in June and July and grown to single bloom in 4-inch pots are the most convenient for seeding. Such flowers, if not given too much food are more natural and furnish an abundance of pollen, as well as being easier to trim than the massive blooms produced for the exhibition-table. The pollinating should be done on bright, sunny days, and as early in the day as possible. As soon as the seed plants are trimmed, they should be placed by themselves to avoid fertilization by insects, and should there remain until the seeds are ripe. Keep the plants rather on the dry side, and give abundance of air. Seeds, which ripen in five to six weeks, should be saved without delay, and carefully labelled. In sowing seeds,



955. Terminal buds of chrysanthemum at an early stage. None too early for disbudding.

they should be covered very lightly and kept in a temperature of 60°. When the seedlings are large enough to handle easily, remove to small pots, or transplant farther apart in shallow boxes. Chrysanthemums flower the first season from seed.

Section IV.—Varieties.

Of the long list of new varieties sent out each year, but few are retained after the second year's trial. This is probably due to the fact that most American growers are more interested in the commercial value of the flower than the curious forms or striking colors they present. Exhibitions have not reached the people here

as in England and France. There are a few varieties that have stood the test for several years; such as Ivory, 1889; Geo. W. Childs, 1892; Golden Wedding, 1893; Major Bonnaffon, 1894; Yanoma, 1896; W. H. Chadwick, 1898; John K. Shaw and Nagoya, 1899; Monrovia, Col. D. Appleton and White Bonnaffon, 1900. There are many other varieties that have stood the test for four or five years.

It is not the purpose of this article to recommend varieties of chrysanthemums, but the following list includes the best varieties known in North America at the present time. The list will be valuable as showing a serviceable classification, and also for reference when other varieties have come into existence:

Selection of varieties based on main types.—(1) *Incurved:* Æsthetic, Emberta, Major Bonnaffon, Pink Gem, Mary Donellan, Naomah, Smith's Sensation, William Turner. (2) *Japanese:* Pacific Supreme, Crocus, Ramapo, December Gem, F. S. Vallis, Glen Cove, Golden Robin, Reginald Vallis. (3) *Japanese Incurved:* Chrysolora, Col. D. Appleton, W. H. Chadwick, Mlle. Jeanne Nonin, Artistic Queen, Christy Mathewson, Elberon, Nakota. (4) *Hairy:* Arvede Barine, Beauty of Truro, Frison d'Or, Leocadie Gentils, Louis Boehmer, L'Enfant des Deux Mondes, R. M. Grey, White Swan. (5) *Reflexed:* Smith's Advance, Dick Witterstaetter, Harvard, Yanoma, Mrs. J. Wells, Rose Pockett, Thanksgiving Queen, Madison. (6) *Large Anemone:* Satisfaction, Surprise, Ernest Cooper, Geo. Hawkins, Gladys Spaulding, John Bunyan. (7) *Japanese Anemone:* Eleanor, Mrs. F. Gordon Dexter, Zoraida. (8) *Pompons:* Alma, Baby, Clorinda, Fairy Queen, Helen Newberry, Minta, Julie Lagravere, Quinola. (9) *Pompon Anemone:* Diantha, Ada Sweet, Gertrude Wilson, Lida Thomas, Vayenne, Bessie Flight. (10) *Large-flowering Singles:* Arlee, Catherine Livingstone, Felicity, Itaska, Lady Lu, Red Light. (11) *Small-flowering Singles:* Ladysmith, Anna, Blazing Star, Little Barbee.

Selection of varieties based on color.—*White:* Smith's Advance, Chadwick Improved, Christy Mathewson, Mrs. Gilbert Drabble, Naomah, William Turner. *Yellow:* Chrysolora, Comoleta, Golden Glow, Golden Eagle, Ramapo, Lenox. *Pink:* Pacific Supreme, Unaka, Patty, Glen Cove, Morristown, Smith's Sensation. *Crimson:* Dick Witterstaetter, Harvard, Intensity, J. W. Molyneux, Pockett's Crimson, Mrs. Harry Turner. *Bronze and buff:* Glenview, Mrs. J. A. Miller, Mrs. H. Stevens, Ongawa, Rose Pockett, William Kleinheinz. *Crimson, golden reverse:* Harry E. Converse, Howard Gould, Mrs. O. H. Kahn, W. Woodmason. *Amaranth or purplish crimson:* George J. Bruzard, Mrs. G. C. Kelly, Reginald Vallis, T. Carrington, Leslie Morrison.

Selection based on special uses.—*Bush plants:* Golden Age, Brutus, Dick Witterstaetter, Dr. Enguehard, Garza. *Single stemmed pot-plant:* Naomah, Chrysolora, Æsthetic, President Roosevelt, Ben Wells, Glen Cove, Mrs. George Hunt, Mrs. O. H. Kahn, Pockett's Crimson. *Exhibition blooms:* Artistic Queen, Christy Mathewson, Chrysanthemiste Montigny, F. S. Vallis, George J. Bruzard, Glen Cove, Glenview, Harry E. Converse, Lady Hopetoun, Lenox, Elberon, Morristown, M. Loiseau-Rousseau, Mrs. Gilbert Drabble, Mrs. H. Stevens, Mrs. Harry Turner, Naomah, Pockett's Crimson, Rose Pockett, William Turner, W. Woodmason, Ben Wells, Merza, Reginald Vallis. *Commerical blooms.*—*Extra-early-flowering, July to October:* Golden Glow, Smith's Advance. *Second-early-flowering, last of September into October:* Early Snow, Glory of Pacific, Monrovia, October Frost, Roserie. *Early-midseason-flowering, middle of October:* Chrysolora, Comoleta, Gloria, Ivory, Pacific Supreme, Unaka, Virginia Poehlmann. *Midseason-flowering, last of October to November 10:* Col. D. Appleton, Crocus, Dick Witterstaetter, Pink Gem, Ramapo, Mrs. W. E. Kelley. *Late-midseason-flowering, November 10 to Thanksgiving:* Dr. Enguehard, Emberta, Golden Eagle, Golden Wedding, Major Bonnaffon, Patty, President Roosevelt, Timothy Eaton, W. H. Chadwick, Mrs. Jerome Jones, White Bonnaffon. *Late-flowering, Thanksgiving and later:* December Gem, Harvard, Helen Frick, Intensity, John Burton, Mlle. Jeanne Nonin, Thanksgiving Queen, Yanoma.

Section V.—Culture of chrysanthemums for exhibition.

This branch in which the highest standard must be attained if the slightest hope of success at the exhibitions is entertained, requires a thorough knowledge of the most suitable kinds for the purpose and the ability to bring them to the highest state of perfection. The methods are not very different from those employed in the production of high-grade commercial blooms. The most successful growers usually propagate earlier, and if grown on benches they are also planted earlier to secure all the vigor possible. The finest blooms are those produced on the private estates, where one man has charge of a few hundred plants, giving them his undivided attention, so that every need is provided at the proper time. During the past few years, the majority of such expert growers have adopted a system of growing in pots, each plant restricted to one bloom, which is practically the same method as the one used throughout England for many years. Here they are kept under glass the entire season, while in England the climate permits them to be grown out-of-doors during the summer months. By this method, the roots are more closely confined, which has a tendency to produce short-jointed plants with stronger stems, and gives the grower perfect control, so that each variety may be treated according to its needs, especially when liquid fertilizers are necessary to promote the maximum in size and finish. The other factors necessary to the successful exhibitor are full consideration of the requirements of the schedules, so as to select the best varieties for the various classes, and a complete knowledge of packing and staging the blooms. During the past decade, those originating new varieties have scrutinized more closely in making a decision, and, as the commercial and exhibition varieties are considered from an entirely different standpoint, these two sections are drifting farther and farther apart. Size is the foremost quality from the exhibition point of view.



956. Terminal bud after the disbudding operation.

At the present time (1912), the varieties generally shown in prize-winning exhibits are: *White.*—Beatrice May, Lady Carmichael, Merza, Mrs. David Syme, Naomah, Wm. Turner. *Yellow.*—F. S. Vallis, Lenox, Mrs. Geo. Hunt, Mrs. J. C. Neill, Yellow Miller. *Pink.*—Lady Hopetoun, M. Loiseau-Rousseau, Mrs. C. H. Totty, O. H. Broonhead, Wm. Duckham, Wells' Late Pink. *Bronze.*—Glenview, Harry E. Converse, Mrs. O. H. Kahn, Mrs. H. Stevens. *Red.*—J. W. Molyneux, Pockett's Crimson, W. Woodmason.

A few of the commercial section are suitable for this purpose, especially when the schedule calls for twelve or more blooms of a kind for one vase and at exhibitions at which artificial supports are prohibited. The best are as follows: *White.*—Lynnwood Hall, Timothy Eaton, Chadwick Improved, Mrs. Jerome Jones. *Yellow.*—Col. D. Appleton, Golden Eagle, Golden Wedding, Yellow Eaton, Golden Chadwick, Major Bonnaffon. *Pink.*—Dr. Enguehard, Mayor Weaver, Maud Dean. *Red.*—Dick Witterstaetter, Geo. W. Childs.

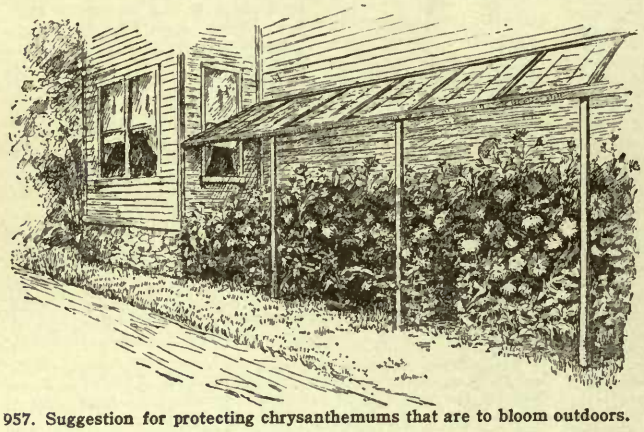
Section VI.—Culture of chrysanthemums out-of-doors.

The kinds most suitable for out-of-door culture are those making abundance of rhizomes or underground stems, which withstand the winter and furnish the new growths for the successive years. The Pompons are more hardy than the large-flowering sorts, and, as hardiness is of vital importance to those interested in this subject, especially north of the Ohio River, it should be fully considered in selecting for this purpose. It is more practicable to choose varieties which perfect their flowers early, during August, September and October when grown in the northern states, as the buds are less likely to be injured while in a soft growing state by frost. In the South many of the later varieties will live over and be satisfactory, owing to the continuance of mild weather. In the past few years, some improvements in this section have been attained, many of which are the results of crosses between the Pompons and the large-flowering Japanese, in which the progeny have combined the hardiness and dwarf habit of the former with the larger and more irregular-formed flowers of the latter, producing aster-like flowers rather than the symmetrical form of the pompons. All of the types may be successfully grown out-of-doors if provision is made to protect the bud, blooms and roots from severe frost. A temporary covering of cloth or sash in early autumn will protect the blooms, but the roots will require artificial heat or should be removed to the greenhouse or frame where the temperature can be maintained a few degrees above freezing. In growing exhibition blooms out-of-doors, all the important details, such as watering, airing, disbudding, feeding,

staking and tying, must be complied with, if the grower expects to be rewarded for his efforts.

The oldest of the outdoor types are the Pompons, which produce from forty to one hundred buttons an inch or two across, with short and regular rays. Such plants can be left outdoors all winter.

Since the large-flowering or Japanese types have come in, numberless attempts have been made to grow them outdoors, but with poor results. The greenhouse varieties are not so hardy. In the North they are likely to be killed by the winter. Their flowers usually lack in size, depth and symmetry, largely because there are more of them on a plant than a florist allows for his best blooms, but chiefly because they do not have so much care in general as is given to plants under glass, where space is precious. For the very best results, chrysanthemums must be flowered under glass, and they need the greatest care and forethought practically all the year round. Half-way measures are unsatisfactory. Thus it happens that the Japanese varieties are usually unsatisfactory out-of-doors, and the Pompons are chosen by those who can give very little care to plants and would rather have many small flowers than a few large ones. This also partly explains why no two dealers recommend anything like the same list of Japanese varieties for outdoor culture. Nevertheless, it is possible to grow excellent flowers 4 and 5 or even 6 inches across outdoors, but it requires staking, disbudding, and some kind of temporary protection, as of a tent or glass, during frosty weather. Fig. 957 shows a cheap and simple structure of coldframe sashes resting on a temporary framework. In severe weather a canvas curtain can be dropped in front, and the window of a warm cellar in the rear opened to temper the air. For general outdoor culture, however, when no special care is given to the plants, the Japanese kinds are usually less satisfactory than the Pompons. These Pompons are a much-neglected class since the rise of the large-flowered Japanese kinds, but they are unlike anything else in our garden flora. Their vivid and sometimes too artificial colors harmonize with nothing else at Thanksgiving time, and they are so strong and commanding that they should have a place by themselves. It is not uncommon for the flowers to be in good condition even after several light falls of snow, and they may be considered the most resistant to frost of any garden herbs. In fact, their peculiar merit is blooming after the landscape is completely desolated by successive frosts. The flowers are not ruined until their petals are wet and then frozen stiff. They are essentially for mass effects of color, and great size is not to be expected. Masses of brown and masses of yellow, side by side, make rich combinations. The whole tribe of crimsons, amaranths, pinks, and the like, should be kept by themselves, because their colors are variable and because they make a violent contrast with yellow, which few persons can find agreeable.



957. Suggestion for protecting chrysanthemums that are to bloom outdoors.

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ELMER SMITH.†

CHRYSOBÁCTRON (*golden wand*, from the Greek). *Liliàceæ*. Two New Zealand rhizomatous herbs, usually classed with "bulbs" by gardeners, bearing many small yellow fls. in a long raceme on the top of an elongated scape: plant often dicœcious or polygamous: perianth 6-parted, the segms. nearly equal; stamens 6: caps. 3-celled and 3-valved. The genus is now commonly united with the S. African Bulbinella, the combined species becoming 13 or 14. **C. Hoòkeri,** Colenso (*Bulbinélla Hoòkeri*, Benth & Hook., now the accepted name. *Anthéricum Hoòkeri*, Colenso)is in cult. in this country. It is a hardy plant 2–3 ft. high, with sword-like foliage: fls. ½in. diam., bright yellow, perfect, on slender pedicels, the segms. linear-oblong, and obtuse and spreading. B.M. 4602.—Cult. in the ordinary border, and treated like the asphodel, they do well. But they are improved in rich, deep and rather moist soil; strong clumps, 4–6 years old, are then at their best and are very excellent plants. After that they should be divided. Prop. by division or seed. Blooms in June and July.

J. B. KELLER and L. H. B.

CHRYSOBÁLANUS (*golden acorn*, from the Greek, referring to the fruit). *Rosàceæ*. Bushes or trees, planted far south for ornament; fruit often edible.

Leaves thick and coriaceous, entire, glabrous: fls. white, rather small, in axillary or terminal short cymes; calyx 5-parted; petals 5, clawed; stamens 15 to many, some of them perhaps sterile: fr. a dryish-pulpy drupe, with stone pointed at base and ridged.—Two species in tropics of Amer. and Afr., reaching Fla., and another one in S. U. S.

Icàco, Linn. COCOA-PLUM. ICACO. On coasts and along streams in S. Fla., to S. Amer., and also in Afr., and is sometimes planted in the extreme S. (and in the tropics) as an ornamental shrub and for its sweetish but insipid and dry plum-shaped frs. which are sometimes used for preserves. It is a mere bush on the northern limits of its distribution, and on elevations, but in extreme S. Fla. it reaches a height of 25–30 ft. Lvs. glossy, thick, obovate (sometimes obcordate): fls. small and white, in axillary erect racemes or cymes; calyx 5-cleft, pubescent; petals 5; stamens about 20: fr. 1-seeded, 1–1⅝ in. long, varying from nearly white to almost black, globular or nearly so. Wood close-grained and heavy, hard, brown or reddish. It is best prop. by seeds, but may also be had from cuttings of half-ripened wood. *C. pellocárpus*, Meyer, the small-fruited cocoa-plum, is a smaller plant, with smaller lvs., petals spatulate, drupe obovoid or oblong, about half the size of that of *C. Icaco;* it grows in extreme S. Fla. and farther south; probably not planted. *C. oblongifòlius*, Michx., occurs from Ga. to Fla. and Miss. It is a low shrub, spreading widely by means of underground sts.: lf.-blades longer than broad, sharp-tipped: fr. ovoid or obovoid, about 1–1⅓ in. long: not in cult.

L. H. B.

CHRYSÓCOMA: *Linosyris.*

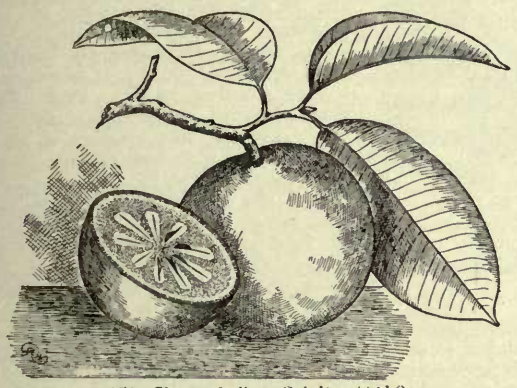
CHRYSÒDIUM: *Elaphoglossum.*

CHRYSÓGONUM (Greek-made name, *golden knee* or *joint*). *Compósitæ*. A few composites, of which **C. virginànum,** Linn., is a perennial yellow-fld. plant of S. Pa. and south; sometimes cult. as a border plant. It blooms in spring or early summer on sts. which become 1 ft. high, the heads being solitary and pedun-

cled in the axils or some of them terminal: lvs. opposite and basal, ovate and mostly obtuse, crenate. Prop. by creeping rootstocks and runners. Of little merit horticulturally.

CHRYSOPHŸLLUM (Greek, *golden leaf*, in reference to the color of the under surface of the leaves). *Sapotàceæ*. Handsome trees, grown far south for fruit and for ornament.

Juice milky: lvs. alternate, thick and stiff, usually shining and copper-colored or golden beneath with



958. Chrysophyllum Cainito. (×⅓)

silky pubescence, with many parallel cross-veins: fls. small, sessile or stalked, clustered at the nodes or in the axils; calyx mostly 5-parted; corolla tubular-campanulate or somewhat rotate, mostly 5-lobed, without appendages; stamens as many as the corolla-lobes, and staminodia 0; ovary 5–10-celled: fr. fleshy and usually edible, 1- to several-seeded.—About 60 species in tropics, the larger part American.

The various species of Chrysophyllum have beautiful broad green leaves, with under surfaces of a silky texture, varying in color from a silvery white through golden to a russet-brown, and are well worth a place in the conservatory as ornamental trees. By giving them sufficient room, they will bear fruit in the course of a few years, under glass, which in the case of *C. Cainito*, the star-apple of tropical America, is edible, and well liked even by people of a temperate clime. All species are strictly tropical, and cannot be grown where frosts occur unless properly protected. Propagation is ordinarily effected by seed, which readily germinate if planted when fresh, and it is stated that all species may be grown from cuttings of well-ripened shoots placed in strong, moist heat. The soil most suited for their growth is of a sandy character, and if not of a good quality should be well manured, using a considerable proportion of potash in the fertilizer for fruiting specimens. They seem to do well on a great variety of soils, however, that are sufficiently well drained, wet land not agreeing with them. (E. N. Reasoner.)

Cainito, Linn. Star-Apple. Caimito. Fig. 958. Thick-headed evergreen, to 50 ft.: lvs. oval or oblong, silky-golden beneath: corolla-tube twice as long as the calyx; stigma 8–10-crenate or -lobed; fls. purplish white. W. Indies, Panama, Cent. Amer. I.H. 32:567. A.G. 11:405.—The fr. is the size of an apple, symmetrically globular and smooth, hard; a cross-section shows the star-shaped core, whence the common name; it varies from white to purple in color of skin and also of flesh. The pulp is delicious (used uncooked) if the fr. is allowed to remain on the tree until ripe. It has large, pumpkin-like dark seeds. It is very impatient of frost.

olivifórme, Lam. (*C. monopyrènum*, Swartz). Satin-Leaf. To 35 ft.: lvs. like those of *C. Cainito*: fls. white; stigma 5-crenate: fr. ovoid-oblong or oval, 1-seeded by abortion of ovules, blackish, 1½ in. long, said to be insipid. S. Fla. and S. B.M. 3303.—Sparingly transferred to grounds as an ornamental tree.

imperiàle, Benth. (*Theophrásta imperiàlis*, Lind.). Plant strict and simple, to 20 ft. or more, unarmed: lvs. obovate-oblong to oblong-oblanceolate, 3 ft. long, on large plants very sharply serrate: fls. yellowish green, small, in clusters along the trunk, the cluster sessile but the fls. pedicellate; corolla rotate, 5-lobed, thick: fr. 5-angled, nearly globular, size of a small apple, with a hard thick flesh; seeds 1 in. long and ¾in. wide, compressed. Brazil. B.M. 6823. I.H. 21:184. Gt. 1864:453.—This species was grown 30 years before its genus was determined, but upon flowering in European gardens it was found to be a Chrysophyllum (by some referred to Martiusella, which see). L. H. B.

CHRYSOPÒGON: *Sorghastrum.*

CHRYSÓPSIS (*golden appearance*, from the heads). *Compósitæ*. Mostly low and hairy perennials, sometimes planted in borders: heads of medium size and many-fld., usually with numerous yellow rays; involucre bell-shaped or hemispherical, of imbricated narrow bracts: achenes compressed, bearing a pappus of numerous hair-like bristles. About 20 species of Chrysopsis are known. Mex. and N. **C. villòsa**, Nutt. (*C. Bolánderi*, Gray), is one of the species in the trade. It is widely distributed from Ill., west, north, and south: 1–2 ft., grayish pubescent: lvs. oblong to lanceolate, entire or few-toothed: heads usually at the ends of leafy branches, aster-like in shape. Extremely variable, and has several named forms. Mn. 7:101. Var. **Rútteri**, Rothr., is larger and later. Of value as a border plant. Cult. the same as aster. Perennials, but bloom the first year from seed, if sown early.

C. mariàna, Nutt. Differs from C. villosa in having corymbose-paniculate fl.-clusters. E. N. Amer. Aug.–Sept. Offered by dealers in native plants. It has showy yellow fls. and prefers dry sandy places.

N. Taylor.†

CHRYSOSPLÈNIUM (name from *golden* and *spleen*, referring to some old medicinal tradition). *Saxifragàceæ*. Golden Saxifrage. Low semi-aquatics, sometimes used in bog-planting. **C. americànum**, Schw., is a native plant creeping in mud. Sts. forking, bearing roundish or cordate small mostly opposite lvs., with very small, nearly sessile, greenish, inconspicuous fls. Scarcely known in cult. and, except for wet places where a cover or carpet is wanted, of no value horticulturally.

CHRYSÙRUS CYNOSUROÌDES: *Lamarckia.*

CHUFA. The edible subterranean tubers of *Cyperus esculentus*, Linn., (which see) much prized in the South. Fig.



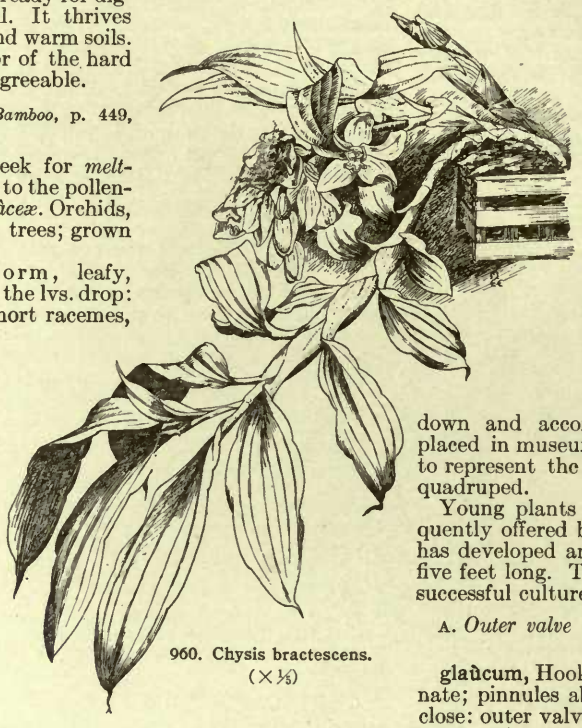
959. Chufa—Cyperus esculentus. (×⅓)

959. Chufas are eaten raw or baked, or used for the making of coffee. The plant is sometimes cultivated in the North, but it will not withstand the winter. The tubers are oblong, ½ to ¾ inches long, cylindrical, hard. The plant is grass-like, and in the North does not flower. Tubers are planted in the spring, and the new crop is ready for digging in the fall. It thrives easily in loose and warm soils. The nutty flavor of the hard tubers is very agreeable.

CHUSQUÈA: *Bamboo*, p. 449, Vol. I.

CHŸSIS (Greek for *melting*, in allusion to the pollen-masses). *Orchidàceæ*. Orchids, pendulous from trees; grown in hothouses.

Stems fusiform, leafy, thickening after the lvs. drop: fls. fleshy, in short racemes, which are produced freely in the axils of the young growths; dorsal sepal and petals similar in shape, the lateral sepals with the foot of the column forming a long foot; lip jointed to the column foot, lamellate longitudinally, the lateral lobes upright, loosely surrounding the column; pollinia 8.—About 6 species in Trop. Amer. Cult. as for Vanda, in baskets, pans or pots. They require tropical temperature when growing, then cooler.



960. Chysis bractescens. (×⅓)

A. *Ground-color of fls. yellow.*

aûrea, Lindl. Fls. 5–8, about 2 in. across; sepals and petals yellow, oblong-oval; lateral lobes of lip yellow, the middle lobe white, downy, spotted with red and yellow. S. Amer. B.R. 1937. B.M. 3617.

lævis, Lindl. Fls. 8–12, about 2½ in. across; sepals and petals yellow, tinted above with lines of purple-carmine; sepals oblong, the dorsal one inflexed, the lateral falcate; lip yellow, marked with red. Mex.

Chélsonii, Hort. Fls. 5–7, about 2½ in. across; sepals and petals yellow, with a large blotch of reddish fawn at the apex; lip yellow spotted with red. Hybrid: *C. bractescens* × *C. lævis*. F.M. 1878:297.

AA. *Ground-color of fls. white.*

bractéscens, Lindl. Fig. 960. Fls. 3–5, about 3 in. across; sepals and petals ivory-white; lip with the lateral lobes white outside, the inner surface yellow, streaked red, the middle lobe yellow, streaked and stained with red. Mex. B.M. 5186. R.H. 1859, pp. 294, 295. I.H. 27:398. O.R. 9:371; 13:236; 19:201. J.H. III. 28:263. C.O. 1. A.F. 28:747.

Límminghei, Lindl. & Reichb. Fls. 4–7, 1½–2 in. across; sepals and petals white, with an apical blotch of purple; lip with lateral lobes yellow, marked with reddish purple on the inside, the middle lobe white, streaked with bright purple. Mex. B.M. 5265. I.H. 7:240. C.O. 3.

Sèdenii, Hort. Fls. 3–6; sepals white; petals white with an apical rose-purple blotch; lip with the side lobes sulfur-yellow, purple-streaked within, the middle lobe white, streaked with amethyst. Hybrid: *C. Limminghei* × *C. bractescens*. GEORGE V. NASH.†

CIBÒTIUM (Greek, *a little seed-vessel*). *Cyatheàceæ*. A small group of tree-ferns from Mexico and Polynesia, with bivalved coriaceous indusia, differing from Dicksonia in having the outer valve entirely distinct from the leaf. For culture, see *Dicksonia*.

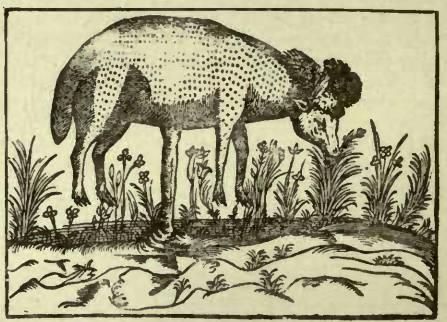
C. Barometz is the plant that gave rise to the wonder stories of the Barometz or Scythian lamb (Fig. 961), which, according to Bauhin, 1650, had wool, flesh and blood, and a root attached to the navel. The plant was said to resemble a lamb in every respect, but grew on a stalk about a yard high, and turning about and bending to the herbage consumed the foliage within reach, and then pined away with the failure of the food until it died. In 1725 Breyne, of Dantzig, declared that the Barometz was only the root of a large fern, covered with its natural yellow down and accompanied by stems, which had been placed in museums in an inverted position, the better to represent the appearance of the legs and horns of a quadruped.

Young plants of *C. Schiedei* and *C. regale* are frequently offered by florists at a stage before the trunk has developed and when the leaves are about four or five feet long. They require greenhouse conditions for successful culture.

A. *Outer valve of the indusium larger, or the valves subequal.*

glaûcum, Hook. & Arn. Lvs. ovate-lanceolate, tripinnate; pinnules about 6 in. long, taper-pointed; segms. close: outer valve of indusium larger, broader than the inner: veins once- or twice-forked. Hawaiian Isls.

Bárometz, J. Smith. SCYTHIAN LAMB. Trunkless: lvs. scented, tripinnate, the lower pinnæ ovate-lanceolate; pinnules short-stalked, 4–6 in. long, with falcate segms.: valves of the indusium nearly equal: veins prominent, rarely forked. China.



961. The Scythian Lamb; reproduced from an old book. See *Cibotium Barometz*.

AA. *Outer valve of the indusium smaller than the inner.*

Schièdei, Hook. Trunk 10–15 ft. high: lvs. oblong-deltoid, tripinnate, with pinnæ 1–2 ft. long; segms. falcate, sharp-pointed: sori sparse: veins forked, on the lowest pinnate. Mex.

regàle, Lind. Trunk 10–12 ft. high: lvs. oblong-deltoid, tripinnate, with pinnæ 18–24 in. long; pinnules sessile, with close, falcate, deeply incised segms.; veins pinnate in the lobes. Mex.

L. M. UNDERWOOD.
R. C. BENEDICT.†

CÍCCA: *Phyllanthus.*

CÌCER, (old Latin name for the vetch). *Leguminòsæ.* Pea-like annual or perennial herbs, with 5-parted calyx, the lobes being nearly equal or the 2 upper ones somewhat shorter and connivent, oblong turgid 2-valved pod, mostly 1-fld. peduncles, odd-pinnate lvs. and toothed lfts.: standard ovate or nearly orbicular, wings obovate and free, keel rather broad and incurved: fls. white, blue or violet: terminal lft. often represented by a tendril or spine.—A dozen or more species, with a Mediterranean-Asian range. **C. arietìnum,** Linn., the CHICK-PEA or GARBANZO, is sometimes cult. in vegetable-gardens for the edible ripe seeds. It is an annual and is cult. the same as bush beans. It withstands dry weather well. It grows 2 ft. high, making a bushy, hairy plant; seeds are planted as soon as warm weather comes, usually in drills, the plants standing 8-12 in. apart. Lvs. with small, roundish lfts.: fls. white or reddish, small, axillary. Seed roundish, but flattened on the sides, with a projection on one side, shaped like a miniature ram's head (hence the name *arietinum,* in vars. of red, black and white. Much cult. in S. Eu. and Asia; and widely known in Calif. and in Mex., and other Spanish-American regions. The peas are eaten boiled, or roasted like peanuts, often used for soup or as a substitute for coffee; and some kinds are used for horse-feed. It is a promising crop for some purposes; yield sometimes 500 to 1,000 lbs. to the acre.

L. H. B.

CICHÒRIUM (from an old Arabic name). *Compósitæ.* Seven or eight herbs, one of which is chicory and one endive.

Perennial, biennial or annual, branching and diffuse when in bloom, mostly with deep hard roots, milky juice and alternate lvs., and sessile axillary and terminal fl.-heads: fls. several to many in the head, all ligulate and perfect, blue, purple or white; involucre double; pappus of bristle-like scales.—Mostly in the Mediterranean region and to Abyssinia.

Íntybus, Linn. CHICORY. SUCCORY. Fig. 962. Stout deep-rooted tall perennial (3–6 ft.): lvs. broadly oblong, oblanceolate or lanceolate, hairy, rapidly becoming very small toward top of plant so that the branches appear nearly naked and wand-like, more or less clasping and the lower ones runcinate: fls. bright azure-blue, 1½ in. or more across, closing about noon; pappus about 8 times shorter than fr. July–Oct.—Now a widespread weed of hard roadsides and fields, but producing one of the clearest of light blues and worthy a place in the fl.-garden. Recent experiments promise attractive color forms. For cult. for the root and for the salad lvs, see *Chicory.*

Endívia, Linn. ENDIVE. Annual or biennial: lvs. many at the base, oblong, lobed and cut, smooth: st. 2–4 ft., branching, grooved: fls. pale blue; pappus about 4 times shorter than fr. India; but by some thought to be a derivative of *C. Intybus,* or of *C. divaricatum* of the Medit. region. For cult. as a salad plant. see *Endive.*

L. H. B.

CIENKÒWSKIA: *Kaempferia.*



962. Flowers of chicory.—Cichorium Intybus. (×½). A familiar weed along roadsides in the eastern part of the country.

CIMICÍFUGA, Linn. (*cimex,* a bug; *fugere,* to drive away). *Ranunculàceæ.* BUGBANE. Tall hardy herbaceous perennials, ornamental, but bad-smelling, suited for the back of plantings or for partially shaded places in the wild garden. The leaves and tall plants are admired in the hardy border.

Leaves large, decompound: fls. white, in racemes; sepals 2–5, petaloid, deciduous; petals 1–8, small, clawed, 2-lobed or none: follicles 1–8, many-seeded, sessile or stalked; stigma broad or minute. Allied to Actæa.—About 10 species, natives of the north temperate zone, practically all of which have been used in gardens.

Cimicifugas thrive in half shady or open places in any good garden soil, but are much taller and more showy if the soil is very black and rich. Propagated by seeds and division of roots in fall or early spring. Seeds should be sown in cool moist soil soon after ripening.

americàna, Michx. (*Actæa podocárpa,* DC.). Slender, 2–4 ft. high: lvs. pale beneath: fls. in elongated raceme; petals 2-horned; pedicels nearly as long as the fl.: follicles 3 or 5, stalked; seeds in 1 row, chaffy; stamens and pistils usually in same fl. Aug.–Sept. Moist woods N. Y. and S.

fœtìda, Linn. Lvs. bipinnate, terminal lft. 3-lobed: petals of the white fls. often tipped with anthers; no staminodia: follicles 3–5; seeds very chaffy. Summer. Siberia.—Following forms are more commonly cult.

racemòsa, Nutt. (*C. serpentària,* Pursh). Fig. 963. St. 3–8 ft. high: lvs. 2–3 times 3–4-parted; lfts. mostly ovate, firm texture: racemes few, rigidly erect, often becoming 2 ft. long: follicles rather shorter than the pedicel, nearly ¼in. long, short style abruptly recurved. July, Aug. Ga. to Canada and westward. Intro. 1891. Gt. 13:443. Gn. 46, p. 269. G.C. II. 10:557; III. 48:218.—Very pretty in fr., with its 2 rows of oval follicles always extending upward from the lateral branches. The commonest in gardens. Rhizome and roots valued in medicine.

Var. **dissécta,** Gray (*C. spicàta,* Hort.). Lvs. more compound than the type: small white fls. closely packed on lateral and terminal branches. Lasting until Sept. Conn. to S. Pa. J.H. III. 33:381.

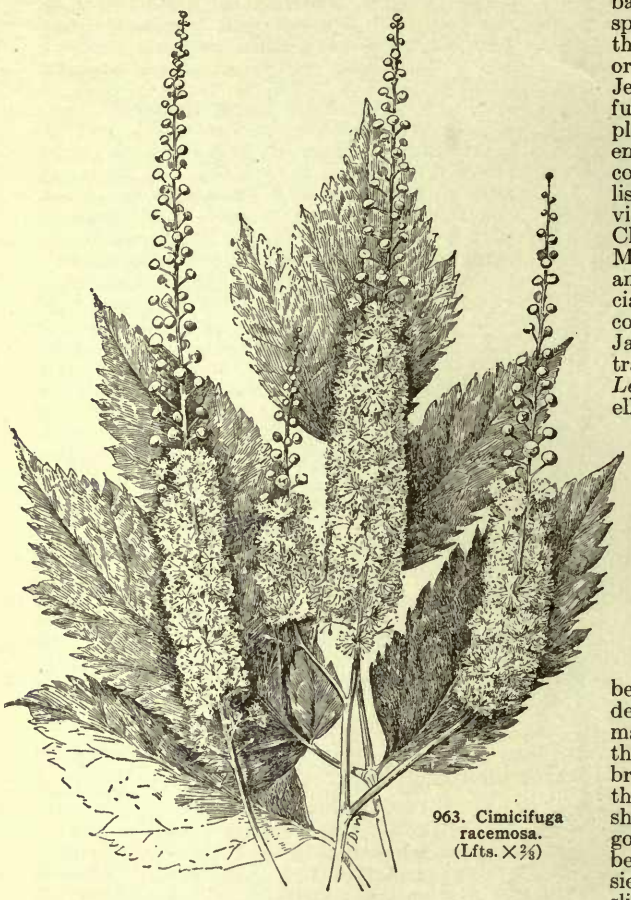
Var. **símplex,** Regel (*C. símplex,* Wormsk.). Tall and handsome: fls. short-pedicelled, forming a fine, dense raceme, and at first pubescent: follicles short-stalked. Kamtschatka. Gn. 67, p. 8. Gn.W. 21:115; 23:899.

C. cordifòlia, Pursh. Lvs. very broadly ovate or orbicular. U. S. B.M. 2069.—*C. dahùrica,* Hutt. Higher and more branched than former. Cent. Asia.—*C. elàta,* Nutt. (C. fœtida, Pursh. Actæa Cimicifuga, Linn.). Used in medicine. Ore., Wash.—*C. japónica,* Spreng. 3 ft. high: lvs. very large. F.S. 22:2363 (as Pithyrosperma acerinum).—*C. palmàta,* Michx.=Trautvetteria carolinensis, Vail.

K. C. DAVIS.

CINCHÒNA (from the Countess Chinchon, wife of a Spanish Viceroy of Peru, who was cured of fever in 1638 by the use of Peruvian bark). *Rubiàceæ.* Plants widely known as yielding a remedy, in the bark, for malaria.

Some of the species are lofty trees, others are mere shrubs. They grow isolated in various districts of the Andes, at elevations ranging from 2,300–9,000 ft., and between 22° south and 10° north latitude. Lvs. opposite, with deciduous stipules: fls. much frequented by humming-birds, fragrant, white and pink in color, growing in terminal panicles; calyx small, 5-toothed,



963. Cimicifuga racemosa. (Lfts. ×⅔)

and persistent; corolla has a long tube with 5 short spreading valvate lobes, hairy at the margins; stamens 5, included in the corolla; ovary 2-celled, with very numerous ovules inserted on linear axile placentæ: caps. opening septicidally from the base upwards; seeds small, numerous, flat and surrounded with a wing.—There are 30–40 confused species. Specimens are sometimes seen in collections of economic plants, but they are not horticultural subjects.

From the pharmacopœial point of view there are two distinct kinds of cinchona bark: (1) Cinchona, also called yellow cinchona and calisaya bark, which is probably the bark obtained from *Cinchona Ledgeriana*, Moens, and hybrids of this with other species of Cinchona. The bark secured from these sources is said to contain 6 to 7 per cent of alkaloids, of which one-half to two-thirds is quinine. (2) *Cinchona rubra*, or red cinchona, which is obtained from *Cinchona succirubra*, Pavon, or its hybrids. In this bark the alkaloid cinchonidine exists in greater proportion.

The cinchona trees are considered to yield the maximum of alkaloids at six to nine years of age. The bark of the trunk and roots is removed; the latter is used mostly in the manufacture of quinine. Effort has been made to adopt the spelling Chinchona, although Linnæus, in founding the genus, used only one h: see Clements R. Markham "A Memoir of the Lady Ana de Osorio, Countess of Chinchon and Vice-Queen of Peru (A.D. 1629–39), with a Plea for the Correct Spelling of the Chinchona Genus," London, 1874.

The febrifuge reached Spain as early as 1639. Knowledge of it was spread by the Countess of Chinchon, hence it was called Countess' powder and Peruvian bark, and also Jesuits' bark, from the knowledge of it spread by Jesuits. The word quinine is derived from the name by which it was known in Peru, *quinaquina*, or "bark of barks." In 1849, trees were sent by the Jesuits to Algeria, but the experiment was not successful. In 1852–4, Hasskarl successfully introduced living plants into Java. in 1859, Clements R. Markham was entrusted by the government of India with the task of collecting plants and seeds on the Andes, and establishing them in India. In his fascinating book "Peruvian Bark: a popular account of the introduction of Chinchona cultivation into British India" (1880), Markham recounts the difficulties in South America and his final success. Cinchona is now grown commercially in India and also in Jamaica, but most of the commercial product is secured from trees grown in Java; it is also cultivated in New Zealand and Australia. *C. Ledgeriana*, Moens (*C. Calisaya*, Wedd., var. *Ledgeriana*, How.), is a small tree with small thick elliptical lvs., reddish beneath, and with yellowish not fragrant fls., and a short caps. *C. succirubra*, Pav., has large and thin broad-elliptic lvs., purple-red calyx and rose-colored petals, and an elongated caps. *C. officinalis*, Hook. f., has oval-lanceolate acute shining lvs., and rose-colored silky fls. It is sometimes seen (in some of its forms) in collections. Var. *Condaminea* (*C. Condaminea*, Humb. & Bonpl.) is one of these forms and has been intro. in S. Calif. and said to be easily grown there. L. H. B.

Cultivation of cinchona. (By Wm. Fawcett.)

The seedlings may be raised either in boxes or in beds. The boxes should not be more than 3 or 4 inches deep. Three-quarter-inch drainage-holes should be made in the bottom, about 6 inches apart. Whitewash the boxes or dust them inside with lime. Put pieces of broken flower-pots over the drainage holes, and cover the bottom with gravel to a depth of 1 inch. The soil should be made up of one-third leaf-mold, one-third good soil and one-third fine river gravel. These should be thoroughly mixed and passed through a ¼-inch sieve. Fill the boxes to within ¼ inch of the top, and slightly water. Sow the seed evenly, and sprinkle over it some of the sifted soil, only just covering it. The boxes should be under shade, sheltered from rain, and watered every day with a very fine spray from a watering-can. The seedlings will appear in three or four weeks. If the seeds are sown in beds, they require the protection of a roof sloping south, and supported by posts 4 feet 6 inches high on the north, and 3 feet 3 inches on the south side. The sides may also have to be covered in. The breadth of the beds is 3 feet. The roof projects beyond the south posts sufficiently to keep off direct sunlight, and in the summertime, at any rate, a narrow north roof must be added at right angles. If the sheds are built under the shade of tall trees, the roof is needed only for shelter from rain.

When the seedlings are 1½ to 2 inches high, they should be transplanted into nursery beds, made up in the same way as for seeds. In transplanting, use a wooden peg 4 or 5 inches long, ¾inch thick at one end and tapering to a dull point. A seedling is picked up with the left hand from a bundle brought from the seed-beds, a hole is made with the peg in the right hand, big enough to receive the roots without bending or crushing them. The soil is then pressed closely over the rootlets with the peg. Two inches between each plant is enough room. At first the plants should be shaded, but

when they are twice or thrice as high as when transplanted the shading may be gradually removed to harden them for putting out in their permanent positions.

The soil and subsoil should be free and open to insure good drainage; newly cleared forest land on a hillside is the best for Cinchona trees. In Jamaica, *Cinchona officinalis* flourishes best at an elevation of about 5,500 feet, with a mean annual temperature of about 60° F., ranging from a minimum of 46° to a maximum of 75° and with a total annual rainfall of 120 to 150 inches.

The distance when planted out in their permanent positions is 3 by 3 feet, and as soon as they begin to interfere with each other's growth they should be thinned out just sufficiently at first to prevent this. The bark of those cut down may be worth stripping if the price of bark is high.

Several methods have been used in taking the bark from the trees. In South America, the tree is uprooted, and the whole of the bark may be taken from both root and stem. A second plan is used if shoots spring from the root; the trunk is cut through above the ground, the bark stripped, and the stump left to coppice, one or two of the shoots being allowed to grow. The third method is to make the same tree yield bark in successive seasons; for this purpose longitudinal layers of the bark are removed from the trunk, and the exposed surface is sometimes covered with moss; the bark renews itself, and the "renewed bark" is as rich (or richer) in alkaloids as the original. In this way, by taking successive strips of bark in different years, the tree yields a continuous supply of bark. L. H. B.†

CINERÀRIA (*ash-colored*, from the Latin, referring to the gray foliage). *Compósitæ*. Herbs or undershrubs, closely allied to Senecio, from which they are separated chiefly by technical characters of the achene. The genus is variously understood by different authors. As limited by Bentham & Hooker, and also by Engler & Prantl, it comprises about 25 South African species, and the common garden Cineraria becomes a Senecio (*S. cruentus*, DC.). The genus Cineraria differs from Senecio in having a cone-like rather than branched style, and a usually flattened or many-angled rather than terete achene; the species are herbs or subshrubs with yellow fl.-heads.

The cineraria of the florists (Fig. 964) is now much modified by cultivation. There are two views of its origin, one holding that it is a direct development of *C. cruenta*, Mass. (*Pericallis cruenta*, Webb. & Berth.), B.M. 406; the other that it is a hybrid, into which *C. cruenta*, *C. Heritieri*, *C. populifolia*, and perhaps others, have probably blended. These are all natives of the Canary Islands. For important literature respecting the origin of the garden cineraria, see Nature, 51:461, 605; 52:3, 29, 54, 78, 103, 128; 55:341. G.C. III. 3:654, 657; 17:588, 655, 742; 18: 89, 186; 29:297.



964. Small plant of the florists' cineraria.—Botanically Senecio cruentus.

The florists' cinerarias run in white, and in shades of blue, pink and purple-red. There is promise of yellow-flowered strains by hybridizing with yellow senecios or related plants.

See *Senecio* for *Cinerària acanthifòlia*, *C. candidissima*, and *C. marítima*. To the garden or florists' cineraria (*C. cruenta*) belong the horticultural names *C. grandiflòra*, *C. kewénsis*, *C. nàna*, *C. stellàta*, and others. There are full-double forms (see R.H. 1874, p. 47; 1886, p. 41. F.S. 22:2347–8. I.H. 32:556.)—*C. flavéscens*, Hort., is a garden hybrid between Cineraria "Feltham Beauty" and *Senecio auriculatissimus*. G.C. III. 45, 322. Gn. 73:252. It is a compact grower, originating with James Veitch & Sons, giving promise of a new strain of winter-blooming plants: fls. creamy yellow, the younger blooms almost canary yellow; lf. peculiarly constricted at the middle and much enlarged at the top.—*C. hýbrida*, Hort., is a hybrid between *Senecio cruentus* and *S. tussilaginis*, with white fls. having pale blue tips on the rays and purplish centers. G.M. 55: 337.—*C. stellàta*, Hort., now a popular race of florists' cineraria, has open spready panicles of star-like single fls. Fig. 965. Most excellent.

The true yellow-fld. South African cinerarias seem not to be in cultivation, although *C. pentactìna*, Hook. f., has been recorded in horticultural literature within recent years: slender and climbing, with lax paniculate inflorescence, pale red flower-stems and five golden yellows rays in each head. B.M. 7799. Elegant greenhouse climber. L. H. B.

Culture of the florists' cineraria.

The single hybrid cinerarias are among the most useful and beautiful of all greenhouse flowering plants. The ease with which they can be raised, the little heat required, together with their free-blooming qualities, brilliant and various-colored flowers, which last for a considerable time in blossom, make them popular with most people possessing even only a small greenhouse. Though they are herbaceous in character and may be propagated by cuttings or division of the roots, the single varieties are best treated as annuals, raising them from seed each year and throwing away the plants after flowering. Although one may save one's own seed, the cinerarias, like most hybrids, will deteriorate both in size and quality of the flower after one or two generations unless they are crossed; therefore, unless one cares to cross one's own plants, it is best to purchase fresh seed from some reliable firm that secures its stock from hybridists. For florists' use, or when a succession of

these flowers is required, two sowings of seed should be made—the first about the middle of August, and the second a month later. The seed should be sown in pans or shallow boxes 1 foot square; these should be well drained, and the soil should consist of one part fine loam, one part leaf-mold, and one part clean sharp silver sand. The surface should be made very fine and pressed down evenly. The seed should then be sown evenly and rather thinly, and covered with sand about the eighth part of an inch. This will in a great measure prevent the seedlings from what gardeners term "damping off," which they are very apt to do if the atmospheric conditions become at all stagnant. The seed-pans or boxes should be carefully watered with a fine rose and then placed in some cool shaded place, such as a frame placed on sifted coal-ashes on the north side of a wall or building, where they will germinate in about a week or ten days. As soon as large enough to handle conveniently, the seedlings should be potted into thumb-pots and grown on as rapidly as possible, shifting on into larger size pots as often as required, never allowing them to become the least pot-bound, or suffer in any way during the season of growth. The soil should consist of half leaf-mold and half fine fibrous loam, with a good sprinkling of silver sand, until the final shift into their flowering pots, when the soil should be three parts fibrous loam and one part well-decayed cow-manure or pulverized sheep-manure. About the first of October the plants should all be removed to the greenhouse, where the atmosphere should be kept cool and moist, but not stagnant. If a rainy spell should set in, a little artificial heat should be given to cause a circulation of the atmosphere, and as autumn advances the temperature should be kept about 45° at night, with a rise of 10° by day. Liquid stimulants should not be given until the flower-buds begin to appear, when they are greatly benefited by an occasional watering of clear liquid cow- or sheep-manure. The plants should be well in bloom after the holidays.

If bloom is wanted in late fall or early winter, seed may be sown in May; keep the plants growing all summer, but do not let them bloom till they are established in 5- or 6-inch pots.

The Star cineraria (Fig. 965), now popular, is an open grower, 2 feet, not having the large solid masses of flower-heads of the older larger-flowered kinds. The blooms are single and mostly smaller, and the rays are separated as in a wild aster. These plants go under the name of *C. stellata*. They are very free flowering, and as pot plants are more decorative than the large-flowered types; they meet the present demand for simplicity. In color they have the same range as the ordinary florists' cinerarias; and there are cactus-flowered strains, with narrow rolled petals. The star cinerarias require the same handling and treatment as the others.

Double-flowered varieties of cineraria are not commonly grown, neither are they so beautiful as the single varieties. They may be propagated by seed or by cuttings, the latter being the best method, as a large percentage of seedlings are sure to turn out single, which will be inferior in size of flower as compared with the best single varieties. Double-flowering varieties must be propagated each year to secure the best results. As soon as the plants have finished blossoming, the flower stalks should be cut away to induce the plants to make fresh growth, which, as soon as large enough for cuttings, should be taken off and inserted in an ordinary propagating bed, where they will soon root, after which they should be potted and shifted on as often as required, growing them during the hottest months in as cool and shaded a position as can be provided.



965. Stellata, a popular form of cineraria. (×½)

Cinerarias are very subject to the attacks of greenfly. To keep these in check, the house in which they are grown should be fumigated with tobacco about once in ten days, or tobacco stems placed among the plants if fumigating is objectionable; or the cyanide treatment used. See *Diseases* and *Insects*.

Of the different species of Cineraria from southern Europe (properly Senecios), *C. maritima* is perhaps the best. It is of dwarf habit, with tomentose, silvery, pinnatifid leaves, and is a most useful subject for edging flower-beds. It is not hardy in the North, consequently must be treated as an annual, sowing the seeds early in March in the greenhouse, afterward treating it as an ordinary summer bedding plant. The other species from south and eastern Europe do not prove hardy North, and if grown should be treated as tender annuals, planting them in the herbaceous borders for the summer. The species from the Cape of Good Hope require greenhouse treatment, the culture being the same as for the common cineraria, although, from an ornamental point of view, most of them would hardly pay for the room they would occupy.

EDWARD J. CANNING.

CÍNNA (old Greek name for a kind of grass). *Gramineæ*. Tall perennials with flat leaf-blades. Spikelets 1-fld., numerous, in nodding panicles, the

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XXVII. Coconut in flower and fruit. Southern Florida.

rachilla prolonged; lemma short-awned below the apex. There are two species, **C. arundinàcea**, Linn., with contracted panicle, the spikelets 2½ lines long, (Dept. Agric., Div. Agrost. 7:140; 20:79) and **C. latifòlia**, Griseb. (*C. péndula*, Trin.), with open panicle, the spikelets 2 lines long. Both species are native in cooler parts of N. Amer. A. S. HITCHCOCK.

CINNAMÒMUM (the ancient Greek name). *Lauràceæ*. Evergreen trees and shrubs of Asia and Australia, with aromatic leaves and wood, of which a few are cultivated in the extreme southern United States.

Leaves usually thick, mostly opposite, strongly 3-nerved or pinnate-nerved: buds not scaly (exception in *C. Camphora*): fls. usually perfect, with 9 (or less) perfect stamens in 3 unlike rows and a row of imperfect ones; perianth short-tubed, segms. 6 and nearly equal: fr. a small 1-seeded berry, in the cup-like perianth.—Upward of 50 species, among which are plants yielding cinnamon (*C. zeylanicum*), camphor (*C. Camphora*), cassia-bark (*C. Cassia*), and other aromatic and medicinal products. Various species may be expected in collections of economic plants, but most of them are not strictly horticultural subjects. It is not known whether some of the species in cult. in this country are passing under the proper names; possibly *C. Tamala*, Fr. Nees, widely distributed in the Far East, may be confused in our cultures.

The genus Cinnamomum embraces tropical and semi-tropical shrubs and trees, which are mostly of economic value, and in one or more cases are valuable shade trees for lawn and street planting. The leaves are evergreen, usually of a rich shining green, and in *C. Camphora* have a silvery blue color on the under surfaces. *C. Camphora*, the camphor tree, is hardy in the lower Gulf states, and is now being extensively planted, both for shade and extraction of gum. *C. Cassia* is not quite so hardy, but withstands a temperature of 20° F. without injury, and has been planted in Florida for manufacture of its various products,—oil, gum, buds and cinnamon bark. *C. zeylanicum*, is likely to be extensively grown in Mexico and the West Indies.—The various species are usually propagated by seeds, which are sown as soon as ripe in a shaded bed, the seedlings being transplanted when very small into pots and kept thus growing until permanent planting out. The species, without exception, are very difficult to transplant from the open ground, and hence pot-grown plants are almost a necessity. Cuttings of half-ripened wood of some species may be rooted in the spring in moderate heat, following the usual method of preparation, and planting in coarse sand. The soil best suited to cinnamomums in general, and *C. Camphora* in particular, is sandy loam, although a heavy loam, when well prepared, answers fairly well. The sandy soil of Florida, when moderately manured, suits all species so far tried admirably. (E. N. Reasoner.)

Camphòra, Nees & Eberm. (*Camphòra officinàrum*, Nees. *Laùrus Camphòra*, Linn.). CAMPHOR TREE. Stout tree with enlarged base, to 40 ft.: lvs. alternate, ovate-elliptic, acuminate, not large or very thick, pinkish on the young growths, with a pair or more of strong side veins: buds scaly: fls. small, yellow, in axillary panicles; perianth membranaceous: fr. a drupe the size of a large pea. China, Japan. B.M. 2658.—A handsome dense-topped tree when young, becoming bare below with age; withstands some frost. The young growth is very attractive. It is hardy in central peninsular Fla., where it thrives well if attention is given to fertilizing and cultivating; it does not thrive in wet soils. Camphor is a common roadside planting in S. Calif. Commerical camphor is extracted from the wood.

zeylànicum, Nees. CINNAMON TREE. Small tree (20–30 ft.): lvs. very stiff, 4–7 in. long, ovate to lance-ovate, glossy, 3–5-nerved, obtuse or somewhat acute, reticulate on under side: fls. small (¼in. long), yellow-white, in loose somewhat silky clusters, which often exceed the lvs.: fr. ⅔in. long, dry, pointed. India, Malaya, and widely dispersed in tropical countries as a cult. plant. B.M. 2028. L.B.C. 1:91.—Variable; and many forms have been described.

Cássia, Blume. CASSIA-BARK TREE. Handsome tree: lvs. stiff, 3–6 in. long, oblong to nearly lanceolate, long-acuminate, glossy, 3-ribbed; petiole slender: fls. very small, in terminal or axillary silky-tomentose panicles 3–6 in. long: fr. size of a pea. China.—Young branches somewhat 4-angled. Hardy and successful in central peninsular Fla. (Nehrling), thriving best in moist and rich land, and making specially fine specimens near residences where now and then it receives applications of fertilizer and water.

pedunculàtum, Presl. Glabrous tree: lvs. thick, oblong-lanceolate, acuminate, 3-nerved, glossy above; petiole to ¾in. long; blade 2–5 in. long and somewhat glaucous or areolate beneath: fls. very small (⅛in. or less long), in axillary corymbs that about equal the lvs.; perianth glabrous outside and whitish-puberulent inside, the lobes oval-obtuse: berry globose-ovoid, ¼in. long. Japan.—This species is said to have been intro. at Los Angeles some 35 years ago, where a handsome tree still exists, seedlings of which are to be found in other parts of S. Calif. In central peninular Fla., this species and *C. Lourierii* are hardy and attractive, thriving particularly well in rich and rather moist land.

Lourèirii, Nees. CASSIA-FLOWER TREE. Middle-sized tree, glabrous: lvs. opposite or alternate, rigid, elliptic or oblong, attenuate-acuminate; petiole to ½in. long, the blades 3–5 in. long: fls. very small (there is a variegated-lvd. form). China, Japan.—Perhaps a form of the last, with nerves on upper side of lf. less prominent or sunken, and other minor differences.

L. H. B.

CINNAMON FERN: *Osmunda.*

CINNAMON VINE: *Dioscorea.*

CINQUEFOIL: *Potentilla.*

CIPÙRA (origin of name unexplained). *Iridàceæ*. Four Trop. American bulbous plants, rarely grown under glass. Allied to Nemastylis: fls. with 6 parts or petals, the inner 3 being much smaller, white or light blue, borne in terminal heads, short-tubed. The only species likely to be in cult. is *C. paludòsa*, Aubl., with white fls. and radical linear-lanceolate lvs.; bulb conical-globose. B.M. 646 (as *Marica*). Prop. by seeds and offsets; to be kept on the dry side through winter.

CIRCÆA (Circe, the enchantress). *Onagràceæ*. ENCHANTER'S NIGHTSHADE. Six or seven herbs of low or moist woods in North America and other temperate and cold regions of the northern hemisphere, two of which have been offered for growing in shady places and about garden bogs.

Perennials, small and soft: lvs. opposite and stalked: fls. perfect, small, and white, in terminal and lateral racemes; calyx-tube hairy, prolonged beyond the ovary, 2-lobed; petals 2, notched: fr. a small, bristly bur. They are interesting little plants, but not showy. Of easy cult. in shady, damp spots.

Lutetiàna, Linn. Erect and branching, 1–3 ft., the st. swollen at the nodes: lvs. ovate-acuminate, more or less rounded at the base, somewhat toothed: pedicels slender, reflexed in fr.: fr. 2-celled, bristly. Woods, E.

pacífica, Aschers & Mag. From 6–12 in., from a little tuber; smaller than the above, lvs. less acuminate, fls. smaller, fr. 1-celled and less bristly. Wyo., west.

L. H. B.

CIRRHÆA (from *Cirrhus*, a tendril). *Orchidàceæ*. About a half-dozen Brazilian orchids, of no special importance, one of which, *C. viridipurpùrea*, Lindl., is sparingly offered abroad, and two or three others of

which are mentioned in horticultural literature. Allied to Gongora; cultured as for Cymbidium; warmhouse. Fls. mostly greenish and red (or purple), on long pendulous racemes that arise from base of the pseudobulbs.

CIRRHOPÉTALUM (*tendril petal*, alluding to the narrow lateral sepals). *Orchidàceæ*. Epiphytes, grown in baskets or on blocks in a warmhouse.

Pseudobulbs from a creeping st.: dorsal sepal free; lateral sepals much longer than the dorsal, cohering excepting at the base; petals much shorter, often ciliate; lip entire, usually recurved; column short, 2-winged at the apex; pollinia 4.—About 90 species in Trop. Asia, Mascarene Isls., and Australia.

Being of rambling habit, with creeping rhizomes, cirrhopetalums should be grown in baskets sufficiently large to afford plenty of growing surface, and suspended from the roof where they will get abundant light and free access of air to the roots, which is equally essential. Liberal allowance must be made for drainage, which should consist of either broken potsherds or charcoal, the latter being preferable, as it is light, durable and contains nothing detrimental. Two-thirds osmundine, or other clean fiber, and one-third chopped live sphagnum moss, well mixed together, afford a good compost; and after this has been carefully tucked in about the roots and interstices, the plant should be held firm with brass or copper wire until reëstablished. The compost should be used rather sparingly to prevent over-watering. Many of the smaller-growing species do very well on orchid blocks, firmly attached, with a small quantity of compost beneath them. During the winter months, little or no shade is required. The temperature may range from 58° to 65° F. by night, with about 10° rise through the day, or even a little more, with sun-heat, will do no injury. No artificial heat is necessary in summer, except in extreme cold or wet weather, but a shaded moist location should be chosen, such as is afforded in the cattleya or palm department. When the plants are dormant, light syringing overhead will keep the compost moist and the plants in healthy condition, but as the growing season advances, a liberal quantity of water and copious syringing in bright weather will be necessary. The stock is increased by division, the most judicious method being to cut nearly through the rhizome with a sharp knife, about three pseudobulbs behind the part to remain until the dormant eyes start to grow, when it may be removed and treated as an established plant. A little extra heat and moisture at this period will prove beneficial with the weak plants. All are of moderately easy culture. (Robert M. Grey.)

Medûsæ, Lindl. Pseudobulbs ovoid, ribbed: lvs. 5–8 in. long, oblong-elliptic: scapes with large sheathing bracts; umbel many-fld.; fls. creamy, yellow-spotted; dorsal sepal lanceolate; lateral sepals with long pendent tails, 4–5 in. long; petals and lip minute. Singapore. B.R. 28:12. B.M. 4977. I.H. 39:154. G.C. III. 21:25.

picturàtum, Lindl. Pseudobulbs ovoid, about 2 in. long, angled: lvs. 3–5 in. long, linear-oblong: scape with sheaths pale yellowish-green, red-speckled; umbel 10–15-fld.; sepals and petals green, the dorsal sepal erect, obtuse, red-spotted, with a thread-like purple-knobbed summit, the lateral sepals linear; petals small, rounded, curved; lip blood-red, obtuse. India. B.M. 6802.

C. Ándersonii, Kurz. Dwarf habit: fls. in umbels; lateral sepals whitish, with fine rose dots; dorsal sepal marked with purple lines. Sikkim.—*C. appendiculàtum*, Rolfe. Dorsal sepals and petals pale yellow; lip rosy purple. E. Indies.—*C. biflòrum*, J. J. Smith. Sepals purple-spotted, the dorsal elliptic, about 1¼ in. long, including the seta, the lateral sepals linear-lanceolate, 3–3½ in. long. Java. B.M. 8321.—*C. breviscàpum*, Rolfe. Dorsal sepal oblong-lanceolate, about ¾in. long, dull purple, the lateral sepals yellow, spotted red-brown, about 1 in. long, the lip rose-purple, broadly cordate, ovate-cuneate, hairy at base. Perak. B.M. 8033.—*C. caudàtum*, King & Pantl. Dwarf species: dorsal sepals short; lateral sepals tail-like, about as long as scape. Himalayas.—*C. chinénse*, Lindl. Fls. pale fawn-color, the dorsal sepal hooded, crimson-spotted, the lateral sepals linear-lanceolate, the lip crimson-spotted. China. B.R. 29:49.—*C. chrỳseum*, Kränzl. Scape filiform, 1-fld.; fls. yellow. Philippines.—*C. Cúmingii*, Lindl. Umbel 9–12-fld.; fls. purple, the dorsal sepal glandular-ciliate, the lateral sepals 1 in. long, linear-oblong; lip with 2 erect processes. Philippines. B.M. 4996.—*C. Hoòkeri*, Duthie. Fls. 1 in. long, yellow, the dorsal sepal about ¼in. long, obtuse, purple-streaked, the lateral linear-lanceolate, acuminate. Himalayas. B.M. 7869.—*C. lépidum* (Bulbophyllum lepidum, J. J. Smith). Dorsal sepal, erect, ciliate, ⅛in. long, brownish yellow; lateral sepals united, spreading, bright brownish yellow, somewhat red-flushed, at base, the upper portion pale yellow, marbled with brown-red, about 1 in. long; petals ⅛in. long, ciliate. Java.—*C. longíssimum*, Riddell. Fls. whitish, rosy-streaked, the dorsal sepal lanceolate, ⅜–¾in. long, the lateral sepals linear, 8–12 in. long, with slender tails; petals falcate, ciliate. Siam. B.M. 8366.—*C. Micholítzii*, Rolfe. Umbels 8–12-fld.; lateral sepals deep yellow; dorsal sepal and petals blotched with dark purple on a pale ground. Annam.—*C. miniàtum*, Rolfe. Fls. vermilion-colored with hairs of dorsal sepal and petals yellow; lateral sepals caudate, almost thread-like. Annam.—*C. papillòsum*, Rolfe. Umbels usually 6-fld.; dorsal sepals and petals lined with dark purple on a pale ground; lateral sepals speckled with red-brown. Siam.—*C. púlchrum*, N. E. Br. I.H. 33:608. O.R. 17:328. A.F. 6:609.—*C. retusiúsculum*, Reichb. f. Fls. ¾in. length; upper sepals dark purple; lower coherent, yellow, marked with dark red. China.—*C. Róxburghii*, Lindl. Small, with ovate reddish green lvs. and almost globose umbels of cream-white fls. tinged with rose or purple. India. A pretty dwarf species.—*C. Thoudrsii*, Lindl. Umbel of 10–12 fls.; sepals and petals tawny yellow, the dorsal ovate, cuspidate, with purple warts, the lateral lanceolate, acute, stained claret; petals small, ovate-lanceolate, pale yellow, purple-spotted, with a thread-like tail at apex; lip oblong. Madagascar, Java, Philippines, Society Isls. B.R. 24:11. B.M. 4237.—*C. sinénse*=C. chinense.

GEORGE V. NASH.

CÍRSIUM (old Greek name, referring to the use of the plant in an ailment). *Compósitæ*. THISTLE. Prickly-leaved plants (largely biennial) of bold habit and showy purple, pinkish, white or even yellowish heads, sometimes planted in wild gardens.

The thistles are botanically confused. By some authors, Cirsium is combined with Carduus, but others keep it distinct because of the plumose or feathery pappus (which is most constant on the inner florets); and this disposition is here accepted. The cirsiums are herbs or subshrubs, more or less spiny: lvs. alternate, sessile, often pinnatifid: fl.-heads large, mostly terminal; involucre ovoid or spherical, with many rows of imbricated often spiny-tipped scales, many-fld.; florets all tubular and alike (seldom more or less dicœcious).—More than 120 species of annuals, biennials or perennials, widely spread in the northern hemisphere.

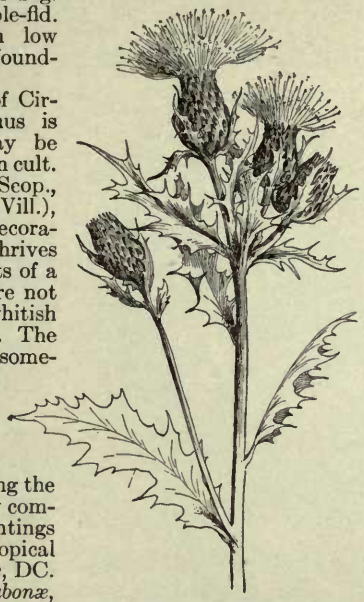


966. Head of pasture or bull thistle. (×½)

Other generic names partaking in the confused usage are Carbenia, now a synonym of Cnicus; Chamæpeuce, now a section of Cirsium; and Cnicus (which see), a genus of one species, distinguished by sterile marginal florets, pappus of ten long bristles and equal numbers of shorter ones and of horny teeth, and achene attached obliquely near the base rather than squarely on the base.

A number of the thistles are field and pasture weeds. The most penicious of these weeds is the Canada thistle, *C. arvense*, Scop. (*Carduus arvensis*, Robs.), Fig. 795. The common bull thistle or pasture thistle (Fig. 966) is a stately biennial, and very decora-

tive. It is *C. lanceolatum*, Hill (*Carduus lanceolatus*, Linn.). Both these species are introduced from Eu., as well as two or three others of lesser distribution in this country. There are a number of showy native species, one of which, *C. muticum*, Michx., (*Carduus muticus*, Pers.) is shown in Fig. 967. This purple-fld. species occurs in low grounds from Newfoundland to W. Va.



967. Cirsium muticum. (×½)

A few species of Cirsium (as the genus is here defined) may be expected to occur in cult. *C. oleraceum*, Scop., (*Carduus oleraceus*, Vill.), of Eu., has very decorative foliage, and thrives in the moister parts of a garden; the fls. are not very handsome, whitish or yellowish; 3 ft. The Chamæpeuces are sometimes grown for the large prickly spreading rosettes of lvs. that are produced the first year, the bloom appearing the second year. They combine well with plantings made for subtropical effect: *C. Casabonæ*, DC. (*Chamæpeuce Casabonæ*, DC. *Carduus Casabonæ*, Linn.), has lvs. deep green veined white, spiny, the fl.-heads pale purple; *C. Diacantha*, DC. (*Chamæpeuce Diacantha*, DC. *Carduus Diacantha*, Labill.), has thick lvs. shining green with silvery lines, white beneath, linear-lanceoate, the principal nerve or rib terminated by a single spine and the lateral nerves usually 2-spined, and dense clusters of purple heads; *C. afrum*, DC. (*Chamæpeuce afra*, DC. *Carduus afer*, Jacq.), has dark green blotched white linear-lanceolate lvs. tomentose beneath, and large bright purple heads; *C. Sprengeri*, Hort., a garden hybrid, perennial, with dark green white-veined spiny lvs., and white fragrant heads; *C. tauricum*, Hort., is probably *C. Diacantha*.

L. H. B.

CISSÁMPELOS (Greek for *ivy* and *vine*). *Menispermàceæ*. Mostly twining plants, shrubs and herbs, one of which is cultivated far south.

Leaves various, mostly cordate or reniform, often peltate, alternate: fls. in axillary racemes or clusters, the plant diœcious; sterile fls. with 4 sepals and 4 petals united, the anthers 2–5 on a staminal column or disk; fertile fls. with 2 united fleshy sepals, subtended by a sepal-like bract, and solitary ovary, with 3 styles: fr. a subglobose drupe, with a flattened and tuberculate stone. Many species or distinct forms in tropical regions, but many of them are evidently forms of the widely distributed **C. Pareìra**, Linn. This plant, as *C. heterophylla*, DC., and under other names, is cult. in S. Fla. and the tropics. It is known as Velvet-Leaf and False Pareira. It is an exceedingly variable vine, with downy round-cordate or peltate entire or lobed lvs., the very small sterile fls. in stalked corymbs and the fertile in large-bracted clusters, and a hairy or glabrate nearly globular red drupe. It occurs in all tropical countries. "Pareira brava" of the pharmacopœas is derived from the root of the related perennial climber, *Chondrodendron tomentosum*, of Peru and Brazil. Whether the genus Cissampelos contains 20 or 70 species depends mostly on the rank given to the many forms of the cosmopolitan *C. Pareira*.

L. H. B.

CÍSSUS (Greek name of *ivy*). *Vitàceæ*. Mostly tendril-climbing shrubs, a few of which are grown in the open, and others under glass for the handsome often colored foliage.

Very like Vitis (with which some authors unite it): at best a mixed group botanically, and capable of good definition only when certain groups or subdivisions are removed from it. For the characters of related genera, see *Ampelopsis*, *Parthenocissus*, *Vitis*. As constituted by Gilg in Engler & Prantl's "Pflanzenfamilien," the genus includes Cayratia but which might well be kept distinct. This subgenus, of which two or three interesting species from China and Japan are in cult., differs from Cissus proper in the always compound lvs., which are usually pedate, the axillary infl., the thin or even membranous disk, the 2–4-seeded fr., and the plants mostly herbaceous. Excluding Cayratia, Cissus is known by usually simple lvs., 1-seeded fr., and the disk being deeply 4-lobed or separated into 4 gland-like bodies. From Ampelopsis, as that genus is characterized in this work, Cissus differs in the 4-merous fls., often herbaceous, and fleshy st., the 1-seeded rather than 2–4-seeded fr. and in the disk not being cup-like and not irregularly lobed. From Vitis, it differs in its 4-merous fls., its expanding petals (the corolla not falling off as a cap), the 4-parted disk, its 1-seeded mostly dry and inedible fr., and other characters. Cissus comprises probably 200 species, widely dispersed in tropical regions and a few of them reaching extra-tropical areas (as in the southern U. S.): mostly climbers by means of tendrils without enlarged or disk-like ends, rarely erect shrubs or even perennial herbs, sometimes with greatly thickened sts. either under ground or above: lvs. alternate, simple or compound, with tendril (if present) opposite or at same node: fls. usually perfect, in mostly umbel-like cymes that are terminal or axillary; parts of the fl. in 4's, the petals at length spreading and falling separately; disk around the ovary 4-parted or -separated; style long and mostly slender rather than conical: fr. typically a dryish 1-seeded berry (2–4-seeded in Cayratia).

In cultivation there are very few species of Cissus, and these are mostly the tendril-climbing Vitis-like species grown under glass for the handsome foliage. The best known is *C. discolor*, although other species are likely to become widespread and popular in greenhouses. The fleshy-stemmed erect species are sometimes grown in botanical collections for the cactus-like forms and for illustrations in adaptive morphology. The species are readily propagated by cuttings.

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A. *St. herbaceous.*

1. **japónica,** Willd. (*Cayràtia japónica*, Gagnep.). Herbaceous, glabrous or minutely puberulent, the branches striate, climbing by tendrils: lvs. pedately 5-foliolate, long-stalked, the lfts. lanceolate or obovate-oblong, serrate: fls. in a long-peduncled 2–3-forking cyme, greenish; petals ovate-triangular, blunt: berry size of a small pea, 2–4-seeded, the seeds 3-angled-ovate, keeled.. Japan, Java, Austral.—Appears to be root-hardy N., when covered.

2. **oligocárpa** (*Vìtis oligocárpa*, Lev. & Van. *Cayràtia oligocárpa*, Gagnep.). Differs from the above in the acuminate and more sharply and closely serrate lfts., which are puberulous when young: anthers orbicular. China.—Very recently intro.

3. **adenópodus,** Sprague. Herbaceous, climbing by tendrils, slender, terete root tuberous: lvs. red and decorative, 3-foliolate, petioled, 3–6 in. long, hairy;

lfts. stalked, ovate, abruptly acuminate, coarsely serrate, green with sunken nerves above and red with prominent nerves beneath: fls. light yellow, in a loose panicle or cluster about 4 in. long, the pedicels recurved after flowering; petals oblong, much reflexed (about ⅕in. long): berry globose, ⅔in. diam., dark purplish black. Trop. Afr. (Uganda). B.M. 8278.—A quick-growing plant requiring warmhouse conditions. Readily prop. by cuttings or seeds, and of very easy cult. Thrives well in sunlight. A recent intro.

AA. *St. not herbaceous at maturity, although perhaps fleshy.*

B. *Lvs. fleshy, 3-lobed or 3-foliolate.*

4. **ácida,** Linn. Low glabrous climber, with slender and striate somewhat fleshy branches and long stout tendrils: lvs. rigid, petiolate; lfts. or lf.-divisions rather small, broad-cuneate and sharply toothed near the apex: fls. small, in corymb-like or umbel like clusters: fr. an ovoid and abruptly pointed dark purple berry, with 1 or 2 large seeds, the pedicel being recurved at maturity. S. Fla., and Trop. Amer.; also, in Ariz. and S.—Sometimes planted.

5. **incîsa,** Desm. (*C. Rocheàna,* Planch.). Climbing 20–30 ft., the sts. warty and very fleshy and the tendrils root-like: lvs. pale green, very fleshy; lfts. or divisions wedge-ovate, notched on both sides and top, the middle one sometimes again lobed and the lateral ones 2-lobed: fls. in umbel-like mostly 3-forking cymes opposite the lvs.: fr. an obovoid blackish berry, with 1 or 2 seeds, the pedicel being strongly recurved. Fla., to Ark. and Texas. R.H. 1884, pp. 272–3.—Often planted in the extreme S. Sometimes called "marine ivy."

BB. *Lvs. not fleshy.*

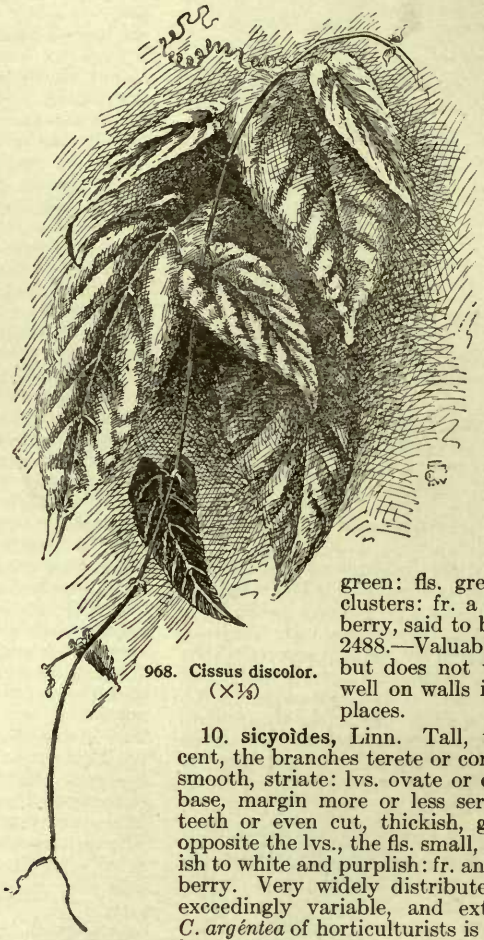
C. *The lvs. 3–5-foliate.*

6. **gongylòdes,** Planch. (*Vìtis gongylòdes* and *V. pteróphora,* Baker). Vigorous tendril-climber with 4-angled branches, desirable for large greenhouses where tropical effects are desired, sending down long bright red aërial roots: lvs. large, stalked, 3-foliolate; lfts. rhomboid or the middle one often 3-lobed, the lateral ones sometimes lobed on the outside at the base, hairy on margin and nerves: fls. red-brown, in pedunculate cymes opposite the lvs.: a tuber (reaching 5–6 in. long) is borne at the end of each branch when the season's growth has ceased, and this drops and produces new plants. Brazil. B.M. 6803. Gt. 37:1273. R.H. 1908:203.

7. **striàta,** Ruiz & Pav. (*Ampelópsis sempérvirens,* Hort.). Low, shrubby evergreen vine, tendril-climbing, the branches striate and usually lightly hairy: lvs. small, 3–5-foliolate, with cuneate-obovate or lanceolate coriaceous lfts., serrate above the middle: fls. yellowish, in many-fld. pedunculate cymes opposite the lvs.: fr. depressed-globose, size of small pea, often 2-celled and 2–4-seeded. Chile, S. Brazil.—Graceful small climber for the cool greenhouse; robust in S. Calif.

CC. *The lvs. not compound although perhaps lobed.*

8. **díscolor,** Blume. Fig. 968. Tendril-climber, smooth, but not glaucous, the branches slender and with 4 or 5 ribs or angles, red: lvs. oblong-ovate or cordate-ovate, acuminate, bristly serrate, reddish beneath, velvety green and mottled with silvery white above: fls. small and yellowish, in dense and very short axillary peduncled clusters: fr. globular, 1-seeded. Java. B.M. 4763. Lowe 13. F.S. 8:804–5.—One of the best of warmhouse foliage plants. Easily grown. Prop. by cuttings. It must have a season of rest, usually in spring or early summer. If wanted for winter growth, temp. must be about 75°. It thrives in rich somewhat moist soil and responds to small applications of fertilizer now and then. The plant is very susceptible to root-knot. Variable. Known to some as "trailing begonia."



968. Cissus discolor. (×⅓)

Var. **móllis,** Planch. (*C. velùtinus,* Lind.). Pubescent or velvety: lvs. green and boldly veined with white above, blood-red beneath: fls. intense bright red, in large laxer and longer-peduncled cymes. Habitat unknown. B.M. 5207.

9. **antárctica,** Vent. (*C. Baudiniàna,* Brouss.). KANGAROO VINE. Upright shrub, but the branches climbing by tendrils, hairy: lvs. rather thick, glossy, ovate to oblong, sometimes more or less cordate, very short-acuminate, mostly toothed or notched, green: fls. green, in few-fld., axillary clusters: fr. a globular- or few-seeded berry, said to be edible. Austral. B.M. 2488.—Valuable for cool greenhouses, but does not withstand frost. Grows well on walls in darkish and neglected places.

10. **sicyoìdes,** Linn. Tall, tendril-climbing, pubescent, the branches terete or compressed, tuberculate or smooth, striate: lvs. ovate or oblong, often cordate at base, margin more or less serrate with bristle-tipped teeth or even cut, thickish, green: infl. corymb-like, opposite the lvs., the fls. small, and varying from greenish to white and purplish: fr. an obovoid, 1-seeded black berry. Very widely distributed in Trop. Amer., and exceedingly variable, and extending into Fla. The *C. argéntea* of horticulturists is var. **ovàta,** Baker, which has glabrous ovate or ovate-oblong remotely serrate and somewhat glaucous lvs. Called "season vine" in tropics.

It is probable that some of the plants listed as Cissus belong to other genera, and some of the trade names are unidentifiable botanically.—*C. dìbo-nìtens,* Hort. Lvs. oblong-acuminate, more or less cordate at base, silvery white and shining over the upper surface. Brazil. Warmhouse climber.—*C. amazónica,* Lind. Lvs. glabrous and glaucous, oval-acuminate and narrower, reddish beneath and silvery veined above. Brazil. Warmhouse climber. —*C. Davidiàna,* Carr., is a Vitis (which see).—*C. Lìndeni,* André (I.H. 17:2), has large ovate-cordate silver-blotched lvs.: a glabrous climbing shrub, with terete branches. Colombia.—*C. porphyrophýlla,* Lindl., is a Piper.—*C. Veìtchii,* Hort., is Parthenocissus.

L. H. B.

CÍSTUS (ancient Greek name). *Cistàceæ.* ROCK ROSE. Low shrubs grown for their red or white hairy flowers.

Plants usually with villous and glandular tomentum, aromatic: lvs. opposite, mostly persistent, entire, the opposite petioles connate at the base: fls. large, in terminal and axillary cymes at the end of the branches, rarely solitary, white to purplé; sepals 3 or 5; petals 5; stamens numerous; style elongated or short with a

large 5–10-lobed stigma: caps. many-seeded, splitting into 5 valves.—About 20 species in the Medit. region and many natural and garden hybrids. Monograph by Grosser in Engler, Pflanzenreich, hft. 14, pp. 10–32 (1903) and an illustrated monograph by R. Sweet, Cistineæ (1825–30) quoted below as S.C.

The cistuses are ornamental free-flowering shrubs, usually only a few feet high, with very showy purple or white flowers similar to a small single rose, appearing in early summer. They are hardy only in warmer temperate regions, but many of them will stand 10° of frost without injury, and *C. laurifolius* and *C. villosus* var. *tauricus* even more. They thrive best in a well-drained light soil, mostly preferring limestone soil, and in a sunny position; the dwarfer species are well adapted for rockeries with southern aspect. They do not bear transplanting well, and should be grown in pots until planted out. Some species yield ladanum, a resin used in perfumery. Propagated by seeds sown in spring in pans or boxes and the young seedlings shaded; increased also by layers and cuttings in spring or late summer, inserted in sandy peat under glass. In the Old World, the cistuses are important garden plants, but they are little known in America.

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A. *Color of fls. purple or red.*

B. *Fls. 1½–2 in. wide; petals imbricate.*

C. *Lvs. penninerved, 3-nerved only at the base.*

D. *Petals without a dark blotch at the base.*

1. **villòsus,** Linn. (*C. incànus*, Linn.). Erect shrub, 3–4 ft., villous or tomentose: lvs. penninerved, roundish-ovate or oblong, narrowed into a very short petiole, rugose above and grayish green, tomentose or villous beneath, 1–2 in. long: fls. 1–3, long-peduncled, reddish purple, 2 in. wide; petals light pink or yellowish at the base. May, June. Medit. region. B.M. 43. S.C. 35. Gn. 27, p. 571.—A very variable species. Var. **crèticus,** Boiss. Lvs. smaller, more spatulate at the base, very rugose, undulate at the margin: fls. purple. S. E. Eu., Asia Minor. Sibthorp, Fl. Græca 5:495. S.C. 112. Gn. 27, p. 571; 33, p. 490.

Var. **rotundifòlius,** Loud. Dwarfer, with more roundish lvs. S.C. 75. Garden form. Var. **taùricus,** Grosser (*C. taùricus*, Presl). Lvs. obovate-spatulate, the upper ones lanceolate, scarcely undulate: pedicels twice as long as sepals. Asia Minor. Var. **undulàtus,** Dunal. Lvs. linear-oblong, acute, undulate: fls. solitary. S.C. 63. Garden form.

2. **heterophýllus,** Desf. Erect, to 2 ft.: lvs. short-petioled, elliptic- or oval-lanceolate, green on both sides and slightly hairy, ½–1 in. long: fls. 1–3, 2 in. wide; petals red, yellow at the base. N. Afr. S.C. 6.—More tender.

DD. *Petals with a dark blotch at the base.*

3. **purpùreus,** Lam. (*C. ladaníferus* × *C. villòsus*). Shrub to 4 ft., somewhat glutinous: lvs. nearly sessile, lanceolate or oblong-lanceolate, acute, rugose above, slightly undulate and revolute at the margin, 1–2 in. long: fls. usually 3, lilac-purple, 3 in. across, the petals yellow at the base and with a maroon blotch. Of garden origin. Gn. 31:326; 45, p. 33; 53, p. 134. B.R. 5:408. S.C. 17. G.C. III. 48:118–19.—One of the most beautiful rock roses.

CC. *Lvs. 3-nerved to the apex.*

4. **crìspus,** Linn. Compact shrub, to 2 ft., villous: lvs. sessile, linear-lanceolate or oblong-elliptic, undulate, rugose above, villous beneath: fls. 3–4, nearly sessile, 1½–2 in. wide, deep rose-colored. June–Aug. S.W. Eu. S.C. 22. Gn. 34:252.

5. **álbidus,** Linn. Shrub to 4 ft., the young parts white-tomentose: lvs. sessile, elliptic or ovate-oblong, revolute at the margin, reticulate beneath, whitish tomentose, ½–2 in. long: fls. 3–6, lilac or rosy, 2½ in. across; style longer than stamens. S.W. Eu. N. Afr. S.C. 31. G.C. III. 45:117. G.M. 51:783.

BB. *Fls. 1 in. wide; petals not imbricate.*

6. **parviflòrus,** Lam. Much-branched shrub, 1–2 ft.; tomentose: lvs. 3-nerved, elliptic-ovate, undulate, rugose above, reticulate beneath, twisted, 1 in. long: fls. 3–5; petals palè rose, yellow at the base. June. Greece, Crete. S.C. 14.

AA. *Color of fls. white: lvs. 3-nerved.*

B. *Sepals 3.*

C. *Lvs. nearly sessile: plant very glutinous: fls. usually solitary.*

7. **ladaníferus,** Linn. Shrub, to 4 ft., glutinous: lvs. lanceolate, glabrous and viscid above, whitish tomentose beneath, 1½–4 in. long: fls. usually solitary, long-peduncled, 3–3½ in. wide; petals yellow at the base. June. S. W. Eu. S.C. 84. F.S.R. 2, p. 44. G. 22:213. Gn. 58, p. 171; 66, p. 257. F. 1874, p. 160. Var. **maculàtus,** Sweet. Petals with a dark brownish crimson spot above the base. Gn. 30:30; 33, p. 490. S.C. 1. G. 26:598. Grosser 23.—Probably the most beautiful of all cistuses.

CC. *Lvs. distinctly petioled: fls. several.*

8. **cýprius,** Lam. (*C. ladaníferus* × *C. laurifòlius*). Erect shrub, to 6 ft., somewhat glutinous: lvs. oblong-lanceolate, glabrous above, villous-tomentose beneath: fls. 5–7, nearly 3 in. wide; petals blotched purple at the base. June. Garden origin. S.C. 39. Gn. 76, p. 438. B.M. 112 (as *C. ladaniferus*).

9. **laurifòlius,** Linn. Fig. 969. Shrub to 6 ft.: lvs. petioled, ovate or ovate-lanceolate, glabrous above, whitish or brownish tomentose beneath, 1–2½ in. long: fls. 3–8, 2–3 in. wide; petals with yellow blotch. June–Aug. S. W. Eu. Gn. 53, p. 131; 64, p. 234. G.M. 34: 95. S.C. 52.—The hardiest species.



969. Cistus laurifolius. (×⅓)

BB. *Sepals 5.*

10. **salvifòlius,** Linn. Shrub, to 2 ft., sometimes procumbent: lvs. petioled, oval to ovate-oblong, rigid, very rugose above, tomentose on both sides, ½–1¾ in. long; bracts deciduous: fls. solitary or several, white, 1½ in. across. S. Eu., N. Afr., Orient. S.C. 54. Gn. 76, p. 352. G. 30:593.—A very variable species.

11. **populifòlius,** Linn. (*C. cordifòlius,* Mill. *C. Cupaniànus,* Presl). Shrub to 6 ft.: lvs. long-petioled, cordate-ovate, acuminate, penninerved, rugose, glabrous, 2–3½ in. long: fls. 2–5, white, 2 in. across. S. W. Eu. S.C. 23, 70.

C. algarvénsis, Sims=Helianthemum ocymoides.—*C. candidissimus,* Dun.; S.C. 3=C. symphytifolius, var.—*C. canéscens,* Sweet (C. villosus var. canescens, Nichols. C. albidus×C. villosus). Lvs. short-petioled, narrow-oblong or lanceolate, 3-nerved, obtuse, undulate: fls. dark purple. Of garden origin. S.C. 45.—*C. Clùsii,* Dun.=C. rosmarinifolius.—*C. corbariénsis,* Pourr. (C. populifolius ×C. salvifolius). To 5 ft.: lvs. slightly cordate, glutinous: fls. 1–5, white, 1½ in. S.C. 8.—*C. florentinus,* Lam. (C. monspeliensis× C. salvifolius). Dwarf: lvs. lanceolate: fls. white, 2 in. S.C. 59. G. 11:183; 14:241. G.M. 32:277; 31:587. Gn. 27:570; 38, p. 177; 53, p. 130, 134; 75, p. 422. F.S.R. 2, p. 43.—*C. formòsus,* Curt.= Helianthemum formosum.—*C. glaùcus,* Pourr. (C. Ledon, Lam. C. laurifolius×C. monspeliensis). 1–2 ft.: lvs. lanceolate, glossy above: fls. 5–10, white, 1½ in. S. France.—*C. hirsùtus,* Lam. 1–3 ft., clothed with spreading and glandular hairs: lvs. sessile, lanceolate: fls. 1–5, white. S.W. Eu. S.C. 19.—*C. latifòlius,* Sweet, S.C. 15=C. populifolius var.—*C. làxus,* Ait.=C. nigricans.—*C. Lèdon,* Lam.=C. glaucus.—*C. longifòlius,* Lam.=C. nigricans.—*C. Lorètii,* Rouy & Fouc. (C. ladaniferus×C. monspeliensis). Habit like C. monspeliensis: lvs. linear-lanceolate, revolute, grayish beneath, glutinous: fls. 1–5, white, 2 in. across. Of garden origin; also found spontaneous. Var. *maculàtus,* Rouy & Fouc. Fls. with 5 dark red blotches. Gn. 75, p. 633; 76, p. 439.—*C. monspeliénsis,* Linn. To 5 ft.: lvs. sessile, lanceolate: fls. white, cymose, 1 in. S. Eu. S.C. 27.—*C. nígricans,* Pourr. (C. longifolius, Lam. C. laxus, Ait. C. monspeliensis×C. populifolius). 2–4 ft., glandular: lvs. oblong-lanceolate, glossy above: fls. white, 1½ in. S.W. Eu. S.C. 12. Variable.—*C. oblongifòlius,* Sweet; S.C. 67=C. nigricans var.—*C. obtusifòlius,* Sweet, S.C. 42=C. nigricans var. —*C. rosmarinifòlius,* Pourr. (C. Clusii, Dun.) Allied to C. ladaniferus. Lvs. linear, strongly revolute at the margin, viscid above while young, tomentose beneath: fls. 4–6, white, 1–1½ in. across. W. Medit. region. S.C. 32. G.M. 31:587; 32:277.—*C. symphytifòlius,* Lam. (C. vaginatus, Dry. Rhodocistus Berthelotianus, Spach). To 2 ft.: lvs. petioled, ovate, acuminate: fls. cymose, deep rose-colored, yellow in center. Canary Isls. S.C. 9. B.R. 3:225. F.S. 15:1501.—*C. vaginàtus,* Dry.=C. symphytifolius.

ALFRED REHDER.

CITHARÉXYLUM (*Zither-wood:* used for the making of certain musical instruments). *Verbenàceæ.* Shrubs or trees, sparingly planted in southern California, and perhaps elsewhere South for ornament.

Spiny or unarmed, tomentose or glabrous, with opposite entire serrate often spinose-dentate lvs.: fls. white or sometimes yellow, odorous, small, in spiciform terminal or axillary racemes; calyx 5-toothed or -lobed; corolla-tube cylindrical, the limb broad and 5-lobed, the lobes spreading and obovate; stamens 5, included, one of them abortive, the 4 polliniferous ones didynamous; ovary more or less 4-celled, each cell 1-seeded; style often 2-lobed: fr. a fleshy drupe, partly inclosed in the calyx.—About 20 species, Mex. to S. Amer.

cinèreum, Linn. Tree, to 20 ft., the branches 4-angled and becoming cylindrical: lvs. elliptic-oblong or lance-oblong, usually obtuse, glabrous or nearly so beneath: fls. white, in long lax and nodding spike-like racemes; calyx unequally lobed; corolla-tube twice as long as calyx: fr. nearly globular, red becoming black. W. Indies. L.D. 7:493.

quadrangulàre, Jacq. Larger tree, the branches permanently 4-angled: lvs. elliptic-oblong: fls. white; calyx nearly truncate. W. Indies.—These two species are here defined as understood by Grisebach, as it is probable that the plants in cult. were determined on that basis. Schulz, however (Symbolæ Antillanæ), refers *C. cinereum,* Linn., to *C. fruticosum,* Linn.; and *C. quadrangulare,* Jacq., to *C. spinosum,* Linn. *C. quadrangulare* of Grisebach, at least in part, he refers to *C. fruticosum;* and *C. cinereum,* Jacq., to *C. spinosum.* What are the plants catalogued cannot be determined without a bringing together of material.

ilicifòlium, HBK. Low shrub, very branchy, not spiny, the branches 4-angled: lvs. elliptic-oblong, narrowed into a short petiole, entire or spinose-dentate, thick, the margin revolute, shining above and punctate beneath: fls. white, in a short terminal raceme; calyx 5-toothed; corolla scarcely exceeding the calyx, the lobes pilose: drupe size of a pea. Ecuador.

barbinérve, Cham. Spiny shrub, the branches 4-angled: lvs. obovate or elliptic-lanceolate, acute or obtuse or retuse, narrowed into a petiole, nearly entire, glabrous and shining above and paler and somewhat pilose beneath, bearded at the axils of the nerves: fls. white, in a terminal laxly-fld. raceme. Brazil, Uruguay.

L. H. B.

CITRANGE (from *Citrus trifoliata* and *orange* by syncopation: *Ci*[*trus*] *tr*[*ifoliata*] [*or*]*ange*). *Rutàceæ.* A hybrid between the common orange and the hardy trifoliate orange, *Poncirus trifoliata* (*Citrus trifoliata*).

Citranges have trifoliate lvs., but the lateral lfts. are much smaller than the terminal one: lvs. semi-deciduous, falling completely only during a very severe winter: fls. borne on new wood in spring, very large, white, sometimes over 2½ in. diam., but with long and narrow petals, which vary much in size in different citranges: frs. variable, from 1–4 in. diam., globose, or depressed-globose, red-orange or lemon-yellow, smooth or hairy, the pulp abundant and very juicy, acid or subacid, with an agreeable aromatic flavor; peel often full of a disagreeably flavored essential oil.

The citranges are very cold-resistant if in a dormant condition, being able to stand temperatures as low as 15° or even 10° F. without injury. They are not adapted to commercial culture but are of much interest for home use in the cotton-belt of the southern states where the winters are too severe to permit of the culture of oranges or other citrous fruit. The flowers are showy and fragrant and the handsome fruits are used for making ade and for culinary purposes. The first successful hybrids between these plants were made by the writer at Eustis, Florida, in March, 1897, where eleven were secured. These remarkable hybrids were named citranges by H. J. Webber and the writer in 1905 (Yearbook, Department of Agriculture for 1904).

The principal varieties now grown in the southern states are:

Rusk (Fig. 970).—This is the most precocious of the citranges and has the smallest fls. and smallest (1½–2 in. diam.) and reddest frs. Young grafted trees often bear in 3 years. The foliage is dense and dark green. The frs. are thin-skinned, aromatic, juicy, and almost seedless. The peel contains a disagreeable oil and care must be taken to keep this out of the juice of the fr. Many thousand trees of this variety are now growing in the southern states and are prolific bearers.

Colman.—This is very unlike all the other citranges. The frs. are large, 3–3½ x 2¾–3½ in., flattened, light yellow, and with a thick fuzzy peel, usually nearly seedless; the pulp is greenish, juice abundant, strongly acid, agreeably aromatic. It can be used for ade.

Morton.—The largest of the citranges, fr. often weighing more than 1 lb. Fr. round, resembling a large orange, rind medium, pulp sprightly acid, with a peculiar taste, usually seedless. Tree a vigorous grower, cold-resistant.

Saunders.—A small-fruited variety. Frs. 2–2½ in. diam. with 5–10 seeds, orange-yellow, peel thick with prominent oil-glands. The thick skin of this hybrid makes it keep well.



970. Rusk citrange. (×⅓)

The juice is sharply acid This is probably the most cold-resistant of the citranges tested as yet.

Etonia.—This hybrid is remarkable for its profuse bloom. The large white fragrant fls. make this a good ornamental in the cotton-belt; frs. small, very few.

Cunningham.—This resembles the Colman in having fuzzy frs. which are, however, small and nearly spherical. The juice is sharply acid, aromatic, and makes very good ade.

Savage.—Fr. similar to an orange in appearance, 2–3 x 2½–3½ in., light yellow, rind medium thick, bitter, pulp tender, translucent, juice with a sprightly acid flavor, aroma pleasant. Tree very vigorous and prolific. Foliage dense.

WALTER T. SWINGLE.

CITRON (*Citrus Mèdica*, Linn.). *Rutàceæ*. Fig. 971. A large lemon-like fruit with a very thick peel and a small amount of very acid pulp; the peel is candied and used in confectionery and for culinary purposes.

The citron is grown in the Mediterranean regions, especially in Corsica, and large quantities are preserved in brine and shipped to the United States to be candied. The Corsican citron of commerce was introduced into this country in 1894 by David Fairchild for the Division of Pomology of the United States Department of Agriculture, and it has been grown to some extent in California.



971. Citron—Citrus Medica, Corsican variety. (×⅖)

The plant usually is propagated by cuttings but it can be grafted on rough lemon or other stock. In the region of Valencia, in eastern Spain, the citron is used in propagating oranges, since citron cuttings strike root more easily than oranges. A piece of citron twig is grafted into branches of orange which are afterwards set as cuttings whereupon the citron strikes root and later on the orange. Then the roots are exposed and the citron roots cut away, leaving the orange growing on its own roots.

The citron can be planted and cultivated much as the lemon in cool equable climates, such as in the coastal region of southern California. In Corsica, the trees are kept low and trained in vase form, but otherwise treated like lemons.

There are but few citron orchards in the United States; one at West Riverside, California, about 10 acres in extent, is perhaps the largest.

The Etrog or sacred Jewish citron, used by the Jews at the Feast of Tabernacles, has small greenish yellow fruits which, if they are of exactly the prescribed size, form and color, may bring as much as $5 or $10 each. This variety is grown principally in the island of Corfu. See *Citrus* and *Etrog*.

The word citron is also applied to the preserving watermelon: see *Citrullus* and *Melon, Water*.

WALTER T. SWINGLE.

CITRÓPSIS (*Limonia* § *Citropsis*, Engler). *Rutàceæ*. AFRICAN CHERRY ORANGE. Very interesting and as yet little-known citrous trees, of interest for use in hybridizing and for stocks, also promising as ornamentals.

Small spiny trees: lvs. compound, 3–12 in. length; lfts. 3, 5 or even 7, coriaceous; petioles and rachis usually very broadly winged; fruiting twigs sometimes with unifoliate lvs.: spines usually paired, sometimes single: fls. large, white, in the axils of the lvs., tetramerous (rarely 5-merous), with 8 free stamens: frs. small, ¾–1½ in. diam., borne in tufts in the axils of the lvs., bright orange-colored, with an agreeable odor and a pleasant flavor, 3–4-celled, with a single seed in each cell; cells in some species filled with pulp-vesicles full of pleasantly flavored juice.

There are several species of this interesting genus in the tropical forests throughout central Africa. These plants, because of their sweet high-flavored fruits borne in tufts like cherries and their unusually large compound leaves, should prove very interesting for use in hybridizing. Tests made in the greenhouses of the Department of Agriculture, at Washington, have shown that at least two species of Citropsis can be budded readily and grow very well on the common citrous stocks. This genus is undoubtedly closely related to Citrus. See descr. in Journ. Ag. Research, 1:419–436, w. figs.

Preûssii, Swingle & M. Kellerman (*Limònia Preùssii*, Engler. *L. Demeùsei*, De Wild?). Lvs. 3–5-foliate, with very broadly winged petioles and rachis; lfts. large, broadly oval: fls. large, axillary; style long, slender, broad at the base: frs. small, apiculate. Kamerun. W. Congo. Ill. Engler & Prantl, Nat. Pflanzf. III. 4:189, fig. 109, E. H. De Wildeman, Etudes Fl. Congo, pl. 41.

Schweìnfurthii, Swingle & M. Kellerman (*Limònia Schweìnfurthii*, Engler. *Limònia ugandénsis*, Baker). Fig. 972. A species named from sterile leafy twigs collected by Schweinfurth at Uando at the headwaters of the Ghazal branch of the Nile. Lvs. 3–5-foliate; lfts. narrowly lanceolate, acute at both ends: fls. large, usually 4-merous; style rather short and thick: frs. lime-like, 1½ in. diam., sweet. Sudan, Uganda, Congo.

gabonénsis, Swingle & M. Kellerman (*Limònia gabonénsis*, Engler). Lvs. of medium size, sometimes unifoliate like orange lvs., sometimes 5–7-foliate; rachis narrowly winged; lfts. caudate: fls. small, borne on long pedicels, 4-merous; style not broad at base: frs. globose, small, about 1 in. diam., almost dry, having only rudimentary pulp-vesicles; seeds large. French Congo, Kamerun.

WALTER T. SWINGLE.
MAUDE KELLERMAN.

CITRÚLLUS (diminutive of *Citrus*, said to be in allusion to the shape of fruits and color of flesh resembling those characters in fruits of the orange or citron). *Cucurbitàceæ*. Annual or perennial tendril-bearing herbs of three or four species, one yielding the watermelon and one the colocynth.

Climbing or long-trailing, hispid or rough, with 2–3-parted tendrils, often with a strong odor: lvs. alternate, petiolate, mostly round-cordate in general outline, deeply 3–5-lobed, and the divisions often again lobed, and the segms. commonly obtuse: fls. monœcious, solitary and peduncled in the lf.-axils, the corollas 5-lobed; stamens 3, included and united or cohering by the anthers, and rudiments of stamens in the pistillate fls.; pistil 1, the ovary ovoid or globose, bearing a short style and 3-lobed stigma: fr. a globular pepo, morphologically 3-celled, usually smooth and with a hard rind.—Trop. Afr. and Asia, 2 of the species now widely distributed in warm and tropical countries.



972. Citropsis Schweinfurthii. (×¼)

vulgàris, Schrad. WATERMELON (see *Melon*, for culture). Annual, glabrous or pubescent: lvs. not rough, either deeply or moderately divided, the sinuses open and obtuse: fr. in the wild state from the size of an apple to that of a man's head, sweet or slightly bitter. Trop. and S. Afr.—When the fr. is sweet and edible (*C. Cáffer*, Schrad.), it is the watermelon, or "kaffir watermelon" of S. Afr.; when bitter (*C. amàrus*, Schrad.), it is the "bitter-apple" of S. Afr. The fr. now varies widely in cult., in size, season, shape and quality. The soft pink flesh is much prized in its natural state for eating. A form with hard and inedible white flesh is known as "citron," and the rind is used for the making of preserves (as is the rind of the true citron).

Colocýnthis, Schrad. (*Colocýnthis officinàlis*, Schrad. *Cùcumis Colocýnthis*, Linn.). COLOCYNTH. BITTER-APPLE. Perennial (in the wild), the st. angular and rough: lvs. rough, 2–4 in. long, 3- or 7-lobed, the middle lobe sometimes ovate, the sinuses open and the lf. in general form like that of *C. vulgaris:* ovary villous: fr. globose, green-and-yellow variegated, about 3–4 in. diam., intensely bitter; seeds small (¼in. or less long), smooth. Trop. Asia and Afr., now widely distributed in Afr. and the Medit. region.—The dried frs. are used in medicine (as purgative), being imported from Turkey and Spain. Sometimes cult in this country as a curiosity or in collections of economic plants; culture for officinal purposes has been attempted in New Mex., but the frs., although larger than the official product, are reported to be less active. L. H. B.

CÍTRUS (ancient name of a fragrant African wood, afterward transferred to the Citron). *Rutàceæ*. CITRON. LEMON. ORANGE. Small evergreen, more or less spiny trees or shrubs, grown for their edible fruits, and also attractive in foliage and flower.

Leaves glandular-dotted, persistent, apparently simple (in reality unifoliate compound lvs.), borne on more or less winged or margined petioles, which are usually articulated with the blade and at their attachment to the twig: spines usually present, borne singly at the side of the bud in the axils of the lvs.: fls. clustered or rarely solitary in the axils of the lvs., or in small lateral or terminal cymes or panicles, white or pinkish purple in the bud; petals 5 (rarely 4 or 6) thick, strap-shaped, not clawed at the base, imbricated; stamens numerous (16–60, usually 20–40) at least four times as many as the petals, polyadelphous, cohering toward the bases in a few bundles; ovary 8–15-celled, with a prominent usually deciduous style containing as many tubes as there are cells in the ovary: fr. a hesperidium, globose, oval or oblate-spheroid, the segms. filled with juicy pulp composed of stalked pulp-vesicles; seeds 1–8 in a cell, oval or oblong, ¼–¾in. long, with a pergameneous testa and thick fleshy cotyledons, usually with adventive embryos arising as buds from the nucellar tissue of the mother plant. Natives of Trop. and Subtrop. Asia and the Malayan Archipelago.—Half a dozen species are commonly cult. and have given rise to very many varieties as well as numerous hybrids, making the delimitation of the species exceedingly difficult. See *Citrange, Citron, Etrog, Grapefruit, Lemon, Lime, Limequat, Orange, Pomelo, Tangelo.*

The nomenclature here followed is based on the writer's treatment of the species of Citrus in "Plantæ Wilsonianæ." The fewest possible number of changes have been made consistent with presenting a clear account of the genus. A careful study of Citrus and the genera most nearly related to it has shown that the trifoliate orange differs in so many and such important characters that it seems necessary to recognize it as a separate genus (*Poncirus*). The same is true of the kumquats and the Australian limes.

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KEY TO THE SPECIES.

A. *Winged petiole nearly as large as the blade of the lf.: seeds very large, thick: fr. rough, oval, lemon-yellow when ripe: fls. solitary* ..... 9. ichangensis

AA. *Winged petiole much smaller than the blade of the lvs.: seeds small or medium sized: fls. usually in clusters.*

B. *Lvs. apparently not jointed between blade and petiole, oblong-serrate; petiole wingless: fl.-buds tinted reddish: fr. with a very thick peel, fragrant, pulp acid* ..... 1. Medica

BB. *Lvs. with an obvious joint between the blade and petiole, crenate: peel thin or only moderately thick.*

C. *Fl.-buds tinted reddish on outside: petioles merely margined: lvs. crenate: frs. oval, more or less apiculate* ..... 2. Limonia

cc. *Fl.-buds white: petioles more or less winged.*
d. *Frs. oval, often slightly papillate, small, 1–1½ in. diam., greenish-yellow when ripe, thin-skinned, smooth: fls. small: petioles plainly winged: lvs. small, pallid above, crenate, more or less punctate, obtuse: spines short, very sharp* ..... 3. **aurantifolia**
dd. *Frs. globose, depressed globose, rarely oval or pyriform, never papillate, orange-colored, or if yellow, frs. large and thick-skinned.*
e. *Size of fr. very large, pale yellow when ripe: twigs pubescent when young: petioles broadly winged* ..... 4. **grandis**
ee. *Size of fr. medium or small, orange or orange-yellow.*
f. *The frs. with a solid core and a light skin; pulp sweet: petioles slightly winged* ... 6. **sinensis**
ff. *The frs. with a hollow core when fully ripe, skin loose or, if tight, pulp acid and petioles broadly winged.*
g. *Skin tight: petioles broadly winged: pulp acid* .... 5. **Aurantium**
gg. *Skin loose: petioles only narrowly winged or margined.*
h. *The fr. borne singly at tips of branches, small; segms. 7–10, pulp very acid: lvs. pale beneath* ..... 8. **mitis**
hh. *The fr. borne in axils of the lvs.; segms. 8–15, pulp sweet: lvs. dark green below* ..... 7. **nobilis**

1. **Mèdica,** Linn. (from Media whence the species first came to the notice of the ancient Greeks and Romans). CITRON. Fig. 971. A shrub or small tree, with long irregular branches: thorns short, stout and stiff: lvs. rather pale green, large, oblong, 4–6 or 7 in. long and 1½–2 in. wide, bluntly rounded at the tip with serrate margins, not articulated with the petioles, which are wingless: fls. large, reddish tinted when in the bud, usually in terminal panicles, or clustered, in the axils of the lvs.; petals large, white above, reddish purple below; stamens numerous, 30–40 or more; ovary tapering gradually into the often persistent style: fr. large, oval or oblong, 6–10 x 4–6 in., bluntly apiculate, often rough or bumpy, lemon-yellow when ripe; skin very thick, fragrant; pulp scanty, acid; seeds oval, smooth, white inside.—The citron is very sensitive to cold because of its ability to grow at low temperatures, which causes it to start into a fresh and very tender growth after a few days of warm weather in winter. It is cult. in the Medit. region, especially in Corsica, whence large quantities of the peel are exported in brine to Amer. to be candied. The candied peel is much used in confectionery and in cakes. Sparingly cult. in Calif. and Fla. A number of ill-defined varieties are grown, the most important being the Corsican, intro. from Corsica in 1894 by David Fairchild. The Etrog or sacred Jewish citron is grown in Corfu. See *Citron.*



973. Fingered citron.—Citrus Medica var. sarcodactylis. (×⅛)

Var. **sarcodáctylis,** Swingle (*Cítrus sarcodáctylis* v. Nooten. *C. Mèdica* var. *digitàta,* Auct., not Lour.). FO SHU KAN (Chinese). BUSHUKAN (Japanese). Fig. 973. Differs from the common citron in having the segms. of the fr. separated into finger-like processes. The frs. are very fragrant and are used by the Chinese and Japanese for perfuming rooms and clothing. It is sometimes grown as a dwarf potted plant for ornament. It should be intro. into this country.

2. **Limònia,** Osbeck (from Arabic *limūn,* a lemon) (*C. Mèdica* var. *Limon,* Linn. *C. Limònium,* Risso). LEMON. Fig. 974. A small tree with long irregular branches: thorns short, stout and stiff: lvs. rather pale green, elongate-ovate, pointed at the tip, with serrate or sub-serrate margins; petioles wingless but sometimes narrowly margined, articulated both with the blade and the twig: fls. rather large, solitary or in small clusters in the axils of the lvs., reddish-tinted in the bud; petals white above, reddish purple below; stamens 20–40; ovary tapering into the deciduous style: fr. oval or oblong, with an apical papilla, 3–5 x 2–3 in. with 8–10 segms., lemon-yellow when ripe, with a prominently glandular-dotted peel, often more or less rough and moderately thick; pulp very abundant, very acid; seeds small, ovate, smooth, often few or none, white inside. —The lemon is very sensitive to cold as, like the citron and the lime, it is readily forced into new growth by a few days of warm weather in winter. It is found in all tropical and warm subtropical regions and is cult. on a large scale in the Medit. region, especially in Sicily, whence large quantities of the frs. are exported to the U. S. In this country the lemon is widely cult. in Calif. and to a much smaller extent in Fla. The frs. are gathered just before they ripen while still green in color and often before they attain their full size and are then ripened in curing-houses, in which temperature and humidity are artificially controlled. The juice is used for making lemonade, for cooking, and the arts; the peel is used in cooking and the oil extracted from it is used in cooking and in perfumery. The principal cult. varieties have rather small smooth frs. The more important varieties are listed here: *Eureka.* Frs. oval-oblong, medium size, usually seedless, ripening early: tree small, nearly thornless. *Genoa.* Frs. oval, pointed at base and tip, ripening early, seedless: tree dwarf. *Lisbon.* Frs. oblong, with a large papilla at the tip, few-seeded: tree of medium size, thorny; a vigorous grower. *Villa Franca.* Frs. oval-oblong, medium to large, apex abruptly papillate, seeds numerous: tree of good size, nearly thornless. *Kennedy.* Frs. oval, with a very small papilla, thin-skinned, nearly seedless. *Ponderosa.* Frs. very large, sometimes weighing 2½ lbs., with a neck at the base; seeds numerous. *Everbearing.* Frs. large, abruptly papillate at the tip, with a narrowed neck at the base, rough all over; seeds rather numerous: everbearing, borne on a straggling bushy tree that sprouts from the roots. Grown for home use in Fla. *Rough* (Florida Rough). A tree of doubtful origin, occurring wild in the Everglades of S. Fla.: frs. round-ovate, very rough, apical papilla surrounded by a depressed ring; seeds numerous: tree large and vigorous. The frs. of this variety are useless for commercial purposes, but the seeds are in considerable demand by



974. Citrus Limonia. (×⅛, fr. ¼)

nurserymen as the tree makes an excellent stock for very poor sandy or calcareous soils. See *Lemon*.

3. **aurantifòlia,** Swingle (*Limònia aurantifòlia,* Christmann. *C. límétta* Auct. not Risso). LIME. A small tree, with rather irregular branches: spines very sharp, short, stiff: lvs. small, 2–3 in. long, elliptic-oval, crenate, rather pale green; petioles distinctly but narrowly winged: fls. small, white in the bud, occurring in few-fld. axillary clusters; petals white on both surfaces; stamens 20–25; ovary rather sharply set off from the deciduous style: fr. small, oval or round-oval, 1¼–2½ in. diam., often with a small apical papilla, with 10 segms., greenish yellow when ripe; peel prominently glandular-dotted, very thin; pulp abundant, greenish, very acid; seeds small, oval, smooth, white inside.—The lime is perhaps the most sensitive to cold of any known species of Citrus. Even a few days of moderately warm weather in winter suffice to force it into a tender and succulent growth that is killed by the slightest frost. It is found in all tropical countries, often in a semi-wild condition. It is cult. in the warmest parts of Fla., especially on the Keys. Large quantities of the fr., picked when still green and often not full-sized, are packed in barrels and shipped to the cities of the N. U. S., where they are extensively used for making limeade. Large quantities of bottled lime juice are exported from Montserrat and Dominica Isls. in the W. Indies, and used on shipboard for preventing scurvy. Limes are too thin-skinned to keep well and are not processed as are lemons. It is usually prop. from seed—rarely from cuttings. The principal varieties grown in the U. S. are: *Mexican* (West Indian). Frs. small, smooth, often with a slight apical papilla; seeds few: tree small, very spiny, usually branching from the base. This variety, almost always grown from seed, is the only one planted on any considerable commercial scale. *Tahiti* (Persian?). Frs. large, smooth, with a broad apical papilla; seedless, about the size and shape of an ordinary lemon: poor keepers. See *Lime*. Hybrids: *Sweet* (*C. limetta,* Risso ?). Frs. about the size of a lemon, with a sweet and insipid pulp. Commonly grown in the W. Indies and Cent. Amer. Limequats are new hardy hybrids between the common Mexican lime and a kumquat; these hybrids vary much in size, shape and flavor, but some are about the size of a lime and have abundant very acid pulp. See description under *Limequat*.

4. **grândis,** Osbeck (*C. Aurántium* var. *grándis,* Linn. *C. Aurántium* var. *decumána,* Linn. *C. decumána,* Linn.). GRAPEFRUIT (or POMELO). SHADDOCK. PUMMELO. Fig. 975. A large round-topped tree, with regular branches: spines, if present, slender and flexible, rather blunt: lvs. large, dark glossy green above, oval or elliptic-oval, with a broadly rounded base; petiole broadly winged, more or less cordate: fls. axillary, borne singly or in clusters, large, white in the bud; petals white on both sides; stamens 20–25, with large linear anthers; ovary globose, sharply delimited from the deciduous style: fr. very large, 4–6 in. diam., globose, oblate spheroid or broadly pear-shaped, smooth, with 11–14 segms., pale lemon-yellow when ripe, peel ¼–½in. thick, white and pithy inside; seeds usually very numerous, large, flattened and wrinkled, white inside.—The grapefruit (or pomelo) is now one of the most appreciated citrous frs. grown in the U. S. The culture of this delicious fr. was limited to the Fla. pioneers until some 25 years ago, when the first commercial plantations were made. Since then, there has been a steady increase in the area devoted to this fr. in Fla., and plantings have been made in Calif., Ariz., and the West Indies. The pummelo of India, called shaddock in Fla., is not grown on a commercial scale, but occurs in many tropical countries. The grapefruit is usually served as a breakfast fr. cut in half and seeded. It is a vigorous grower, even on light sandy loam soils and is coming increasingly into use as a stock upon which to graft other citrous frs. The young trees are tender, but the mature ones are well protected by a dense canopy of lvs. and may stand more cold than an orange tree. The grapefruit is much like the orange in its ability to resist cold and is much less easily forced into a new growth by a few warm days in winter than the lime or lemon. The varieties of grapefruit grown in the U. S. have almost all originated in Fla., where the early settlers prop. this tree from seed, thereby originating many slightly different varieties, the more important of which are listed here: *Duncan.* Fr. large, keeps well on the tree, seeds few: tree rather hardy. *Hall* (Silver Cluster). Frs. medium size, produced in large clusters; seeds numerous. *Triumph.* Fr. small or medium size, early: tree rather tender. Does not succeed well when budded on sour orange stock. *McCarty.* Fr. large, late, borne singly; seeds numerous. A variety recently found in the Indian River region of Fla. Besides these standard varieties of grapefruit of the Fla. seedling type a large number of other similar varieties are cult. locally in the state, such as the Bowen, Excelsior, Josselyn, Leonardy, Manville, May, McKinley, Standard (or Indian River), Walters, and many others. The following varieties differ more or less widely from the old Fla. seedling type. *Marsh.* Frs. large, depressed globose, often seedless; pulp subacid, less bitter than in the other varieties. This variety, though it originated as a seedling in Fla., is best adapted to cult. in Calif., where many of the ordinary Fla. varieties do not succeed well. *Pernambuco.* Frs. large, skin very smooth, light-colored, late; seeds abundant. Intro. from Pernambuco, Brazil, to the U. S. by the U. S. Dept. of Agric.—The shaddocks or pummelos are seldom cult. in the U. S. The Tresca variety from the Bahama Isls. has large pyriform frs., with pink flesh of good flavor and abundant seeds: the tree is tender. A pummelo from near Canton, China, is imported into San Francisco on a small scale by the Chinese resident there. The frs. are pyriform, very thick-skinned, not pink within; seeds numerous. Some seedlings of this variety are to be found at various points in Calif. They are very leafy and of vigorous growth, and make excellent stocks upon which to graft other citrous frs. Many other sorts of pummelos are known from Asia and the Malayan Archipelago and some have been intro. for trial by the Office of Foreign Seed and Plant Introduction of the U. S. Dept. of Agric. The true grapefruit seems to be scarcely known outside of U. S. and the W. Indies. See *Grapefruit* and *Pomelo*.



975. Citrus grandis. (×⅔)



976. Citrus Aurantium. (×⅔)

5. **Aurántium,** Linn. (*C. vulgàris,* Risso. *C. Bigaràdia,* Risso. *C. Aurántium* var. *Bigaràdia,* Hook. f.). SOUR or SEVILLE ORANGE. Fig. 976. A medium-sized tree, with a rounded top and regular branches: spines long but flexible and blunt: lvs. light green when young, medium-sized, 3–4 in. long, tapering to the somewhat wedge-shaped base, and more or less acuminate at the tip; petiole broadly winged: fls. medium-sized, axillary, single or clustered, white in the bud; petals white on both sides, very fragrant; stamens 20–24; ovary globular, sharply delimited from the deciduous style: fr. 2¾–3¼ in. diam., globose, slightly flattened at the

tip, with a hollow core when fully ripe; pulp acid, membranes with a bitter taste, segms. 10–12; seeds cuneate-oval, flattened, with raised lines, white inside.—The sour or Seville orange is grown all over the world. It is able to withstand more cold than most of the other citrous frs. and is rarely forced into new growth by warm weather occurring in winter. The sour orange is found in a thoroughly naturalized condition in many parts of Fla. where it doubtless was brought by the Spaniards. Most of these wild sour orange trees were dug up and transplanted for use as stocks when orange-culture was being rapidly extended some 25–30 years ago. The Seville orange, as its name would indicate, is grown on a commercial scale in the vicinity of Seville, Spain, whence the frs. are shipped in large quantities to England and Scotland for use in making orange marmalade, for which this species is best adapted. The petals yield a valuable perfume, oil of Neroli, which is produced in the south of France and the Italian Riviera. The peel of the fr. is sometimes candied and, when fresh, yields an essential oil. The sour orange is grown in a small way in Fla. for home use, the frs. being used for making "orangeade." In the U. S. the sour orange is used almost exclusively as a stock on which to bud other citrous fr. trees. The seeds are in demand by nurserymen at a good price for this purpose. The sour orange is well adapted to grow on a great variety of soils but is especially well fitted for low wet soils, where it is valuable because it is immune to the *mal di gomma* or foot-rot so destructive to the common orange and lemon on such soils. There are no named varieties of the sour orange in cult. in the U. S.—Mutations: The so-called *Citrus myrtifolia*, a narrow-lvd. form with spineless twigs and short internodes, bearing small flattened sour oranges is a mutation arising from the root of the sour orange. *Chinotto* (the Chinoise of the French confectioners). This is a broader-lvd. form of the above described mutation. It is cult. along the northern shore of the Medit. from Genoa to Toulon, yields the small green frs. used for candying. This variety, which should be called the Chinotto, is being tested in the U. S. and may prove adapted for commercial culture on a small scale in this country. Hybrids: *Bittersweet.* A good-sized tree occurring wild in Fla., is undoubtedly a hybrid between this species and the following. Frs. oblong, flattened at the ends; pulp sweet, but the membranes separating the segms. have a bitter taste. The fr. ripens very late on some trees and keeps well on the tree.

6. **sinénsis,** Osbeck (*C. Aurántium* var. *sinénsis*, Linn. *C. Aurántium*, Lour. et Auct., not Linn.). Common or Sweet Orange. Fig. 977. A medium-sized tree, with a rounded top and regular branches: spines, when present, slender, flexible, rather blunt: lvs. medium-sized, rounded at the base, pointed at the apex; petiole narrowly winged, articulated both with the blade and the twig: fls. medium-sized, smaller than those of the sour orange, white in the bud; petals white on both surfaces; stamens 20–25; ovary subglobose, clearly delimited from the deciduous style: fr. subglobose or oval, pith solid, pulp sweet, membranes not bitter in taste, segms. 10–12 or 13 in number; seeds cuneate-ovoid with rugose margined plane surfaces, white inside.—The common or sweet orange is widely cult. in all the tropical and subtropical regions of the world. It is rather tender, not so hardy as the sour or Seville orange, but much more cold-resistant than the lemon or lime. A very few orange trees occur in a semi-wild state in S. Fla. Sweet oranges were doubtless intro. into Fla. by the Spaniards nearly four centuries ago and, as they were prop. by seeds until within the last half-century, many local varieties have arisen there. Orange-culture has reached its highest development in S. Calif., where it constitutes one of the most important agricultural industries. Fla. is second only to Calif. in the extent and value of the orange groves, while some oranges are grown in favored spots in La., Texas, and Ariz.—Oranges are the best known and probably the most highly esteemed dessert fr. A few are used in cooking and the peel is sometimes candied. An essential oil is also pressed from the peel. The sweet orange is commonly used as a stock on which to graft other species of citrous frs. It grows well on light well-drained loam or sandy loam soil. On heavy soil it is subject to the *mal di gomma* or foot-rot. Very many varieties are in cult. Some of the principal sorts grown in the U. S. are listed here. (1) Florida seedlings—varieties originated in Fla. as a result of prop. oranges from seed, mostly strong-growing trees: *Parson Brown.* Frs. medium-sized, very early. *Pineapple.* Frs. medium or large, very juicy; seeds rather numerous: midseason: tree a strong grower. *Homosassa.* Frs. medium-sized, very juicy: a good bearer and keeper: tree nearly thornless. *Madam Vinous.* Frs. medium or large; pulp coarse-grained, juicy; midseason. *Nonpareil.* Frs. rather large, flattened; pulp fine-grained, juicy: tree vigorous. Also Arcadia, Summit, Foster, Hick, Magnum Bonum, May, Old Vini, Osceola, Stark, Whittaker, and very many others of the same general type. (2) Florida mutations or hybrids—new sorts originated in Fla., usually differing in some striking way from the old Fla. seedling oranges, perhaps through hybridization with foreign varieties. *Boone* (Boone's Early). Frs. medium size, strongly oval or oblong, very juicy, very late, keeping well on the tree: lvs. with petioles varying in width. *Lue Gim Gong.* Frs. oval, juicy, ripening very late and holding very well on the tree, even until late summer. A variety newly intro. into cult. *Drake Star.* A rare variety with variegated foliage; usually a poor bearer but sometimes bearing a good crop of excellent fr. (3) Mediterranean varieties, largely intro. into Fla. by Sanford and Lyman Phelps, about 30–40 years ago: *Ruby.* Frs. small or medium-sized; peel red-orange; pulp streaked with red when fully ripe, juicy; seeds rather few: rather late: tree vigorous, nearly thornless, prolific. *St. Michael.* Frs. medium-sized, oblong, red-blotched when ripe; flesh wine-red; seeds few; rather early. *Jaffa.* Frs. large, oblong, juicy; seeds few. Possibly not the same as the celebrated orange of Jaffa, Palestine. *Mediterranean Sweet.* Frs. large, oval, juicy, late: tree nearly thornless. *Majorca.* Frs. round or slightly flattened, juicy: rather late. *Hart* (Hart's Tardiff). Frs. round or slightly oval, medium to large size, juicy; seeds few; ripens very late: similar to the next and thought by some to be identical. *Valencia* (Valencia Late). Frs. medium to large, oval or rounded, juicy, nearly seedless, very late. A prolific variety, largely grown in Calif. and held in cold storage until early autumn. There are many other Medit. varieties of nearly or quite as much value as some of the above, such as, Centennial, Du Roi, Joppa, Paper Rind, Prata, Saul Blood, St. Michael (Blood), etc.—The navel oranges all show a second smaller more or less included fr. formed at the tip of the main fr. Many varieties are of foreign origin. *Washington* (Bahia, Washington Navel). Fr. large, rounded slightly, pointed at apex; flesh firm, juicy; skin



977. Citrus sinensis. ($\times\frac{2}{5}$)

very tough; seedless: early midseason. The most famous variety of oranges intro. from Bahia, Brazil, by Wm. Saunders of the U. S. Dept. of Agric. in 1870. Its cult. has steadily extended in Calif. until it is the principal variety grown there. It does not succeed well in Fla. *Thompson* (Thompson's Improved Navel). A smooth-skinned hard-fleshed variety found by A. D. Shamel to arise as a mutation from the preceding, to which it is inferior in quality though better in appearance. *Australian.* Frs. large, coarse: tree vigorous, but a shy bearer. Also found by Shamel as a variation of the Washington Navel (Bahia). *Surprise.* Fr. medium-sized, rounded or even slightly flattened, juicy, early, seedless. A variety originated by E. S. Hubbard, of Fla. *Double Imperial.* Fr. small or medium-sized, navel hidden; pulp firm; seeds few or none. A Brazilian variety, said to fruit well in Fla. when budded on trifoliate orange stock. There are many other varieties of navel oranges occasionally grown on a commercial scale. In Calif., among others, Golden Nugget and Navelencia; in Fla., Egyptian, Melitensis, and Sustain are known. There are doubtless many more navel oranges which should be tested. See *Orange.* Hybrids: Citranges are hardy hybrids between the common sweet orange and the trifoliate orange, *Poncirus trifoliata.* The principal varieties are the Rusk, Morton, Colman, Savage, Cunningham and Saunders. See description under *Citrange.*



978. *Citrus ichangensis.* (×⅔)

7. **nóbilis,** Lour. KING ORANGE. Small trees, with slender twigs and pointed lvs., with very narrowly winged or merely margined petioles: fls. small, white; stamens 18–24: fr. with a loose peel and a hollow pith; seeds usually green inside.—This species comprises several well-marked groups; the original *C. nobilis* of Loureiro was undoubtedly something very like the King orange, a medium-sized tree with long upright branches, with dark bark, having large depressed globose fr. with a rough thick not very loose skin; segms. usually 12–13; seeds rather numerous, large like those of a sweet orange, white inside. See W. A. Taylor, Yearb. Dept. Agric. 1907, pl. 34. This variety was found by Loureiro growing in Cochin China in the latter half of the 18th century and was intro. into Amer. by Mrs. S. R. Magee, of Riverside, Calif., in 1880, from Saigon, Cochin China, which introduction became known as the King orange. It has frs. of large size, very juicy, and of delicious vinous flavor. Its rough skin seems to be no obstacle to its ready sale at good prices.

Var. **deliciòsa,** Swingle (*C. deliciòsa,* Tenore). MANDARIN ORANGE. A small tree, with slender branches, willow-like lvs., with merely margined petioles: fls. small: frs. depressed globose, bright orange-yellow or reddish orange, with a very loose peel; seeds small, beaked, bright green within.—This variety comprises the many varieties of Mandarin oranges, including the so-called tangerine varieties. These are delicious dessert frs., attractive in appearance and easy to handle because of the loose skin and the easily separable segms. Aside from the greater ease of preparing them for the table, Mandarin oranges are used exactly as are common oranges. The principal varieties grown in the U. S. are the following: *Mandarin* (China, China Mandarin, Willow-leaved). Fr. medium-sized, 2–3 in. diam., depressed-globose, early, orange-yellow; very juicy; sweet; seeds abundant. *Oneco.* Fr. medium to large, orange-yellow, midseason. Intro. from India in 1888. *Tangerine* (Dancy's Tangerine). Fr. red-orange, medium size, depressed-globose, juicy; seeds rather abundant: midseason: tree of good size: lvs. much broader than those of the Mandarin variety. Other Mandarin oranges are occasionally grown, especially in Fla., such as the Beauty, Cleopatra, Kino Kumi, and Mikado. Hybrids: Tangelos, are a striking new group of citrous frs. *Sampson,* the first tangelo to be grown commercially, was obtained by the writer in 1897 by crossing the tangerine with Bowen grapefruit; it is unlike either parent in quality, being more like a choice sprightly flavored sweet orange. Many other tangelos are now being tested. See *Tangelo.*

Var. **únshiu,** Swingle (*C. nóbilis* subsp. *genùna* var. *únshiu,* Makino). SATSUMA OR UNSHIU ORANGE. A small spineless tree, with a spreading dwarf habit: lvs. broad, abruptly narrowed toward the apex, with strongly marked veins on both faces: fls. small, very abundant: fr. depressed-globose, 2–3¼ in. diam., deep orange; pulp orange, very juicy, of a peculiar but agreeable flavor; pith hollow; segms. 9–13; seeds often lacking, when present only few in number, broadly top-shaped, not beaked as in the Mandarin oranges, greenish within.—This very marked orange seems to constitute a botanical variety distinct from the King or the Mandarin oranges. It is commonly grown in Japan, whence it was intro. into Fla. by Geo. R. Hall in 1876, according to H. H. Hume, "Citrus Fruits and Their Culture," p. 112. 1909. The Satsuma orange is one of the hardiest of all edible citrous frs. Budded on the trifoliate orange, it can be grown in many parts of the Gulf Coast region, where all other citrous frs. except citranges are killed by cold. The Satsuma can be grown best on the trifoliate orange stock. It grows on sweet stock but does not produce as much nor as good fruit and is not so hardy. It makes only a stunted growth on sour orange stock and soon dies. It cannot be grown satisfactorily on light sandy land or on black waxy lands with a marly subsoil where the trifoliate orange does not grow well. It could be grafted on Rusk citrange for the black waxy lime soils of Texas.

8. **mìtis,** Blanco. CALAMONDIN ORANGE. A small tree, with upright branches: lvs. broadly oval, pale green below like those of kumquat; petiole narrowly winged: fls. small, angular in the bud, borne singly at the tips of the twigs: fr. small, depressed globose, deep orange-yellow when ripe, loose-skinned; segms. 7–10, easily separable; pulp very acid; seeds few, small.—This tree, a native of the Philippine Isls., is commonly cult. in Hawaii, where it is wrongly called "China orange." It was intro. into Fla. by the U. S. Dept. of Agric. from Panama, and was for a time distributed by nurserymen under the erroneous name of To-Kumquat. It is very hardy, probably as hardy as the Satsuma, or even more so. It can be budded on sour orange or on trifoliate orange stock. A promising fr. for home use, for culinary purposes and for making ade.

9. **ichangénsis,** Swingle. Fig. 978. A small tree, with long slender spines: lvs. narrow, with oblong broadly winged petioles nearly or quite as large as the blade: fls. white; stamens 20, cohering in bundles: fr. lemon-shaped, 3–4 in. long, with a very broad low apical papilla surrounded by a shallow circular furrow; segms. 8–11; pulp acid, of good flavor; seeds very large, thick, cuneate-ovate, ½–¾in. long and ¼–⅜in. thick, white within.—This interesting new species, not closely allied to any other of the known members of the genus Citrus, is native in highlands of S. W. China. It is the northermost evergreen tree of the citrous group and grows at high altitude, 3,000–5,000 ft. It is able to withstand considerable cold in winter, so it is very likely to prove of value in breeding new types of hardy substitutes for the lemon. E. H. Wilson, who collected excellent material of this plant for the Arnold Arboretum, is endeavoring to secure it for trial in U. S.

C. bergàmia, Risso. BERGAMOT. A small tree: lvs. oblong-oval, with long, winged petioles: fls. small, white, very fragrant: frs.

pyriform, 3–4 in. diam., thin-skinned, pale yellow when ripe; pulp acid; seeds oblong, many. Extensively cult. in Calabria for the essential oil which is expressed from the peel and used in making Eau de Cologne and other perfumes.—*C. hystrix*, see Papeda.—*C. japónica*, see Kumquat.—*C. taitènsis*, Risso. OTAHEITE ORANGE. A dwarf plant, having lemon-like fls. and lemon-shaped fr. orange in color with a mawkish taste. Commonly grown by florists as an ornamental pot-plant. Rarely used as a stock for dwarfing common citrous frs. This plant is not a native of Tahiti as the name would indicate, but is probably of hybrid origin.—*C. trifoliàta*=Poncirus trifoliata.

WALTER T. SWINGLE.

CIVE: *Chive.*

CLADÁNTHUS (Greek, *klados*, branch, and *anthos*, flower; alluding to the branching, which distinguishes this genus from Anthemis). *Compósitæ*. An annual yellow-rayed herb, sometimes planted in the open garden. Plant branched from the base in a forking manner; a fl. terminates each branch, whereupon 2 new branches start from directly beneath the fl.; each of these is temporarily stopped by a fl., and so on: involucre hemispherical; receptacle conical or oblong, with scales about fls; ray-fls. pistillate, disk-fls. perfect.—One species; allied to Achillea and Anthemis.

arábicus, Cass. (*C proliferus*, DC. *Ánthemis arábica*, Linn.). Glabrous, 2–3½ ft. high: lvs. alternate, pinnately parted; lobes linear, trifid: fl.-heads solitary, bracted. S. Spain and Morocco.—A free-flowering heavy-scented plant of easy culture. L. H. B.†

CLADOTHÁMNUS (*klados*, branch, and *thamnos*, bush, from the Greek). *Ericàceæ*. Shrubs, rarely cult. for their handsome pink fls. Erect, with many virgate branches: lvs. deciduous, alternate, entire: fls. pink, terminal, 1–3, nodding; corolla divided to the base or nearly so into 5 oblong petals; stamens 10: caps. 5–6-celled.—One or 2 species in Pacific N. Amer., from Alaska to Wash. Hardy, with handsome rather large pink fls. in summer; rarely cult. They will probably grow best in peaty and sandy soil, in a half-shady position; prop. by seeds or by cuttings of soft wood under glass, and by layers.

C. pyrolæflòrus, Bong. Shrub, 4–10 ft.: lvs. nearly sessile, obovate-lanceolate, mucronulate, glabrous, pale green, 1½–2½ in. long: fls. solitary, with 5 separate petals, 1 in. across. Alaska to Ore. G.F. 10:215. B.M. 8353.—*C. campanulàtus*, Greene. According to Greene, this species differs from the preceding chiefly in the petals being united at the base and the anthers opening with a pore at the apex, and occurs in Wash., while C. pyrolæflorus is restricted to Alaska, but the specimens from Ore. and Wash. do not differ from C. pryolæflorus; possibly C. campanulatus was based only on an abnormal form.

ALFRED REHDER.

CLADRÁSTIS (Greek, *brittle branch*). *Virgilia* of gardens. *Leguminòsæ*. YELLOW-WOOD. Trees grown chiefly for their large panicles of white flowers and for their handsome foliage.

Deciduous: winter-buds naked, several superposed and concealed during the summer in the enlarged base of the petiole: lvs. alternate, odd-pinnate, with few rather large entire short-stalked lfts.: fls. in long, usually panicled racemes, white, papilionaceous; calyx campanulate, 5-toothed; stamens 10, nearly free: pod narrow-oblong, compressed, 3–6-seeded, with thin membranous valves.—Four species in N. Amer. and E. Asia. Hardy ornamental trees of medium size, with showy fls. and handsome foliage, turning bright yellow in fall. They thrive in almost any soil. Prop. by seeds, sown in spring, or by root cuttings, dug up in fall and kept in sand or moss, moderately moist and cool, until spring.

lùtea, Koch (*C. tinctòria*, Raf. *Virgilia lùtea*, Michx.). Tree, with yellow wood and smooth bark, sometimes 50 ft.: lfts. 7–9, oval or ovate, glabrous, bright green, 3–4 in. long: panicles loose, drooping, 10–20 in. long; fls. white, fragrant, over 1 in. long. June. Ky., Tenn., and N. C. S.S. 3:119–20. B.M. 7767. Mich. Hist. Arb. III. 266. Gng. 2:401; 5:98. F.E. 8:427. G.F. 1:92. Gn. 24, pp. 96–7; 34, p. 329. G.C. III. 42:186–7. M.D.G. 1899:444–5. G.W. 12, p. 397. V. 4:307. A.G. 15:270.—One of the most beautiful flowering native trees, with wide, graceful head and a short trunk, well adapted as single tree on the lawn. Hardy north to New England and Ont. The wood yields a clear yellow dye. There is a var. *aùreo-variegàta* with lvs. variegated with yellow.

sinénsis, Hemsl. Tree, to 80 ft.: lfts. 9–13, oblong to oblong-lanceolate, usually rounded at the base, yellowish green, pubescent beneath along the midrib, 2–4 in. long; rachis and petiole pubescent: fls. in loose, upright, much-branched panicles, 5–12 in. long and 4–8 in. across, white or pinkish, about ½in. long. June, July. W. and China.

C. amurénsis, Koch = Maackia amurensis.—*C. platycárpa*, Makino (Sophora platycarpa, Maxim.). Tree: lfts. 9–15, ovate to elliptic-lanceolate, 2–3½ in.: panicles broadly pyramidal, upright; fls. ½in. long, white; standard with yellow spot at the base: pod narrowly winged. Japan. S.I.F. 2:32. Very rare in cult.—*C. Tashiròi*, Yatabe = Maackia Tashiroi.—*C. Wilsonii*, Takeda. Tree, to 50 ft.: lfts. 7–9, elliptic-ovate to ovate-oblong, usually broadly cuneate at the base: panicles upright, 5–8 in. long; fls. ¾in. long; ovary pubescent. Cent. China.

ALFRED REHDER.



979. Clarkia elegans. (×⅔)

CLÁRKIA (Capt. Wm. Clark, companion of Lewis, explorer of the Rocky Mt. region and beyond, 1806). *Onagràceæ*. Flower-garden annuals.

Herbs, with alternate mostly entire lvs., and showy fls. in the upper axils or in terminal racemes: fls. regular, the calyx tubular, the petals 4, narrow at the base and entire or lobed, wide-spreading; stamens 8, the alternate ones short or rudimentary; stigmas 4, large and spreading: pod oblong or linear, 4-sided.—Half dozen or more species in W. N. Amer. See also *Eucharidium*.

Clarkias are hardy annuals of easy cultivation. They thrive in a warm, light soil, either fully exposed to the sun or in partial shade. They are useful for low masses or for edgings; also for vases and baskets. They have been much improved by domestication.

A. *Stamens (8) all perfect: lvs. broad.*

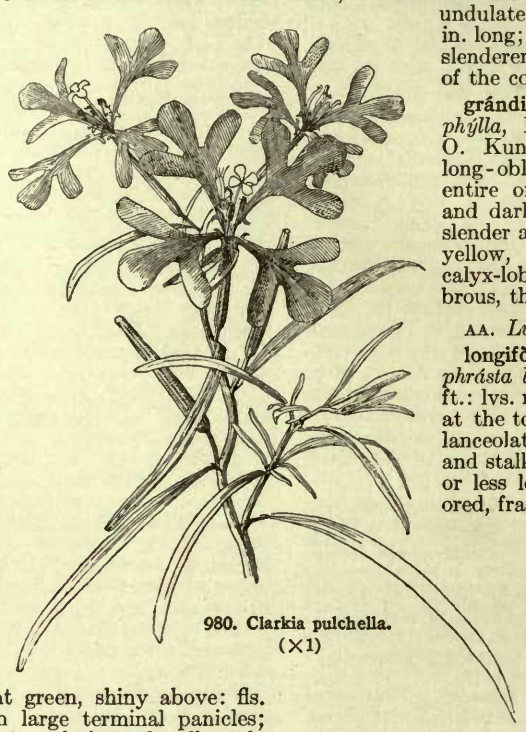
élegans, Douglas (*C. unguiculàta*, Lindl. *C. neriifòlia*, Hort.). Fig. 979. From 1–6 ft. high, glabrous or nearly so, the sts. reddish and glaucous, simple or sparingly branched: lvs. broad-ovate to linear, remote-dentate: fls. purple or rose-colored, running into white vars.; double forms in cult.; claw of the petal about as long as its rhomboidal entire limb: caps. sessile. B.M. 3592. B.R. 1575. R.H. 1845:385. Mn. 1:22.—One of the commonest annual fls.

rhomboídea, Douglas. Not so tall and more slender: lvs. thin, lance-oblong or ovate-oblong, entire: claw

often toothed, shorter than the rhomboidal limb: caps. stalked. B.R. 1981. R.H. 1864:151(?).—Not much cult.

AA. *Stamens 4 perfect and 4 rudimentary: lvs. very narrow.*

pulchélla, Pursh. Fig. 980. One ft. to 18 in. high, branchy, often tufted and dwarf, the sts. mostly puberulent: lvs. narrowly lance-oblong to linear, narrowed into a petiole, entire: fls. lilac, running into white vars.; petals ¾in. or less long in wild plants, with 3 wide-spreading lobes and a pair of recurved teeth on the claw: caps. stalked. B.M. 2918. B.R. 1100. R.H. 1845:385; 1886, p. 557.—Common in cult. There are semi-double and dwarf forms. Var. **holopétala,** Voss (*C. integripétala,* Hort.) is a garden form or race with entire petals. There are also dwarf forms of it. The garden names *kermesina* and *limbata* belong with *C. pulchella.* L. H. B.



980. Clarkia pulchella. (×1)

CLARY. The dried leaves of *Salvia Sclarea,* which are used for seasoning. Other species of Salvia have been used for the same purpose. See *Salvia.*

CLAUCÈNA (a personal name). *Rutàceæ.* Small inermous trees: lvs. pinnate: fls. in terminal panicles or loose racemes; ovary raised on a short disk, 4–5-celled, with 1–2 ovules in each cell; style short, deciduous; stamens 8–10: fr. 4–5-celled, with usually 1 seed in each cell; cotyledons aërial in germination, first foliage-lvs. opposite or alternate.

Lánsium, Skeels (*Clausèna Wámpi,* Oliver. *Quinària Lánsium,* Lour. *Coòkia Wámpi,* Blanco). Wampi. Low spineless tree, with spreading branches: lvs. spirally arranged, pinnate; lfts. 5–9, ovate-elliptical, 3–5 in. long, petiolate, light green, shiny above: fls. 4–5-parted, small, white, in large terminal panicles; ovary villous, 5-celled, with 1 ovule in each cell; style short; stamens 10: fr. ovate-globose, about 1 in. long; skin glandular, pubescent; seeds green.—The wampi is a native of S. China, where it is commonly grown for its frs. It is cult. to some extent in Hawaii and could probably be grown in the warmer parts of Fla. and Calif. It can be grafted on grape-fruit and other species of Citrus, which makes it desirable to test it as a stock for common citrous frs. Walter T. Swingle.

CLAVÌJA, (Don José de Viera y Clavijo, of Madrid). Syn., *Horta. Myrsinàceæ;* by Mez separated in the family *Theophrastàceæ.* Thirty and more tropical American evergreen unbranched trees or shrubs, a few of which are sometimes grown in the warmhouse. The sts. are simple, often spiny, bearing at the top a cluster of large rigid, simple, entire or spiny-toothed lvs.: fls. polygamous-dicœcious in axillary racemes; calyx 4–5-parted, the segms. round; corolla white, yellow or orange, the tube short and fleshy, the limb mostly spreading and 4–5-lobed; stamens 4 or 5, the filaments often united in the sterile fls.; staminodia 4 or 5, being scales in the throat; ovary fusiform, narrowed into a short style, the stigma obtuse or capitate: fr. several-seeded, berry-like. The clavijas thrive in a peaty potting soil, and prop. by cuttings of half-ripened growths. They are odd plants. The features are here given as apparently understood by horticulturists.

A. *Lvs. entire, or only repand.*

nóbilis, Mez, (*C. clavàta,* Decne). Plant 4–5 ft.: lvs. long-petioled thick, 1½ ft. or less, elliptic or oblong or oblanceolate, entire, acute or semi-acute: fls. yellow, with a very large disk, ¾in. long, the corolla fleshy, in drooping racemes 2–4 in. long. Venezuela. B.M. 6928 (as *C. Ernstii,* Hook., f.).

integrifòlia, Mart. (*Theophrásta integrifòlia,* Pohl). Allied to *C. longifolia,* differing chiefly in the less rigid, broader and entire leaves, longer petioles and larger fls. Lvs. distinctly petioled (petioles ½–1 in. long), obovate-oblong to lanceolate-oblong, acute and mucronate, cuneate at the base, quite entire or slightly undulate, 8–18 in. long: racemes erect, 5–7 in. long; fls. larger than in *C. ornata,* on slenderer pedicels, 5-merous; appendages of the corolla rounded, short. Brazil.

grándis, Decne. (*Theophrásta macrophýlla,* Lind., not Link. *T. grándis,* O. Kuntze). Lvs. large (to 3 ft.), long-oblong, narrowly pale-margined, entire or sinuate-repand; petiole thick and dark violet, the secondary nerves slender and simple or forked: fls. orange-yellow, in short and erect racemes; calyx-lobes orbicular and nearly glabrous, the corona 5-lobed. Colombia.

AA. *Lvs. serrate, often spiny-toothed.*

longifòlia, Mez. (*C. ornàta,* Don, *Theophrásta longifòlia,* Jacq.). Plant 10–20 ft.: lvs. many, in a crowded head or tuft at the top of the st. oblong-spatulate to lanceolate, leathery, narrowed at base and stalked, acute, spiny-toothed, 1½ ft. or less long: fls. orange- or saffron-colored, fragrant, in drooping racemes 4–10 in. long. Venezuela, Colombia. B.M. 4922. B.R. 1764. Blooms in June and July.

spinòsa, Mez (*C. Riedelìana,* Regel). Plant 5–6 ft., glabrous, stout and erect: lvs. obovate-lanceolate, sessile, 20 in. or less long, spinose-serrate: fls. orange-yellow, in slender racemes 5–8 in. long. Brazil.

fúlgens, Hook. f. Plant 3 ft. or more, very stout: lvs. spatulate-obcuneate, narrow, remotely toothed near the apex, narrowed into a very short petiole, very coriaceous, 1 ft. or so long: fls. deep red, with yellow disk, handsome, in erect racemes 4 or 5 in. long. S. Amer. B.M. 5626.

C. latifòlia, Radlk. (Theophrastus latifolia, Willd.). Lvs. gracefully elliptic, petioled, narrowed at both ends, mucronate-serrate: racemes erect. Colombia. L. H. B.

CLAYTÒNIA (after John Clayton, of Virginia, one of the earliest American botanists upon whose collections Gronovius based the Flora Virginica). *Portulacàceæ.* Spring Beauty. Little smooth succulent herbs sometimes transferred to gardens for their bright flowers.

Perennials with slender, 2-lvd. sts. from a deep, globular corm, and loose racemes of white or rose-colored fls. with deeper veins, appearing among the first wild fls. and lasting only a few days. The genus is characterized by its oval, persistent sepals and 5 stamens. Plants can be secured from dealers in native plants. They can be naturalized in moist places, and do well in half-shady spots at the bottom of a rockery. For *C. parvifòlia, C. parviflora* and *C. perfoliata,* see *Montia.*

virgínica, Linn. Plant 4–8 in. long, often forcing an irregular way through the leaf-mold of damp, rich woods: lvs. linear-lanceolate or linear, 2–6 in. long, including the gradually tapering base: fls. larger and more numerous than in *C. caroliniana*, whitish, tinged with pinkish. Colo. to Atlantic and south to Gulf. B.M. 941. L.B.C. 7:643.

caroliniàna, Michx. Lower and fewer-fld.: lvs. 1–2 in. long, oblong, oblong-lanceolate, somewhat spatulate, or even ovate-lanceolate, with a blade 1–2 in. long, abruptly contracted into a marginal petiole: fls. smaller than in the preceding and more deeply colored. Minn. to Atlantic and south to mts. of N. C.—Should be grown only in cool places above 1,000 ft.

lanceolàta, Pursh. About 4 in. high: lvs. oblong or lanceolate, ½–1½ in. long, the base broad or narrow; petiole as long as the blade: raceme short-peduncled; petals emarginate or almost obcordate. N. W. N. Amer.—Considered by some to be a mere form of the preceding.

WILHELM MILLER.
N. TAYLOR.†

CLEISÓSTOMA (Greek, *closed mouth*, referring to the structure of the spur). *Orchidàceæ*. Epiphytic orchids, adapted to the warmhouse.

Stems leafy: lvs. coriaceous, flat or nearly terete: sepals and petals adnate to the column, spreading; labellum with a large saccate spur; column short, thick; pollinia 2. From E. Asia and Austral.—A genus comprising in the neighborhood of 40 species, which suggest Saccolabium. The plants are little known in Amer. They require the treatment usually given Aërides. The leading species are *C. crassifòlium*, Lindl., from India, with small green rosy-lipped fls. in nodding panicles, and thick recurved lvs. 10 in. long. J.F. 4:397; and *C. ringens*, Reichb. f., Philippines, with yellowish white purple-lipped fls. with orange spot on side lobes, spur large, in few-fld. racemes: lvs. 3–4 in. long. *C. Dawsoniànum*, Reichb. f., is a Trichoglottis; *C. multiflòrum*, Hort., is probably *Aërides multiflorum*. *C. secúndum*, Rolfe, a recent introduction from Burma, has light rose-pink fls. that are turned sidewise, the front lobe of the lip rose-purple, borne on a scape 3–4 in. long: lvs. lance-oblong, about 4–5 in. long and ½in. broad.

CLEISTÁNTHUS COLLÌNUS: *Lebidieropsis.*

CLEISTOCÁCTUS (*closed Cactus*, referring doubtless to the peculiar flowers). *Cactàceæ*. Slender columnar cacti, with few branches and many-ribbed: fls. short and narrowly curved, orange-red; ovary covered with small appressed bracts bearing hairs in their axils; filaments somewhat exserted and grouped together near the upper lip: fr. spineless; pulp white; seeds slightly punctate.—About 14 species have been described in this genus.

Baûmannii, Lem. (*Cèreus Baùmannii*, Lem. *C. colubrìnus*, Otto). Sts. dark green, slender, flexuose, columnar, reaching a height of 6 ft. and a diam. of 1–1½ in., the few branches ascending, slender, parallel with the main st.: ribs 12–16, rounded: areoles close together, brown: spines fine, slender, very sharp, 15–20, fascicled, white to yellow or dark brown, about ¼in. long; sometimes a single one from the center reaches a length of ¾in.: fls. numerous, tubular, zygomorphous, 2½–3 in. long by about ½in. diam. throughout, red or sometimes with orange-red petals and red tube. Uruguay, Paraguay and Argentina. J. N. ROSE.

CLÉMATIS (Greek name of a climbing plant). *Ranunculàceæ*. Familiar garden plants, prized for their handsome and often very showy flowers followed in many species by attractive feathery-tailed fruits.

Climbing vines, or erect or ascending perennial herbs, more or less woody: lvs. opposite, mostly slender-petioled, usually pinnately compound, lobed, or in some species entire and rarely sessile: sepals usually 4 or 5, sometimes more, valvate in the bud, rarely imbricate, petaloid; petals none (or small in Atragene section, usually considered as petaloid staminodes); stamens many; pistils many: achenes in a head, 1-seeded; style persistent, long, plumose, silky or naked. Fig. 983.—About 150 species of very wide geographical distribution, most abundant in temperate regions. About 20 species found native in N. Amer. and about 80 in E. Asia. Les Clematites, Alphonse Lavallée, Paris, 1884; referred to below by "Lav."—The Clematis as a Garden Flower, Thomas Moore and George Jackman, London, 1872; referred to below by "M. & J."—Clematises, Dr. Jules le Bele, in Bull. de la Societe d'Hort. de la Sarthe; republished in The Garden (vol. 53), June–Oct., 1898.—O. Kuntze, Monogr. der Gattung Clematis in Verh. Bot. Ver. Brandenb. 26 (1885).—A. Gray, Fl. N. Amer. 1:4–9, 1895.—Finet & Gagnepain, Contrib. Fl. As. Orient 1:1–42 (1905).

The culture of clematises. (K. C. Davis.)

A rich soil of a light, loamy character is the best for clematises, and a little mixture of lime will make it better. The soil must be well drained, and must be kept rich by at least annual applications of horse- or cow-manure. On dry, hot soils cow-manure is best, while on heavy soils a thorough dressing of rich leaf-mold would best serve the purpose. Mulching with half-rotted manure on the approach of winter tends to increase the strength of the plants and the size of the flowers. In dry seasons, spraying is always helpful during the growing period.

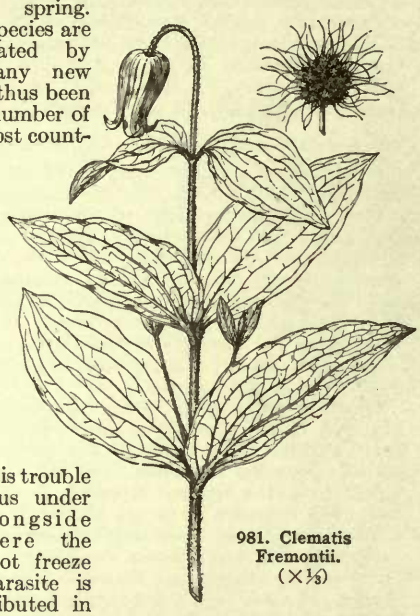
Clematises belonging to the Montana, Patens, Florida, and Lanuginosa types should be pruned in February or March, by cutting away all weak, straggling and overcrowded branches. The first three mentioned flower from the ripened wood; it is essential, therefore, that in order to secure blossoms, enough of the strong one-year-old wood should be retained. Viticella, Jackmanii and Lanuginosa should be vigorously cut back, say in November; they blossom from the new shoots. Those of the Patens type should be pruned very little, soon after the flowers have disappeared, by simply trimming off useless branches and seed-bearing peduncles.

Clematises of the vigorous climbing varieties are used in many places to cover walls, root-fences, mounds, arbors, balconies, trellises, small buildings, and, in fact, many other places the ingenious gardener will think of. For pot culture in the greenhouse, and for conservatory walls, the less vigorous species are best suited. All the many varieties and hybrids of the Patens and Lanuginosa types, including Henryi and the forms of Jackmanii, are well adapted to this use, as well as for outdoor purposes. The dwarfer and more bushy species are used in greenhouses to some extent, but are found principally in borders or on large rockeries. Of the latter J. B. Keller says: "Their flowers are not so large as we see them in most of the climbers, yet they are indispensable in the flower-garden, being prolific bloomers and free growers in ordinarily rich, deep garden soil. There is room for improvement in this class, however, and specialists, who hitherto have done so much for the climbers, ought to direct their efforts now to the long-neglected bush clematises. A noble beginning has been made, resulting in the large-flowering *C. Durandii*, but we expect more of them in the future." See special notes on culture and hybrid-forming qualities after the descriptions of some of the species and varieties.

The most common method of propagation is by grafting. Roots of *C. Flammula* or *C. Viticella* are used; the cions are taken from plants that have been grown under glass, and are used before the wood is entirely ripe. Cions taken from plants grown in the

garden in summer are rarely successful. The grafts, in pots or trays, are grown in a moist coolhouse, over gentle bottom heat. Another method of propagation, involving less labor but usually successful, is to take cuttings of nearly ripe wood, grown under glass, and treat them as the cions first above mentioned, without the roots. The latter method is practised preferably in summer in gentle hotbeds; shading, spraying, and later on airing, must be strictly attended to. Layering is practised when large old stools are at hand. The knife is not used in the operation, but a twist of the stem will split the inner bark lengthwise. Every other joint is thus treated, pegged down, and covered with soil. It is best to leave the layers undisturbed until the following spring.

Many of the species are often propagated by seed, and many new varieties have thus been secured. The number of hybrids is almost countless; in this account are carefully recorded those in the American trade which are traceable to their origin.



981. Clematis Fremontii. (×⅓)

The clematis is subject to a very serious disease, due to the depredations of a nematode worm in the roots. This trouble is most serious under glass and alongside buildings where the ground does not freeze deep. The parasite is probably distributed in the soil adhering to pot-grown plants. It is probable that hard freezing kills the parasite. There is no remedy, so far as known, for affected plants. Using only soil which has been frozen is to be recommended to the propagator.

The kinds of clematis. (Jackson & Perkins Co.)

The hybrid varieties of Clematis, commonly known as the large-flowering sorts, are, when successfully grown, among the most beautiful of hardy climbing plants. The commercial propagation and growing of most of the large-flowering varieties, however, is attended with so many difficulties and disappointments that it has never been very generally attempted by nurserymen or florists in this country. At the present time there are scarcely half a dozen houses on this continent who attempt the propagation of clematis to any considerable extent, and it is only within the past thirty years that clematises have been commercially grown even by this limited number. Prior to that, practically all of the large-flowering clematises planted in this country were imported from Europe, the major part being supplied by Holland, whose moist atmosphere and black soil produces large, vigorous plants, but whose climatic conditions are so entirely different from those usually found in this country that the plants often failed to adapt themselves to their new surroundings, and did not thrive to the extent that their good size and vigorous condition seemed to give promise.

The propagation of clematis throughout Europe is usually effected by grafting pieces of well-ripened, year-old wood upon roots of almost any of the more vigorous-growing species, *Clematis Flammula* being most commonly used. In this country, on the contrary, the method commonly pursued is by means of cuttings from young wood, stuck in sand, with gentle bottom heat, usually during May or June. So far as concerns the comparative vigor and desirability of plants produced by these two methods, there is small choice between them. Propagation by cuttings is, in this country, the more rapid and economical way, and further, it removes the possibility, sometimes realized in grafted plants, of sprouts being thrown up from the roots, and, if in the hands of an uninformed amateur, entirely "running out" the variety grafted in; thus considerable annoyance is avoided.

Clematises hybridize so readily that the number of varieties resultant from various crosses forms a long list. But while so many have been dignified with names and places in the catalogues of nurserymen, yet the varieties of large-flowering clematis that have proved so valuable as to secure permanent places for themselves in popular demand can almost be counted upon one's fingers. There are many varieties possessing most beautiful shades and variations of coloring that fail to attain popularity, chiefly on account of deficiency in two essential characteristics—vigorous habit of growth and abundance of bloom. *Clematis Jackmanii*, purple, originated in 1862, by Mr. George Jackman, was one of the first hybrid clematises introduced, and still stands as the most popular, and, of its color, the most valuable variety yet known. The variety, Madame Edouard André, a deep rich crimson, is distinct and novel, being at this time about the best large-flowering sort of a truly crimson shade. It is not quite so vigorous habit as the Jackmanii, but its flowers are similarly massed, though not produced in quite such profusion. Clematis Madame Baron Veillard is a distinct variety. It is of exceedingly vigorous habit, and the flowers are quite freely produced, though, being more dispersed over the plant, they do not make so much of a show as do varieties whose flowers are closely massed. The flowers are of very large size and of a light rose-color, shaded with lilac. Of white varieties, Henryi, Mrs. George Jackman and Lanuginosa Candida, all of them introduced long ago, still remain about the most desirable ones known. Ramona, deep sky-blue, is a variety which originated some twenty-five years ago. It is of extra-large size, often 9 to 10 inches across, of very vigorous habit and free-flowering.

Of double-flowered varieties, Duchess of Edinburgh, white, is the best known in this country, and about the most desirable. John Gould Veitch is a double sort with flowers of lavender-blue, but has seemed a shy bloomer and of weak habit. Mme. Grange (purplish violet), Star of India (purple), Velutina Purpurea (purple), and Viticella Venosa (reddish purple), are all desirable varieties.

Although they are in reality slightly less hardy than the Florida and Patens types, varieties of the Lanuginosa, Viticella and Jackmanii types, which produce their flowers from young growing wood, are recommended for northern localities. Plants of these types, even if frozen back to the ground, will still produce a good show of flowers, since, as stated, they bloom from the recent vigorous wood, even if the old tops are killed. Indeed, they need to be pruned back considerably anyway to induce a free growth of young vigorous blooming wood. With plants of the Patens and Florida types, however, which blossom from year-old wood, a severe freezing back of the plants would destroy the crop of flowers for the year.

Of the small-flowering varieties, *Clematis paniculata* (white), introduced from Japan, has proved to be a wonderfully valuable acquisition in this country, and has become exceedingly popular. It is of remarkably vigorous habit, often making a growth of 20 to 25

feet in a season. It seems thus far to be entirely free from disease, is delightfully fragrant, and so floriferous that the blossoms form a dense sheet of bloom, remaining in full beauty for several weeks. The foliage is very thick and heavy, thus making it very desirable for covering porches and arbors.

Crispa (blue) and texensis (red) are species with very pretty, bell-shaped flowers. They are easily grown and do well in almost all situations.

The perennial, non-climbing varieties of clematis are most pleasing border plants, succeeding well in all ordinary soils and making a rich show of bloom at their flowering season. Davidiana (blue) and recta (white) are about the best known and most desirable varieties of this class.

To grow clematis most successfully, they should be given a good depth of loamy soil, with a fair supply of well-rotted manure spaded in and thoroughly distributed through the soil. In hot, dry weather, the plants should be regularly watered in order to obtain the greatest number of flowers possible, for the plants are very susceptible to injury by drought. A point of great importance, especially in caring for newly set plants, is to provide a firm support for them to climb upon. A solid wooden or metal trellis is preferable, for the reason that it prevents the plants from being whipped about by the winds, which often results in breaking the stalks just above the ground or else in cracking the outer bark of the stalks and rendering them more liable to the attacks of insects and fungous diseases. Training the vines upon strings, or a pliable support of any kind, is not to be advised for this reason. Propagation of the hybrid varieties is effected both by cuttings and by grafts. All of the type varieties grow readily from seed.

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KEY TO THE SPECIES.

A. *Sepals upright, forming a tubular or urceolate fl.; stamens upright, appressed, pubescent; or sepals more spreading and fls. with petaloid staminodes.*
  B. *Fls. without petaloid staminodes.*
    C. *Lvs. simple: herbaceous, not climbing.*
      D. *Color of fls. purple or blue.*
        E. *The lvs. thin, acute, sessile* ... 1. **integrifolia**
        EE. *The lvs. subcoriaceous, reticulate, obtusish, short-petioled.* ... 2. **Fremontii**
      DD. *Color of fls. yellow* ... 3. **ochroleuca**
    CC. *Lvs. compound.*
      D. *Lfts. entire: fls. solitary.*
        E. *Plants upright, herbaceous.*
          F. *Shape of lfts. lanceolate: lvs. bipinnate or ternately compound.* ... 4. **Douglasii**
          FF. *Shape of lfts. ovate: lvs. pinnate* ... 5. **aromatica**
        EE. *Plants climbing, shrubby.*
          F. *Styles not plumose in fr.*
            G. *The lvs. not reticulate, usually with terminal lft.* ... 6. **crispa**
            GG. *The lvs. reticulate, usually without terminal lft* ... 7. **Simsii**
          FF. *Styles plumose in fr.*
            G. *Fls. axillary, with the pedicels much longer than the fls.*
              H. *Sepals outside pubescent, dull.*
                I. *Lfts. subcoriaceous, reticulate.* ... 8. **reticulata**
                II. *Lfts. membranous, indistinctly veined.* 9. **Viorna**
              HH. *Sepals outside glabrous, bright scarlet.* 10. **texensis**
            GG. *Fls. terminal and axillary, the latter with the pedicels shorter than the fls.* ... 11. **fusca**
      DD. *Lfts. serrate: fls. usually clustered or panicled.*
        E. *Plants herbaceous, upright: fls. clustered, often nearly sessile.*
          F. *Fls. blue or violet, in axillary clusters* ... 12. **heracleæfolia**
          FF. *Fls. whitish, usually in an elongated terminal panicle.* ... 13. **stans**
        EE. *Plants climbing, shrubby.*
          F. *Lvs. pinnate.*
            G. *Fls. yellowish white, in panicles.* ... 14. **nutans**
            GG. *Fls. reddish purple, 1–3, axillary.* ... 15. **lasiandra**
          FF. *Lvs. bipinnate; lfts. small, deeply lobed, usually less than 1 in. long: fls. whitish.* ... 16. **æthusifolia**
  BB. *Fls. with petaloid staminodes; sepals more or less spreading; stamens upright, appressed pubescent.*
    C. *Lvs. always 3-foliolate; lfts. ovate, subcordate.* ... 17. **verticillaris**
    CC. *Lvs. partly biternate; lfts. ovate to ovate-lanceolate.* ... 18. **alpina**
AA. *Sepals spreading; stamens more or less divergent.*
  B. *Stamens glabrous or only with a few hairs below the anthers (or hairy at the base only in No. 19).*
    C. *Fls. solitary or in 3's or in axillary fascicles, blue, violet, red or white, usually large.*
      D. *Lfts. entire: fls. on the new growth after the lvs., solitary or in 3's.*

CLEMATIS

EE. *Plant herbaceous, upright: sepals imbricate in bud; stamens pubescent at the base*.....19. **Stanleyi**

EE. *Plants woody, climbing: sepals valvate; stamens glabrous.*

F. *Achenes with short style; pedicels longer than the sepals.*

G. *Number of sepals 4: fls. open campanulate, usually 1–2 in. across.*

H. *Style glabrous: fls. 1–2 in. across, often in 3's*.....20. **Viticella**

HH. *Style pubescent except at the apex; fls. 1 in. or less across*....21. **campaniflora**

GG. *Number of sepals usually 5–6: fls. flat, 2–4 in. across*.....22. **florida**

FF. *Achenes with long plumose style.*

G. *Pedicels shorter than sepals: lvs. simple or ternate*.....23. **lanuginosa**

GG. *Pedicels longer than sepals: fls. from last year's wood in spring or early summer: lvs. ternate or pinnate*....24. **patens**

DD. *Lfts. or lvs. serrate: fls. in axillary clusters, or solitary on last year's branches with the lvs. in spring, white or pink.*

E. *The sepals with a small involucre below their base; fls. nodding, open campanulate.*

F. *Lvs. simple: fls. whitish*...25. **cirrhosa**

FF. *Lvs. ternate: fls. greenish yellow, spotted red inside*.26. **balearica**

EE. *The sepals without involucre.*

F. *Lvs. pinnate; lfts. small, about ½ in. long*.....27. **gracilifolia**

FF. *Lvs. ternate; lfts. 1–3 in. long.*

G. *Lfts. glabrous or sparingly pubescent*.....28. **montana**

GG. *Lfts. densely silky pubescent beneath, less so above*.....29. **Spooneri**

CC. *Fls. in terminal or axillary panicles or cymes, rarely 3 (if solitary, with bracts about the middle of the pedicel) white, rarely pinkish; sepals 4 (sometimes 4–6 in No. 37), usually small (except in No. 37).*

D. *Lvs. 3-foliolate; lfts. always entire, often sub-coriaceous or coriaceous.*

E. *The fls. from the old wood from scaly buds*.....30. **Armandii**

EE. *The fls. from the new growth.*

F. *Lfts. ovate or ovate-oblong.*

G. *Filaments as long or shorter than anthers: lfts. rounded or subcordate at the base*....31. **Meyeniana**

GG. *Filaments longer than the anthers: lfts. cuneate at the base*.....32. **crassifolia**

FF. *Lfts. narrow-lanceolate or oblong-lanceolate*.....33. **Pavoliniana**

DD. *Lvs. pinnate or bipinnate (if 3-foliolate, lfts. lobed or dentate or fls. diœcious).*

E. *The fls. perfect.*

F. *Lfts. entire or nearly entire, or 3-lobed: anthers linear, much longer than broad.*

G. *Plant herbaceous, upright*.....34. **recta**

GG. *Plant climbing, half-woody.*

H. *The lvs. pinnate*.....35. **paniculata**

HH. *The lvs. bipinnate*....36. **Flammula**

FF. *Lfts. serrate, occasionally nearly entire: anthers oval or oval-oblong, not more than twice as long as broad (longer in Nos. 37 and 38).*

G. *The fls. 1–3, long-stalked, 2–3 in. across: lvs. pinnate*.....37. **Fargesii**

GG. *The fls. in panicles or cymes, not exceeding 1 in. diam.*

H. *Lvs. ternate or biternate: fls. ½ in. across, in many-fld. cymes*.....38. **apiifolia**

HH. *Lvs. usually bipinnate; lfts. ovate-lanceolate: tails of fr. about ¾ in. long*...39. **brevicaudata**

HHH. *Lvs. pinnate: tails longer.*

I. *Sepals glabrous inside: lfts. pubescent beneath*.....40. **grata**

II. *Sepals pubescent inside and outside: lfts. glabrous or nearly so*.....41. **Vitalba**

EE. *The fls. diœcious.*

F. *Foliage deciduous: sepals 4.*

G. *Fls. appearing on the young wood in summer, less than 1 in. across.*

H. *Lvs. ternate; lfts. 2–3 in. long*.....42. **virginiana**

HH. *Lvs. pinnate; lfts. 1–2 in. long.*

I. *Plant glabrous: lfts. rounded or subcordate at the base*.43. **ligusticifolia**

II. *Plant pubescent: lfts. truncate or cuneate at the base*....44. **Drummondii**

GG. *Fls. on last year's branches from scaly buds in early spring, 1½ in. across*.....45. **lasiantha**

FF. *Foliage evergreen; lvs. ternate: sepals 5–7*.....46. **indivisa**

BB. *Stamens pubescent; fls. yellow or yellowish, nodding: achenes with plumose tails.*

C. *Lvs. pinnate or bipinnate.*

D. *Fls. usually several, 1–2 in. across, pale yellow: lvs. bluish or grayish green; lfts. usually entire, often lobed.*

E. *Lfts. often oblong or lanceolate: sepals pubescent inside*.....47. **orientalis**

EE. *Lfts. usually ovate or oval, pale bluish green: sepals glabrous inside*.....48. **glauca**

DD. *Fls. solitary, 2–3 in. across, on stalks to 10 in. long; sepals glabrous inside: lfts. usually lanceolate, serrate, green*.....49. **tangutica**

CC. *Lvs. biternate; lfts. serrate, green: fls. solitary*.....50. **serratifolia**

Section VIORNA.

Group Crispæ.

1. integrifòlia, Linn. Herbaceous, erect, becoming 2 ft. high: lvs. rather broad, entire, ovate-lanceolate: fls. solitary, nodding; sepals 4, rather narrow, blue, coriaceous, 1–2 in. long. June–Aug. Eu. and Asia. B.M. 65.

The following are supposed to be hybrids of this species: *C. cylindrica*, Sims (×C. crispa. C. integrifolia var. diversifolia, Hort. C. integrifolia var. pinnata, Hort.). Lvs. more or less irregularly lobed or pinnate: fls. solitary, cylindric-campanulate with the sepals more or less recurved from the middle, blue or bluish-violet. B.M.

1160. Lav. 13. G.W. 14, pp. 562–3. R.H. 1856:341. Here also belongs probably *C. divaricàta*, Jacq., with short-petioled pinnate lvs. and blue, less spreading sepals.

2. **Frèmontii,** Wats. Fig. 981. Closely allied to *C. ochroleuca*, but with lvs. 3–4 in. long, nearly sessile, either entire or with a few coarse teeth: fls. often drooping; sepals thick, purple, nearly glabrous, except the tomentose edges; styles when young downy rather than feathery. July, Aug. Mo. to Colo. G.F. 3:381 (adapted in Fig. 981). G.W. 14, p. 563.

3. **ochroleùca,** Ait. Herbaceous, 1–2 ft. high, silky-pubescent, becoming glabrate: lvs. ovate, entire: fls. erect, solitary, terminal; sepals yellow outside, cream-colored within; styles becoming somewhat plumose. July, Aug. Dry grounds, N. Y. to Ga. L.B.C. 7:661. —Intro. 1883.

4. **Doùglasii,** Hook. Has habit of *C. integrifolia*, about 2 ft. high: st. and petioles angled and ribbed: lvs. twice pinnately or ternately compound; lfts. narrow-linear or lanceolate: fls. tubular or bell-shaped, 1 in. long; sepals recurved, deep purple within, paler without. June. In mts., Mont. to New Mex.—Intro. 1881. Var. **Scóttii,** Coulter, has the lfts. ovate- or oblong-lanceolate. A hybrid of *C. Douglasii* var. *Scottii* × *C. texensis* is *C. globulòsa*, Hort., with deep purple pitcher-shaped fls. Gn. 75, p. 472.

5. **aromàtica,** Lenné & C. Koch (*C. cærùlea* var. *odoràta*, Hort.). Slender, herbaceous or somewhat climbing, reaching 6 ft. high if supported: lvs. of 3–7 ovate, nearly entire lfts.: fls. solitary, terminal, very fragrant, 1½–2 in. across; sepals 4, spreading, reflexed, reddish violet; stamens white. July–Sept. Nativity, perhaps S. France. It is thought by some to be an old garden hybrid, probably *C. Flammula* × *C. integrifolia*. R.H. 1877, p. 15. Lav. 9.

6. **crìspa,** Linn. A slender climber, reaching 3–4 ft.: lvs. very thin; lfts. 3–5 or more, variable in outline and sometimes undivided, often 3–5-lobed: fls. purple, varying to whitish, cylindrical or bell-shaped, 1–2 in. long; points of sepals recurved; styles of fr. hairy but not plumose. June–Sept. Va. to Texas. B.R. 32:60. B.M. 1892. I.H. 2:78 (as *C. campaniflora*). G. 30:503; 34:147. V. 6:379. Lav. 14.—This and the allied species are fragrant. A hybrid of this species is *C. cylindrica*, Sims (× *C. integrifolia*). See No. 1. A number of hybrid forms, the offspring of a cross between this species and *C. texensis* are figured and described in M.D.G. 1898:500 and one as "blue bells" in Gn. 49, p. 189.

7. **Símsii,** Sweet (*C. Pitcheri*, Torr. & Gray). High climbing: branchlets pubescent: lvs. of 3–4 pairs of lfts. and a terminal lft. reduced almost to a midrib; lfts. coarsely reticulated, lobed or 3-parted, usually mucronate: fls. 1 in. long and ¾in. diam., with swollen base; sepals dull purple, recurved at the tips: achenes pubescent, styles not plumose. June–Aug. S. Ind. to Mo., southward to Mex. Lav. 15. B.M. 1816 (as *C. cordata*). Var. **Sárgentii,** Rehd. (*C. Sárgentii*, Lav.). Fls. smaller, paler: lfts. rarely lobed. Lav. 18.—A hybrid of this species with *C. texensis* is figured in R.H. 1893:376.

8. **reticulàta,** Walt. A slender climber, allied to *C. crispa:* lfts. much reticulated and very coriaceous: fls. solitary in the axils of the lvs., nodding, bell-shaped; sepals recurved, crispy at the margin: mature fr. with plumose tails. June, July. S. C. to Ala. and Fla. B.M. 6574. Lav. 16.

9. **Viórna,** Linn. Fig. 982. Climbing, 8–10 ft., sparingly pubescent or glabrous: lvs. not glaucous nor coriaceous; lfts. subcordate-ovate to ovate-lanceolate, slightly reticulated: fls. solitary, on long peduncles, pitcher-shaped; sepals 4, 1 in. long, variable in color, often dull purple, thick and leathery, finely pubescent outside, tips often recurved; styles plumose when mature, 1 in. long. June–Aug. Pa. to Ala. and westward. Lav. 17. Gn. 45, p. 240.

10. **texénsis,** Buckl. (*C. coccínea*, Engelm. *C. Viórna* var. *coccínea*, Gray). Climbing, to 6 ft.; glabrous: lvs. glaucescent, subcoriaceous; lfts. broadly ovate, often obtuse, subcordate, 1½–3 in. long: fls. solitary, pitcher-shaped, nodding, carmine or scarlet, glabrous outside: achenes with plumose style, 1–2 in. long, glabrous at the tip. Texas. Lav. 19. B.M. 6594. Gn. 19:284. G.W. 10, p. 498. G.C. II. 15:405. W.G.Z. 2:111. F. 1880, p. 115. Gt. 32:86. R.H. 1878:10; 1888:348.—Much superior to the preceding because of its beautiful fls. Some of the garden hybrids of this species, which have been classed under *C. pseudo-coccínea*, Schneid. (× *C. Jackmanii*), are found under the names: *Countess of Onslow*, deep scarlet. Gn. 57, p. 376. M.D.G. 1898:481. G.M. 37:381. G.C. III. 16:9. *Countess of York*, white, tinted with pink. *Duchess of Albany*, clear pink. Gn. 52:304. See also No. 6 for hybrid forms of *C. crispa* with this species and No. 7 for a hybrid with *C. Simsii*.



982. Clematis Viorna. (×⅓)

11. **fúsca,** Turcz. Climbing, to 15 ft.; sparingly pubescent: lvs. pinnate; lfts. usually ovate, to ovate-oblong, acute, glabrous or pubescent beneath and ciliate, 1½–2½ in. long, the terminal one usually wanting: fls. on rather short villous pedicels, nodding, urceolate, about 1 in. long; sepals with recurved tips, densely brownish pubescent outside, violet inside: pubescence of achenes and plumose tails fulvous. June–Aug. E. Siberia, Japan. Lav. 20. Var. **violàcea,** Maxim. (*C. jánthina*, Koehne). Less pubescent: fls. violet. Gt. 13:455.

Group Tubulosæ.

12. **heracleæfòlia,** DC. (*C. tubulòsa*, Hook.). Stout, erect, woody only at the base: lvs. ternate, large, bright green; lfts. broadly ovate, rounded at the base, slightly pubescent, mucronately toothed, 4–6 in. long: fls. numerous, in corymbs, either axillary or terminal, polygamous, tubular in form, with 4 light blue sepals, becoming reflexed; peduncles and pedicels downy; recurved stigmas club-shaped. Aug., Sept. China. M. & J. 17. B.M. 4269; 6801 (as var. *Hookeri*). P.M. 14:31. F.S. 3:195. R.H. 1858, p. 42.—Prop. by root division. Var. **Davidiàna,** Hemsl. (*C. Davidiàna*, Decne.). About 4 ft. high, hardly strong enough to stand without support: lvs. usually cuneate at the base, nearly glabrous: fls. brighter blue, fragrant, in clustered heads, 6–15 together, and also singly or clustered in the lf.-axils. R.H. 1867, p. 90. Gn. 31, p. 145; 45, p. 241; 49, p. 99; 68, p. 273. G.M. 37:48. G.W. 6, p. 124. Mn. 9:76. A.F. 25:1055. Var. **ichangénsis,** Rehd. & Wilson. Lfts. broad at the base, sparingly pubescent above, densely beneath: achenes densely villous. Cent. China.

A hybrid of this species is *C. Jouiniàna*, Schneid. (var. Davidiana × C. Vitalba). Half-climbing, to 6 ft.: fls. in large panicles, bluish white, first tubular with the sepals finally spreading. G.C. III. 51:34. Another hybrid is *C. Davidiàna hýbrida*, Lem. (var. Davidiana × C. stans) of which Lemoine advertises several named forms varying from light to deep blue; very floriferous.

13. **stàns,** Sieb. & Zucc. (*C. heracleæfòlia* var. *stàns*, Hook.). Herbaceous, upright, to 6 ft.: branches grayish pubescent: lfts. broadly ovate, lobed and coarsely

toothed, more or less pubescent: fls. in terminal panicles sometimes 2 ft. long and in axillary clusters, whitish or bluish white, tubular, with revolute sepals, less than ½in. long, dicœcious. Sept., Oct. Japan. B.M. 6810.—Used chiefly because of the striking foliage and its late-blooming qualities. Var. **Lavállei**, Schneid. (*C. Lavállei*, Decne.). Fls. ½–¾in. long, monœcious.

Group CONNATÆ.

14. **nùtans,** Royle. Slender woody climber: lvs. pinnate; lfts. ovate-oblong or lanceolate, deeply 3–5-lobed, rarely entire, 1–3 in. long: fls. nodding in many-fld. panicles, yellowish white, tubular, ½–¾in. long, pubescent outside; filaments silky pubescent below the middle: achenes silky with plumose tails. July–Oct. Himalaya. Var. **thyrsoídea,** Rehd. & Wilson. Climbing to 20 ft.: lfts. broadly ovate, usually cordate at the base, silky pubescent beneath: panicles larger and more compact, on upright stout peduncles 3–6 in. long. W. China. G.C. III. 48:310. Gn. 75, p. 557 (as *C. nutans*). R.H. 1905, p. 438 (as *C. Buchaniana vitifolia*). See page 3567.

15. **lasiándra,** Maxim. Climbing, to 12 ft.: young growth viscid: lvs. pinnate with 3-foliolate or 3-fid segms.; lfts. ovate to ovate-lanceolate, long-acuminate, serrate, glabrous or sparingly pubescent on both sides, 1½–2½ in. long: fls. axillary, solitary or in 3's on stalks 1–3 in. long, campanulate, reddish purple, about ¾in. long; sepals with recurved tips, as long as the stamens. Aug.–Oct. Cent. and W. China.

16. **æthusifòlia,** Turcz. Slender, climbing: lvs. bipinnate, pubescent; lfts. finely cut, usually unequally 3-lobed and deeply incisely serrate with obtusish mucronulate narrow lobes, ⅓–¾in. long: fls. 1–3, axillary, on slender stalks, whitish, tubular, ¾in. long; sepals with recurved tips: achenes pubescent with long plumose whitish tails. Aug., Sept. Mongolia, Manchuria. Var. **latisécta,** Maxim. Lfts. larger, to 1½ in. long with oval or oblong rounded lobes. Gt. 10:342. B.M. 6542. Gn. 6, p. 423; 31, p. 186; 45, p. 241. R.H. 1869, p. 10.—This is the form usually cult.; the type with much more finely divided foliage is very rare in cult.

Group ATRAGENEÆ.

17. **verticillàris,** DC. (*Atrágene americàna,* Sims). Fig. 983. Trailing or sometimes climbing, 8–10 ft.: usually 4 trifoliate lvs. from each node; lfts. thin, ovate, acute, toothed or entire, somewhat cordate: fls. solitary, blue or purple, nodding at first, 2–4 in. broad when expanded; 4 thin sepals, silky along the margins and veins; staminodes spatulate, narrow, scarcely half as long as sepals. May, June. Woodlands, Va. to Hudson Bay, west to Minn. B.M. 887.—Intro. 1881. Var. **columbiàna,** Gray. Sepals narrower and more pointed than in the type. Rocky Mts.



983. Achene of Clematis verticillaris. (×1)

18. **alpìna,** Mill. (*Atrágene alpìna,* Linn.). Sts. 3–5 ft., slender, with prominent joints becoming swollen with age: lvs. once or twice ternate, with ovate or ovate-lanceolate lfts., serrate or incised; many petal-like stamens, which are devoid of anthers; sepals 4, bright blue. Spring. N. W. N. Amer., Siberia to S. and Cent. Eu. B.M. 530 (as var. *austriaca*). Gn. 46:318; 57, p. 481. R.H. 1855:321. L.B.C. 3:250. G.W. 10, p. 82. H.W. 3, p. 16.—A very hardy climber, preferring a northern exposure. Var. **sibírica,** Kuntze (var. *álba,* Hort. *Atrágene sibírica,* Linn.). Fls. white or nearly so. B.M. 1951. L.B.C. 14:1358. R.H. 1855:321. Var. **occidentàlis,** Gray. Petal-like stamens very few, and often bearing rudimentary anthers. Rocky Mts.

Section PSEUDANEMONE.

19. **Stânleyi,** Hook. (*C. Stanleyàna,* Hort.). Fig. 984. Erect robust herbs, 3 ft. high: lvs. biternate; lfts. sessile or petioled, variable in size, cuneate, silky:



984. Clematis Stanleyi. (×⅓)

fls. 1–3 in. across, white to pink-purple; sepals becoming widely expanded; stamens yellow; styles becoming very plumose, white. July–Oct. Transvaal. Intro. 1893. B.M. 7166. Gn. 39:76. G.F. 3:513 (adapted in Fig. 984). G.C. III. 8:327. G.M. 34:320.—Suitable for greenhouse cult.; in the northern states it is apt to winterkill if left unprotected.

Section VITICELLA.

20. **Viticélla,** Linn. Climbing 8–12 ft.: lvs. sometimes entire, but usually divided into 3 nearly entire lfts.: fls. 1½–2 in. diam., growing singly on peduncles or sometimes in 3's; sepals 4, blue, purple or rosy purple, obovate, pointed, reflexed; stamens yellow: fr. with rather short glabrous tails. June–Aug. S. Eu. to Persia. R.H. 1860, p. 183; 1876:110; 1879:350 (vars.). B.M. 565. G. 22:310; 8:399. H.W. 3, p. 15. Lav. 7. —This is the type of one of the leading groups of garden clematises, and is one of the parents of the Jackmanii type of hybrids.

The following are garden varieties:

Var. *albiflòra,* Kuntze. Fls. white.

Var. *rùbra,* Hort. Fls. purple.—Var. *rùbra grandiflòra,* Jackman, has larger bright crimson fls. and 6 sepals. F.S. 20:2053 (1783). F. 1872:265.

Var. *kermésina,* Lem. (C. kermesina, Hort.). Fls. of bright wine-red color, purple being absent. Gn. 39:30.

Var. *lilácina-floribúnda,* Hort. (C. lilacina-floribunda, Hort. C. floribunda, Hort.). Fls. pale gray-lilac, conspicuously veined. Gn. 18, p. 389 (note).—An abundant bloomer. Produced in an English garden in 1880.

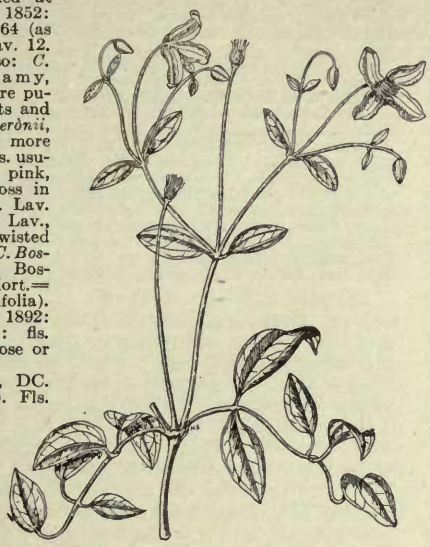
Lady Bovill, Jackman (C. Lady Bovill, Hort.). Fls. cup-formed, sepals being concave and little or not at all recurved at the ends, fls. 4 in. across; sepals 4–6, grayish blue; stamens light brown. M. & J. 15. R.H. 1876:190.

Var. *marmoràta,* Jackman (C. marmorata, Hort.). Fls. rather small, with 4 broad sepals, light grayish blue with darker veins, 3

longitudinal bars. M. & J. 1, f. 2; same plate in F.S. 20:2050–55 (2008). F. 1872:265.

Hybrids of *C. Viticella* which are closely allied to that type:

C. eriostèmon, Decne. (×C. integrifolia; C. Hendersonii, Henderson. C. Chandleri, Hort.) Fig. 985. St. and habit of C. Viticella: lfts. and fls. much like C. integrifolia: climbing 8–10 ft.: 4 blue sepals, spreading, reflexed at the tips. R.H. 1852: 341. F.S. 13:1364 (as var. venosa). Lav. 12. Here belong also: *C. intermèdia*, Bonamy, smaller, with more pubescent branchlets and paler fls. *C. Bergerònii*, Lav., resembling more C. integrifolia: lvs. usually entire: fls. pink, about 2 in. across in terminal panicles. Lav. 10. *C. distórta*, Lav., with rosy-lilac twisted sepals. Lav. 11. *C. Boskoop*, Hort. (C. Boskoop Scedling, Hort.= C. V. ×C. integrifolia). A new race in 1892: growing 3–5 ft.: fls. blue, lavender, rose or reddish rose.



985. Clematis eriostemon. (×⅙)

C. violàcea, DC. (×C. Flammula). Fls. in several- to many-fld. terminal panicles, pale violet, about 1 in. across; petals sometimes 6. Here belongs also: *C. Othéllo*, Cripps (=C. V. var. rubra × C. Flammula). Fls. of medium size, of a deep velvety purple; continues blooming until Oct.—*C. rùbro-marginàta*, Jouin (C. Flammula var. rubro-marginata, Cripp.). Similar to C. Flammula; sepals white bordered reddish violet.

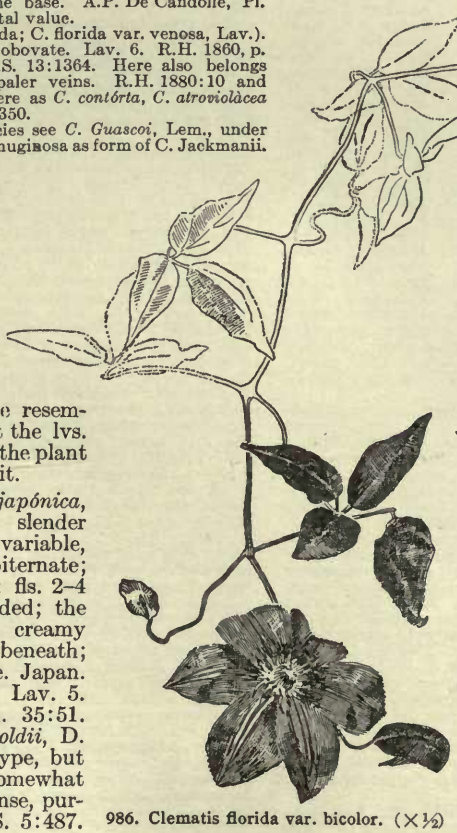
C. parviflòra, DC. (×C. campaniflora; C. revoluta, Desf.). Fls. white, small, scarcely 1 in. across, sometimes larger: achenes with the tail usually pubescent at the base. A.P. De Candolle, Pl. Rar. Geneve. 12.—Of no ornamental value.

C. venòsa, Krampen (×C. florida; C. florida var. venosa, Lav.). Similar to C. florida, but petals obovate. Lav. 6. R.H. 1860, p. 183. G. 2:251. G.Z. 6:160. F.S. 13:1364. Here also belongs *Louise Carriere*; fls. lilac with paler veins. R.H. 1880:10 and several forms described by Carriere as *C. contórta*, *C. atrovioláceа* and *C. Viticélla álba*. R.H. 1879:350.

For other hybrids of this species see *C. Guascoi*, Lem., under C. patens, *C. splendida* under C. lanuginosa as form of C. Jackmanii.

21. **campaniflòra,** Brot. Climbing, 10–15 ft.: fls. reflexed and bell-shaped as in the above type or more so, usually 1 in. or less diam., purple or whitish: fr. with short pubescent tail. June, July. Native of Portugal. L.B.C. 10:987. Gn. 31, p. 187. Lav. 8.—This has been called *C. Viticella* because of its close resemblance in fl., fr. and lf.; but the lvs. are often twice ternate, and the plant is much more slender in habit.

22. **flórida,** Thunb. (*C. japónica*, Makino, not Thunb.). A slender plant, climbing 9–12 ft.: lvs. variable, more or less ternate or biternate; lfts. small, ovate-lanceolate: fls. 2–4 in. across, flat when expanded; the 5–6 broad, ovate sepals creamy white, barred with purple beneath; stamens purplish. May, June. Japan. B.M. 834. R.H. 1856:41. Lav. 5. J.H. III. 44:321. G.C. III. 35:51. Var. **bícolor,** Steud. (*C. Sièboldii*, D. Don). Fig. 986. Like the type, but with the purple stamens somewhat petal-like, and forming a dense, purple head in the center. F.S. 5:487. Lav. 5. M. & J. 16. B.R. 24:25. P.M. 4:147. Gn. 22: 142. R.H. 1856:401. S.B.F.G. 11. 4:396. F. 1872, p. 200. Var. **Fórtunei,** Moore (*C. Fórtunei*, Hort.). Fls. large, very much doubled; sepals creamy white, becoming pink. F.S. 15:1553. G.C. 1863:676. I.H. 10, p. 86. M. & J. 13. F. 1863:169. F.M. 3:153.



986. Clematis florida var. bicolor. (×½)

Belle of Woking. A hybrid form: fls. very full and double; sepals purple.

John Gould Veitch (C. Veitchii, Hort.). Fls. velvet, double, resembling var. Fortunei, except in the color of the sepals. From Japanese gardens. F.S. 18:1875–6.

Hybrids of this species are: *C. venosa*, Krampen, see C. Viticella; *C. Lawsoniana*, see C. lanuginosa.

23. **lanuginòsa,** Lindl. (including var. *pállida*, Hort.). Climbing only 5 or 6 ft.: lvs. simple or of 3 lfts., cordate-acuminate, woolly beneath: fls. erect on stout stalks shorter than the sepals, woolly in the bud, the largest of the wild species, being 6 in. across; sepals 5 or 6, broadly ovate, leathery, rather flat, overlapping, lavender or bluish gray; center of stamens pale reddish brown; styles plumose. Summer. Native near Ningpo, China. F.S. 8:811. I.H. 1:14. Lav. 1. M. & J. 4. J. F. 4:363. H.F. 1855:1. 1854:225. G.C. III. 29:23. G. I, p. 257. Gng. 5:38.—It is to this species, more than to any other, that the beauty and popularity of the garden varieties and hybrids are due. The finest hybrids, including *C. Jackmanii* and its section, and *C. Lawsoniana*, contain more or less of the blood of *C. lanuginosa*.

Forms of *C. lanuginosa* are:

Var. *cándida*, Lemoine (C. candida, Hort.). Like the type, except that the simple lvs. and lfts. of the compound lvs. are much larger, and the fls. are larger, being 7–8 in. across, and white with a purplish shading around the margins. F.M. 5:310. V. 6:225.—Perhaps a hybrid of C. patens.

Var. *nívea*, Lemoine (C. nivea, Hort.). Sepals 6–8, narrowish, pure white; anthers pale brown.—Thought to be of same origin as the above var.

álba mágna, Jackman. Fls. very large, pure white, with about 6 broad sepals and purplish brown anthers. G.C. II. 3:685.

Lady Caroline Nevill, Cripps. Fls. often 7 in. across; sepals 6, nearly white, with mauve-colored stripe down center of each. Gn. 46, p. 33.—One of the finest light-colored varieties.

Princess of Wales, Jackman. Fls. 6 in. across; sepals 8, satiny bluish mauve, very broad. G.C. III. 27:53. Gn. 59, p. 366.

Marie Lefebvre, Cripps. Resembles the last, but has 8 sepals, more pointed, and darker in shade.

Perfection, Froebel. Fls. very large; sepals 8, very broad, lilac-mauve. R.B. 6:193.

Sensation, Cripps. Fls. like the type, but with 6–7 grayish blue sepals, 6 in. across.

Madame Emile Sorbet, Paillet. Fls. bright blue. R.H. 1878:291.

Madame Van Houtte, Cripps. Late-blooming; sepals pale blue, becoming white.

Madame Thibaut. Fls. very abundant.—Thought to be a hybrid with C. Viticella.

The President, Noble. A rich violet-blue fl.

Excelsior, Cripps. Fls. double; sepals grayish purple, with a reddish bar down the center of each. F.S. 20:2055.

violàcea, Noble. Fls. violet-blue, 7 in. across. F.M. 1876:217.

Robert Hanbury, Jackman. Sepals bluish lilac, flushed at the edges with red, and the bar slightly tinted with red. Gn. 16:128.

This species has given rise to numerous beautiful hybrids which in many cases are the product of so much intercrossing that it is impossible to recognize the exact parentage. By far the most important group of these hybrids may be classed under *C. Jackmanii*, which, however, by some is considered not a hybrid, but a species intro. from Japan.

C. Jáckmanii, Moore (C. lanuginosa × C. Hendersonii and C. lanuginosa × C. Viticella. C. hakonensis, Franch. & Sav.). Fig. 987. Habit and lvs. of C. lanuginosa: fls. flat, 5–6 in. broad, usually in 3's and forming

panicles at the ends of the branches; sepals 4–6, very broad, velvety purple, with a ribbed bar down the center; broad, central tuft of pale green stamens. M. & J. 5, 6, 9, 10, 11, 12, 14. I.H. 11:414. F.S. 16:1629. Gn. 22:142; 53, p. 262; 71, p. 107. A.G. 12:125; 19:269. A.F. 10:1329; 14:995–7; 16:283. R.H. 1868: 390. Gng. 4:261; 9:17; 7:230–2. C.L.A. 5:379. Gn. M. 4:226. G.M. 47:102. G.Z. 9:96. F. 1864:193. V. 6:129; 9:340. 18: 70. Lav. 4. Var. *álba*, Hort. Fls. nearly pure white. G. 23:185. F. 1884:33. Gn. 25:126. Var. *rubélla*, Jackman. Fls. deep velvety reddish violet. F. M.5:310. F.S.20: 2050–51 (1874). Var. *supérba*, Hort. Fls. violet-purple, resembling C. Madame Grangé.



987. Clematis Jackmanii.

Also the following hybrids are to be classed under *C. Jackmanii: modésta*, Modeste - Guérin (=C.V. ×C.lanuginosa). Fls. well expanded, large, bright blue, bars deeper colored. *fúlgens*, Simon-Louis (=C.V. var. grandiflora×C. lanuginosa). Sepals 5–6, rather narrow, dark purple to blackish crimson, velvety, edges somewhat serrate. *purpùrea-hýbrida*, Modeste-Guerin (=C. V. ×C. Jackmanii). Fls. 4–6 in. across, deep purple-violet, with red veins, but not barred. *rùbro-violàcea*, Jackman (C. lanuginosa × C. Viticella var. atrorubens). Lvs. pinnate, with ovate-acuminate or sometimes ovate-lanceolate lfts.: sepals 4–6, maroon-purple with a reddish bar; stamens greenish. F.S. 16:1630. G. Z. 10:112. F. 1864:265. Var. *Prince of Wales*, Hort., has fls. of lighter tint. *La France*, Gégu (C. lanuginosa×C. Jackmanii). Lvs. smooth: buds woolly; sepals deep cobalt-blue, pointed, with wavy edges. *Reine des Bleues*, Boisselot (same cross as the last). Fls. large, blue, with broad, recurved sepals. *devoniénsis*, Lem. (same cross). Fls. 8–9 in. across; sepals 8, delicate lavender-blue. Gn. 9, p. 563 (note). *spléndida*, Simon-Louis (×C. Viticella). Fls. very dark purple, changing to reddish violet. R.H. 1865:71.

Gipsy Queen, Cripps. Deep violet. *Alexándra*, Jackman. Reddish violet. *Star of India*, Cripps. Five in. across, purple, barred with red. *tunbridgénsis*, Cripps. Reddish purple, barred with light blue. Lav. 4 bis. I.H. 18:50. *magnífica*, Jackman. Rich purple, shaded with crimson, 3 bars of red in each sepal. F.M. 8:453. R.H. 1876:110. *Madame Grangé*, Hort. Sepals very concave, purple-crimson. R.H. 1877:150. *Mrs. James Bateman*, Noble. Pale lavender; a probable cross of C. J. with C. lanuginosa. M. & J. 2, f. 1. F.S. 20:2053 (1779). *Mrs. Moore*, Jackman. Eight to 9 in. across, sepals rather narrow, white. *Thomas Moore*, Jackman. As large as the last, rich violet, with white stamens. *Madame Baron Veillard*, Baron Veil. Rose-lilac. *Madame André*, carmine-violet. R.H. 1893:180. *velùtina-purpùrea*, Jackman. Fls. 4–6 in. across, usually 4, sometimes 5 or 6 sepals, blackish purple. *François Morel*, Morel. Fls. 4 in. across; sepals usually 4, bright violet-red. R.H 1884:444. *Ville de Lyon*, Morel. Fls. 5 in. across; sepals usually 6, broad, deep amaranth-red. R.H. 1899:184.

Other hybrids of *C. lanuginosa* are the following:

C. Durándii, Kuntze (C. integrifolia or possibly C. Jackmanii × C. integrifolia). Upright, to 6 ft.: lvs. simple, petioled: fls. and infl. similar to C. Jackmanii; fls. blue, 4–5 in. broad, flat, with usually 4, rarely 5 or 6 recurved sepals. June–Sept. Gn. 49:98. Gng. 5:276. G. 31:257.—Here belongs probably *C. Pellièri*, Carr., 1880, p. 228.

C. Lawsoniàna, Anderson-Henry (×C. florida var. Fortunei). Fig. 989 (adapted from Floral Magazine, 1872). Fls. very large; sepals 6–8, broad, rose-purple, marked with darker veins. Aug.–Nov. G. 33:411. Var. *Symesiàna* (C. Symesiana, Anderson-Henry. ×C. florida var. Fortunei). Fls. 7 in. across; sepals 6–8, pale mauve; a profuse bloomer. Var. *Hénryi* (C. Henryi, Anderson-Henry). Fig. 988. Robust plant; free bloomer: fls. creamy white, becoming fully expanded when grown in the open sun or under glass. Aug.–Nov. Gn.M. 13:348. G.M. 43:318.—It resembles more the lanuginosa parent. It is not to be confused with C. Henryii, Oliv., a Chinese species allied to C. orientalis and not in cult.

C. Gablénzii (×C. patens; C. patens var. Gablenzii, Hort.). Lvs. simple or 3-parted, ovate, subcordate: fls. large deep violet-blue; sepals 6–8. G.Z. 14:80.—Here belong also:

Otto Froebel, Lemoine. Lvs. leathery, simple or 3-parted: fls. of fleshy texture, grayish white, sometimes becoming bluish; sepals 8, blunt, broad; anthers brownish. *Imperatrice Eugenie*, Carré (C. l. var. pallida×C. patens). Lvs. simple or 3-parted; lfts. broad and woolly: fls. 8–9 in. across, with 8 broad, white sepals. *Jeanne d'Arc*, Dauvesse. Same cross as last and much like it, but the sepals are grayish white, with 3 blue bars down the center of each. *Gloire de St. Julien*, Carré. (×C. patens var. plena). Plant much like C. lanuginosa, but with larger fls.: sepals 6–8, white or pale gray at first; stamens yellow. *Gem*, Baker (×C. Standishii). Lvs. 3-parted or simple: fls. like C. lanuginosa in form; grayish blue.

24. **pàtens**, Morr. & Decne. (*C. cærùlea*, Lindl. *C. azùrea*, Hort., ex Turcz.). Taller and more slender, and lfts. smaller and narrower than *C. lanuginosa:* fls. appearing on last year's branches on slender stalks longer than the sepals, spreading; sepals about 8, rather narrow, delicate lilac; stamens purple. Spring. Isle of Nippon, Japan. M. & J. 3. Lav. 2 and 3. B.R. 23:1955. P.M. 4:193. B. 3:126. H.B. 4:78. R.H. 1856:261.—Should be grown on a northern exposure to preserve the color of the fls. It is almost as prolific as *C. lanuginosa* in producing garden varieties and hybrids, and it is the most likely of all to produce double-fld. forms. Var. **grandiflòra**, Davis (*C. cærùlea* var. *grandiflòra*, Hook.). Fls. larger than the type. B.M. 3983. Var. **Stándishii**, Moore (*C. Stándishii*, Hort.). Fls. about 5 in. across; sepals light lilac-blue, elliptic, of metallic luster: lfts. 3, ovate, acuminate, small.—A fine variety from Japanese gardens flowering profusely in spring.

The following other garden varieties or crosses belong here:

Mrs. James Baker. Sepals nearly white, ribbed with dark carmine. *Miss Bateman*, Noble. Fls. more compact than the type, 6 in. across; sepals ovate, shortly acuminate, pure white, with cream-colored bars; anthers brown. Probably of hybrid origin; allied to var. Standishii. *Stella*, Jackman. Fls. not so large as the last; sepals deep mauve, with a red bar down the center of each. F.S. 22:2341. *Amalia*, Sieb. Sepals 6 or more, oblong-lanceolate, light lilac. From Japanese gardens. F.S. 10:1051. *Lord Lanesborough*, Noble. Sepals bluish lilac, each with a metallic purple bar.—A good variety to gradually force to blossom in the greenhouse by March. *Lady Lanesborough*, Noble. Sepals silver-gray, the bar being lighter colored.—It will blossom in March in the greenhouse. *Marie*, Simon-Louis. Fls. darker than the type. *Mrs. G. Jackman*, Jackman. Sepals blush-white with indistinct wine-red bars. Gn. 16:128. *The Queen*, Jackman. Fls. rather compact, the sepals being broader than the type. *John Murray*, Jackman. Habit and foliage bolder than the type: fls. somewhat later. Gn. 46:32. *Fair Rosamond*, Jackman. Sepals apiculate, broader than the type, and of the same color. F.S. 22:2342. Gn. 16:128. *Countess of Lovelace*, Jackman. Fls. double, blue-violet; sepals much imbricated. In the second crop of blooms the fls. are single, as is often the case in other double varieties. *Albert Victor*, Noble. Fls. much like the type, but large and more compact.—Suitable for forcing under glass. *Duchess of Edinburgh*, Jackman. Fls. double, white, strongly imbricated. *Marcel Moser*, Moser. Fls. 7 in. across; sepals 8, mauve with a reddish violet bar. J. 1897:104; 1900, p. 85. *Nelly Moser*, Moser. Fls. 5 in. across; sepals 8, mauve-pink, with a darker red bar. R.H. 1898:236. *Louis van Houtte*, Hort. Semi-double, rosy white. *Vesta*, Endl. Sepals gray; anthers red. Gt. 39:1333. Gn. 9:408. R.B. 6:193. *Helena*, Sieb. Fls. pure white, with yellow stamens. F.S. 11:1117. I.H. 1:21. R.H. 1855:341. *Louisa*, Sieb. Fls. pure white, with purple stamens. F.S. 10:1052. *monstròsa*, Planch. Fls. semi-double, pure white. F.S. 9:960. R.H. 1856:9. *Sophia*, Sieb. Sepals deep lilac-purple on the edges, with light green bars. F. S. 8:852. I.H. 1:21. B.H. 4:97. R.H. 1855:461. *violàcea*, Lem. Fls. violet-blue; stamens yellow. I.H. 7:254.

Some double-flowered varieties which possibly belong here are: *Snowdrift*, with white, very double fls. Gn. 49, p. 189. M.D.G. 1898:496. *Ostrich Plume*, also white and very double with narrower wavy sepals. M.D.G. 1898:496. *Waverly*, blue, semi-double. M.D.G. 1898:497.

Hybrids of this species are the following: *C. Guáscoi*, Lem. (×C. Viticella). Branches pubescent: lfts. 5, nearly glabrous: fls. solitary, violet-purple, 3 in. across, with 4–6 sepals, strongly 3-nerved, tomentose outside. J.H. 4:117. I.H. 7:226.—*C. francofurténsis*, Lav., supposed to be a hybrid of C. Jackmanii (C. hakonensis) and C. patens, is hardly different. Lav. 7 bis.—*C. lanuginosa×C. patens*, see the preceding species.—*C. florida×C. patens.* Some believe that C. patens var. Standishii represents this cross.

Section VITALBA.

Group CIRRHOSÆ.

25. **cirrhòsa,** Linn. Climbing, to 10 ft.; glabrous: lvs. persistent, slender-petioled, simple, ovate to ovate-oblong, crenately serrate, 1–1½ in. long: fls. 1–2 on the old wood, axillary, whitish, open campanulate, nodding, 1½ in. across, with a short involucre below the sepals: achenes with long plumose tail. Spring. S. Eu., Asia Minor. B.M. 1070. L.B.C. 19:1806.—Tender, only for warmer temperate regions.

26. **baleárica,** Rich. (*C. calýcina,* Ait.). Closely allied to the preceding: lvs. ternate; lfts. incisely serrate, often deeply 3-lobed, ½–1 in. long: fls. greenish yellow, spotted red inside. Spring. S. Eu. Asia Minor. R.H. 1859, p. 190; 1874, p. 289. G.C. II. 9:500. Gn. 6, p. 425; 31, p. 187; 45, p. 240. L.B.C. 8:720. B.M. 959.—Tender.

Group MONTANÆ.

27. **gracilifòlia,** Rehd. & Wilson. Climbing, to 10 ft.: lvs. deciduous, pinnate; lfts. 5–7, ovate to oblong-ovate, cuneate at the base, coarsely serrate, pubescent, about ½in. long: fls. 1–4, axillary, fascicled, white, 1–1½ in. across, on slender stalks 1–2 in. long; sepals 4, spreading, obovate to oblong-obovate: achenes glabrous, with long plumose tail. June. W. China.—Very graceful and floriferous species; has proved hardy at the Arnold Arboretum.

28. **montàna,** Buch.-Ham. (*C. odoràta,* Hort., not Wall.). A vigorous climber, often reaching a height of 15–20 ft.: lvs. ternate, with oblong-acuminate cut-toothed lfts.: fls. several in each axil, following each other in succession of time, resembling white anemone blossoms, sweet-scented; sepals 4, elliptic-oblong, 1 in. long, spreading, becoming pink; stamens conspicuous, yellow: achenes glabrous with plumose tails. May. Himalaya region. B.R. 26:53. M. & J. 8. Gn. 30, p. 309; 49, p. 39; 51, p. 349; 60, p. 79; 68, p. 379; 75, p. 371. A.G. 19:391. R.H. 1856:161; 1899, p. 529. G.C. III. 18:303; 20:589. M.D.G. 1902:423. Lav. 22. J.H. III. 49:533. G. 27:237. G.M. 38:661; 46:121; 51:319. Var. **grandiflòra,** Hook. (var. *anemoniflòra,* Kuntze). Fls. larger, 3–4 in. across. B.M. 4061. M.D.G. 1902: 422. G. 34:477. Var. **rùbens,** Wilson. Foliage reddish, particularly when unfolding: fls. pink or light pink. June. R.H. 1909:35. R.B. 33:232. F.S.R. 3:252. Gn. 77, p. 84. G.M. 50:395; 54:168. J.H. III. 59:325. —Offsprings of a cross between this variety and the. preceding are: Var. *lilácina,* Lemoine, with bluish lilac fls. G. 34:345. Var. *perfécta,* Lemoine, and var. *undulàta,* Lemoine, with bluish white very large fls. Var. **Wilsonii,** Sprague (*C. rèpens,* Veitch, not Finet & Gagnep.). Lfts. ovate, usually rounded or subcordate at the base, puberulous on the veins beneath; sepals obovate-oblong, ¾–1 in. long: fls. in July and Aug., nearly 2 months later than the type. B.M. 8365. M.D.G. 1912:26. R.B. 35:108. See page 3567.

29. **Spoòneri,** Rehd. & Wilson (*C. montàna* var. *sericea,* Franch.). Climbing, to 20 ft.: lvs. ternate; lfts. ovate or oval, usually rounded at the base, with 1 or few teeth on each side, silky pubescent above and beneath, 1–3 in. long: fls. 1 or 2, white, 3–4 in. across on pedicels 3–6 in. long; sepals broadly obovate, densely pubescent outside: achenes pubescent, with long plumose tail. Spring. W. China.—Beautiful species; has proved fairly hardy at the Arnold Arboretum.

Group RECTÆ.

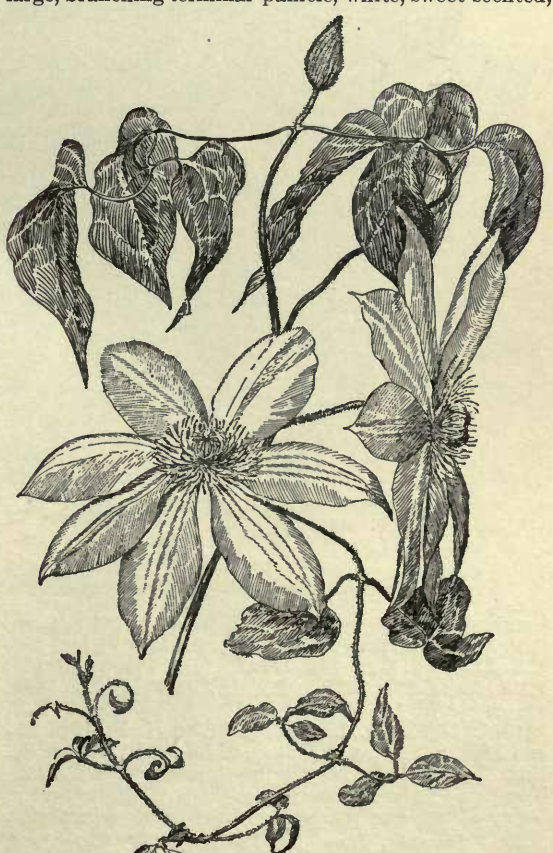
30. **Ármandii,** Franch. Climbing, to 15 ft.: lvs. ternate, evergreen, glabrous; lfts. ovate to ovate-oblong, acuminate, rounded or subcordate at the base, entire, 4–5 in. long, coriaceous: fls. white, 1–2½ in. across, with oblong-obovate sepals, in loose axillary cymes in the axils of last year's branches, with persistent bud-scales at the base: achenes hairy, with long plumose tails. April, May. Cent. and W. China. G.C. III. 38: 30. R.B. 35, p. 281. R.H. 1913, p. 65. Var. **Farquhariàna,** Rehd. & Wilson. Fls. light pink, large, about 2 in. across: lfts. oblong-ovate.—This handsome species is like the following 3 species, adapted only for warmer temperate regions.

31. **Meyeniàna,** Walp. Climbing rapidly; glabrous or slightly pubescent: lvs. ternate; lfts. coriaceous, ovate to ovate-lanceolate, cordate or rounded at the base, entire, 2–3 in. long: panicle loose and many-fld.; fls. white, less than ½in. across: sepals 4, obtusish; anthers as long or longer than filaments: achenes with long feathery tails. Japan, E. China and Indo-China. Summer. B.M. 7897.—Hardy only in warmer temperate regions.

32. **crassifòlia,** Benth. Closely allied to the preceding species: climbing; quite glabrous: lfts. thicker, cuneate at the base, usually obtusish; sepals acuminate; anthers shorter than the filaments. Late summer. China.—Suitable for greenhouse, more tender than the preceding.

33. **Pavoliniàna,** Pampanini. Climbing, glabrous: lvs. subcoriaceous ternate; lfts. long-petioled, lanceolate or oblong-lanceolate, acuminate, 2–3 in. long: fls. slender-pedicelled, white, 1–1½ in. across in axillary racemes; sepals linear-oblong: achenes fulvous-pubescent, with a long plumose tail. May. Cent. China.

34. **récta,** Linn. (*C. erécta,* Linn.). Herbaceous, somewhat tufted, 2–3 ft. long: lvs. pinnate; lfts. stalked, ovate, acuminate, entire: fls. numerous, on a large, branching terminal panicle, white, sweet-scented,



988. Clematis Lawsoniana var. Henryi, a derivative from C. lanuginosa. (×¼)

1 in. across. June–Aug. S. Eu. Gn. 52, p. 510; 53, p. 547; 66, p. 152. R.H. 1899, p. 528. G.M. 45:866. G.W. 14, p. 561. Var. **plèna,** Lemoine. Fully doubled, button-like blossoms. H.F. 1860:13. R.H. 1860, pp. 512–13. Var. **mandshùrica,** Maxim. (*C. terniflòra,* DC. *C. mandchùria,* Rupr.). Taller and slenderer: lfts. 3–5, ovate, subcordate at the base, rarely cuneate, obtuse, reticulate beneath: fls. pure white in axillary and terminal panicles. R.H. 1909, p. 423.

35. **paniculàta,** Thunb. Figs. 990, 991. A vigorous climber: lfts. 3–5, often lobed, acuminate, 1–4 in. long, glabrous: fls. fragrant, 1–1½ in. across, in axillary and terminal panicles; sepals 4, dull white. Sept. Japan. G.F. 3:621 (adapted in Fig. 990); 5:91; 9:75 and 185. F.R. 2:581; 6:471. Mn. 7:113. Gng. 1:101 and 165; 4:161, 229; 6:291; 7:246. A.F. 13:1314. M.D.G. 1898: 487–9. G.W. 11:127. V. 16:18. A.G. 20:847. F.E. 16:375. Gn. 57, p. 155; 61, p. 91. R.H. 1874, p. 465 and 1899, p. 527 (as *C. Flammula robusta*): 1902, p. 86. Prop. by seed. By far the most common of the fall-blooming species in American gardens. Thrives best in sunny situations. Will stand severe pruning in winter.

36. **Flámmula,** Linn. (*C. Pállasii,* J. F. Gmel.). A slender but vigorous climber, reaching 10–15 ft.: lvs. usually bipinnate, dark green, remaining fresh till mid-winter; lfts. small, ovate, oblong or linear: fls. small, numerous, in axillary and terminal panicles; sepals 4, linear-oblong, white; stamens white: fr. bearing white plumes. Aug.–Oct. Medit. region. Gn. 52, p. 499; 55, p. 114; 58, p. 319; 76, p. 23. Gn. M. 13:347. H.W. 3, p. 14. V. 5:321.—Must have a sunny exposure; very beautiful. Var. **rubélla,** Bele (*C. rubélla,* Pers., not Hort.). Differs from the type in having the fls. red outside. Var. **rotundifòlia,** DC. (*C. fràgrans,* Tenore). Lfts. broader, obtuse: fls. fragrant. S. Eu. R.F.G. 4:62 (4666).

There are hybrids of this species with *C. integrifolia* for which see No. 5, *C. aromatica,* and with *C. Viticella,* see *C. violacea* under No. 20.



989. Clematis Lawsoniana, one of C. lanuginosa derivatives. (×½)

Group Euvitalbæ.

37. **Fárgesii,** Franch. Climbing, to 20 ft.: lvs. pinnate; lfts. 5–7, ovate, incised-serrate, sometimes 3-lobed or 3-parted, nearly glabrous or sometimes sparingly silky-pubescent, particularly beneath, 1–2 in. long: fls. 2 in. across, white, in 3-fld. axillary cymes, long-stalked; sepals 4–6, obovate, finely pubescent outside: achenes glabrous with feathery tails. July. W. China. Var. **Soùliei,** Finet & Gagnep. Fls. larger, 3 in. across, solitary.—A handsome species, resembling *C. montana.*

38. **apiifòlia,** DC. Climbing, to 10 ft.: branchlets pubescent: lvs. ternate, long-petioled; lfts. usually ovate, coarsely serrate and sometimes 3-lobed or occasionally the terminal ternate, glabrous above, pubescent on the veins beneath: fls. in axillary, many-fld. short cymes, white, about ½in. across; sepals pubescent on both sides: achenes pubescent with plumose tails. Sept., Oct. Japan. Var. **obtusidentàta,** Rehd. & Wilson. Lfts. broader, usually truncate or subcordate at base, less deeply serrate with shallow rounded teeth, more pubescent. Cent. China.—Resembles *C. grata* in the shape of the lfts.

39. **brevicaudàta,** DC. (*C. brevicordàta,* Hort.). Climbing vigorously: lvs. pinnate to bipinnate; segms. ovate-lanceolate, acuminate, coarsely toothed, sometimes nearly entire, nearly glabrous or pubescent: fls. in axillary panicles, white, ½–¾in. across: achenes hairy, rarely glabrous, with rather short plumose tails. Aug.–Oct. China. G.F. 5:139.—A very variable species, but little used. Var. **tenuisépala,** Maxim. Segms. with only 1–3 teeth on each side or sometimes entire: fls. about 1 in. across with glabrous sepals.

40. **gràta,** Wall. High climbing: young branchlets pubescent: lvs. pinnate; lfts. usually 5, broadly ovate, usually cordate at the base, incisely serrate, sometimes 3-lobed, 1–2 in. long, pubescent on both sides or glabrous above: fls. ¾–1 in. across, creamy white, in large panicles; sepals tomentose outside: achenes densely pubescent, with long feathery tails. Sept., Oct. Himalayas. G.M. 47:642. Gn. 66, p. 365; 71, p. 506. Var. **lobulàta,** Rehd. & Wilson. Lfts. with coarser and fewer

rounded teeth, often 3-lobed or 3-parted, densely pubescent on both sides. Cent. China. Var. **grandidentàta,** Rehd. & Wilson. Lfts. occasionally only 3, incisely dentate, usually rounded at base, glabrescent above, silky pubescent beneath, chiefly on the veins, 2–3½ in. long. Cent. China.



990. Clematis paniculata. (×½)

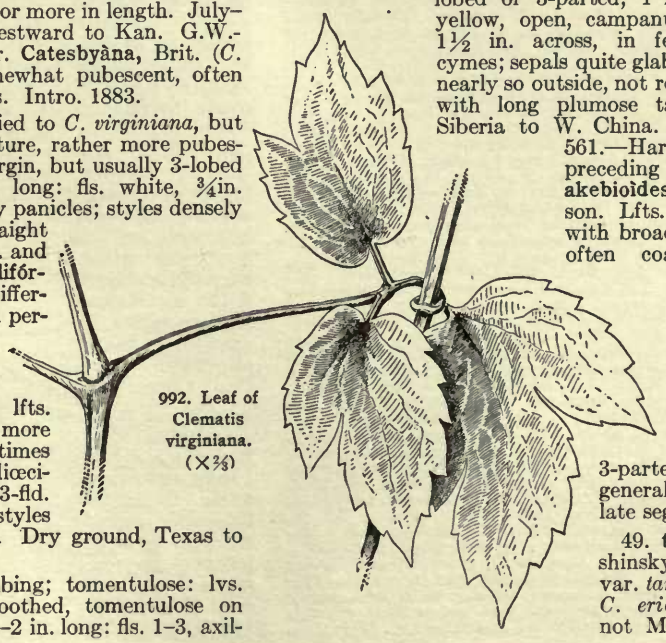
41. **Vitálba,** Linn. In England called TRAVELER'S JOY. The most vigorous climber of the genus, ascending 20–30 ft.: lvs. pinnate; lfts. ovate to ovate-lanceolate, acuminate, cordate at the base, partly cut, 2–3½ in. long: fls. numerous, in axillary panicles, dull white, ¾in. across, with a faint odor of almonds: styles of fr. long and feathery, from which it is given the name "old man's beard." July–Sept. Eu., N. Afr. Caucasus region. Gn. 31, p. 187; 45, p. 389; 53, p. 546. M. D.G. 1898:319. J.H. III. 54:441. H.W. 3, p. 13.—There is a hybrid of this species with *C. heracleæfolia,* for which see No. 12.

42. **virginiàna,** Linn. Fig. 992. Climbing 12–15 ft.: lvs. ternate; lfts. glabrous, cut-toothed, bases often cordate, 2–3 in. long: fls. white, in leafy panicles, often monœcious or dioœcious, about 1 in. across when expanded; plumose styles 1 in. or more in length. July–Sept. Nova Scotia to Ga., westward to Kan. G.W.-F.A. 12. V. 3:19; 9:36. Var. **Catesbyàna,** Brit. (*C. Catesbyàna,* Pursh). Lvs. somewhat pubescent, often biternate. Southeastern states. Intro. 1883.

43. **ligusticifòlia,** Nutt. Allied to *C. virginiana,* but having 5–7 lfts., of firmer texture, rather more pubescent, variable in form and margin, but usually 3-lobed or coarsely toothed, 1–2 in. long: fls. white, ¾in. across, in terminal and axillary panicles; styles densely silky-pubescent, with long, straight hairs. Aug. Mo. to New Mex. and Brit. Col. Intro. 1881. Var. **califórnica,** Wats., has no marked difference: lvs. usually smaller and perhaps more tomentose.

44. **Drúmmondii,** Torr. & Gray. Climbing: st. and lvs. ashy pubescent: lvs. pinnate; lfts. coarsely cleft, with the segms. more or less flaring and sometimes toothed, ½–1 in. long: fls. dioœcious, white, ¾in. across, in 3-fld. cymes or sometimes solitary; styles becoming 2–4 in. long. Sept. Dry ground, Texas to Ariz.

45. **lasiántha,** Nutt. Climbing; tomentulose: lvs. ternate; lfts. roundish, few-toothed, tomentulose on both sides or glabrous above, 1–2 in. long: fls. 1–3, axillary from scaly buds on last year's branches, white, fragrant, 1½ in. across; sepals tomentose outside: achenes pubescent, with long feathery tails. Spring. Calif.



992. Leaf of Clematis virginiana. (×⅔)

Group HEXAPETALÆ.

46. **indivìsa,** Willd. Large woody climber: lvs. ternate, coriaceous; lfts. ovate-oblong to narrow-oblong, subcordate, 1–4 in. long, usually entire: fls. in axillary panicles, white, 2–4 in. across with 6–8 oblong sepals: achenes pubescent with a long plumose tail. New Zeal.—Only the following var. seems to be in cult.: Var. **lobàta,** Hook. Lfts. more or less lobed or even 3-parted. B.M. 4398. R.H. 1853: 241. F.S. 4:402. Gn. 12:400; 41, p. 336; 53, p. 547; 74, p. 527; 77, p. 67. H.F. 1853:144. G.C. III. 29:215; 38:135. G.M. 50: 267. G. 8:289; 32:281–3. J.H. III. 62:387. A.F.13:879; 16:56; 30:221. Gng. 16:199; 8:356. G.F. 6:167.—Only for warm or temperate regions, often cult. as a greenhouse plant and flowering profusely in winter and early spring.



991. Flower of Clematis paniculata. (×¾)

Group ORIENTALES.

47. **orientàlis,** Linn. (*C. gravèolens,* Lindl.). A rapid climber, reaching 12–15 ft.: lvs. thin, glaucous and shiny, pinnate; lfts. 3-parted or -lobed, with small, ovate or oblong-ovate, entire or cut-toothed divisions ½–1½ in. long: fls. in few-fld. cymes, sometimes solitary, becoming erect or nearly so, 1½ in. across; sepals 4, yellow, tinted with green, pubescent on both sides, spreading, somewhat reflexed; styles plumose. Aug., Sept. Himalaya region to Persia. Lav. 21. B.M. 4495. Gn. 31, p. 186; 45:240; 52, p. 501. F.S. 4:374*b* (pl. 336); 6:548. R.H. 1855:321; 1899, p. 530. J.F. 2:128. P.F.G. 2, p. 67. Gng. 5:227. V. 3:362.

48. **glaùca,** Willd. (*C. orientàlis* var. *glaùca,* Maxim.). Slender climber, glabrous: lvs. pinnate, very glaucous; lfts. usually oblong, obtusish, entire or sometimes 3-lobed or 3-parted, 1–2 in. long: fls. yellow, open, campanulate, nodding, 1½ in. across, in few-fld. axillary cymes; sepals quite glabrous inside and nearly so outside, not reflexed: achenes with long plumose tails. Aug.–Oct. Siberia to W. China. R.H. 1890, p. 561.—Hardier than the preceding species. Var. **akebioìdes,** Rehd. & Wilson. Lfts. usually 3-lobed with broad rounded lobes often coarsely crenate, about 1 in. long: fls. usually in 3's, rarely solitary. W. China. Var. **angustifòlia,** Ledeb. (*C. intricàta,* Bunge). Lfts. usually 3-parted with narrow generally linear-lanceolate segms. Mongolia.

49. **tangùtica,** Korshinsky (*C. orientàlis* var. *tangùtica,* Maxim. *C. eriópoda,* Koehne, not Maxim.). Climb-

ing, to 10 ft.: young branchlets slightly villous or nearly glabrous: lvs. green, pinnate; lfts. oblong-lanceolate or lanceolate, acuminate, irregularly serrate with spreading teeth, sometimes 3-lobed or 3-parted, 1–3 in. long: fls. solitary, bright yellow, nodding, 3 in. across; sepals glabrous, except at the margin, acuminate or obtusish: achenes with very long plumose tails. June, sometimes again in Aug. Mongolia to W. China. B.M. 7710. R.H. 1902:528. G.W. 14, p. 651.—Very handsome with its showy bright yellow fls. and later in summer with its large heads of feathery frs.; hardy.

50. **serratifòlia,** Rehd. (*C. koreàna,* Hort., not Komarov). Shrubby climber: lvs. biternate, bright green, glabrous; lfts. ovate-lanceolate to lanceolate, acuminate, inequally serrate, 1–2½ in. long: fls. 1–3, axillary, long-stalked, yellow, nodding, 2 in. across; sepals glabrous, except at the margin: achenes with long plumose tails. Aug., Sept. Korea.—Handsome and quite hardy. The true *C. koreana* belongs to the Atragene group and has petaloid staminodes.

C. acutángula, Hook. f. & Thoms. Allied to C. lasiandra. Sts. deeply grooved: lvs. bipinnate, with ovate or ovatè-lanceolate crenate lfts.: fls. axillary, brownish yellow, with the sepals winged on the back. Sept., Oct. Himalayas. Not hardy N.—*C. Addisonii,* Brit. Allied to C. Viorna. Upright herb; glabrous: lower lvs. simple, upper pinnate: fls. purplish. May, June. Va. and N. C. G.F. 9:325.—*C. angustifòlia,* Jacq. Allied to C. recta. Lvs. pinnate with simple or 3-parted linear lfts.: fls. solitary or in 3's with 4–8 sepals. S. Eu. R.F.G. 4:62 (4665). —*C. aristàta,* R. Br. Allied to C. indivisa. Evergreen: lvs. ternate, with ovate to ovate-lanceolate, cordate lfts.: fls. dicœcious, white, in few-fld. axillary corymbs, 2 in. across, fragrant. Austral. B.R. 3:238 and L.B.C. 7:620 (pistillate plant). G.C. III. 32:55 (staminate plant). Var. *Dénnisæ,* Guilf. (C. Sanderi, Wats.). Fls. with salmon-red filaments. B.M. 8367. Tender.—*C. barbellàta,* Edgew. Allied to C. montana. Lfts. ovate-lanceolate, toothed: fls. solitary, large, dull purple: achenes glabrous. Himalaya. R.H. 1858, p. 407. B.M. 4794. F.S. 9:956.—*C. Benthamiàna,* Hemsl. (C. terniflora, Benth. not DC.). Allied to C. Meyeniana and C. chinensis. Lfts. 5, broadly ovate, subcordate, sparingly pubescent, 1½–2 in. long: fls. in axillary and terminal panicles, white, ½in. across. China.—Of no particular ornamental value.—*C. brachiàta,* Thunb. Climbing; pubescent: lvs. bipinnate or the upper pinnate; lfts. ovate, coarsely toothed: fls. greenish white, in axillary panicles, fragrant, 1–1½ in. across; sepals spreading obtuse; filaments hairy at the base. S. Afr. B.R. 2:97. G.C. III. 30:367. Tender.—*C. brachyùra,* Maxim. Similar to C. recta. Herbaceous, upright: lvs. pinnate with 3–5 ovate, 3-nerved lfts.: fls. axillary, solitary, white; sepals glabrous except at the margin: achenes few with short pubescent style. Korea.—*C. Buchananiàna,* DC. Allied to C. nutans. Large climber, hairy: lvs. pinnate; lfts. broadly ovate, serrate or lobed: fls. in panicles, tubular; sepals ribbed. Himalaya. See also C. nutans var. thyrsoidea.—*C. chinénsis,* Retz. Allied to C. Meyeniana. Lfts. 5, ovate to ovate-lanceolate, nearly glabrous, ¾–1½ in. long: fls. in axillary and terminal panicles. China.—*C. chrysocòma,* Franch. Allied to C. montana. Upright shrub: lfts. obovate with few coarse teeth, ¾–1¾ in. long, yellowish silky-pubescent beneath: fls. axillary, 1–3, 2 in. across; sepals white with pink margin. China. B.M. 8395.—*C. connàta,* DC. Allied to C. nutans. Large climber; glabrous: lfts. 3–7, broadly ovate, slightly pubescent or nearly glabrous, cordate at base, coarsely serrate, often 3-lobed, 2–4 in. long: fls. ¾–1 in. long, in many-fld. panicles. Himalayas. G.F. 4:235.—*C. Delavàyi,* Franch. Allied to C. recta. Upright shrub: lvs. pinnate; lfts. 9–11, ovate, entire, silvery white beneath, ½–½in. long: fls. white, slender-stalked, 3–5, terminal, about 1 in. across. W. China. Very distinct, but apparently not hardy N.—*C. Gebleriàna,* Bong.=C. songarica var. Gebleriana.—*C. Gouriàna,* Roxbg. Allied to C. grata. Tall climber; usually glabrous: lvs. pinnate or bipinnate; lfts. ovate-oblong, glabrous above, pubescent or sometimes glabrous beneath: fls. ½–½in. across, white, in large panicles. Himalayas. S. Asia., Philippine Isls. Wight, Icon. 933–4.—*C. grewiæflòra,* DC. Allied to C. nutans. Tall woody climber; densely tomentose: lfts. 3–5, broadly ovate, cordate, serrate, usually deeply 5-lobed, 3–4 in. long: fls. 1½ in. long, tubular-campanulate, tawny yellow. Himalayas. B.M. 6369.—Very distinct, but only for warmer regions.—*C. hexapétala,* Forst. (C. hexasepala, DC.). Allied to C. indivisa. Lvs. ternate; lfts. coarsely dentate or lobed: fls. dicœcious, in axillary cymes, greenish white, fragrant, 1 in. across. New Zeal. B.R. 32:44.—*C. koreàna,* Komarov. Allied to C. alpina. Lvs. ternate or biternate; lfts. ovate, cordate, coarsely toothed: fls. yellow or violet; sepals about 1 in. long; staminode, spatulate, narrow. Korea. Act. Hort. Petrop. 22:6.—*C. macropétala,* Ledeb. Allied to C. alpina. Lvs. ternate or biternate; lfts. coarsely serrate or nearly entire: fls. large, violet; petaloid staminodes lanceolate, little shorter than sepals. N. China. Gt. 19:651.—*C. mendocìna,* Phil. Allied to C. ligusticifolia. Lower lfts. 3-parted or 3-lobed, segms. lanceolate: fls. monœcious, white, in panicles; sepals sparingly hairy inside: tails of achenes very long. Sept., Oct. Chile. Tender.—*C. Pieròtii,* Miq. Allied to C. brevicaudata. Slender climber: lvs. biternate; lfts. ovate-oblong, coarsely serrate, 1½–2½ in. long: fls. white, ¾in. across, solitary, or in 3-fld., rarely many-fld. cymes: achenes glabrous, with rather short plumose tails. Aug. Japan.—*C. quinquefoliolàta,* Hutchinson (C. Meyeniana var. heterophylla, Gagnep.). Allied to C. Meyeniana. Lfts. 5, lanceolate or oblong-lanceolate, about 3 in. long: cymes few-fld., shorter than the lvs.: tails of fr. fulvous. Cent. China. V.F. 3.—*C. Sánderi,* Wats.=C. aristata var. Dennisæ.—*C. smilacifòlia,* Wall. Tall woody climber: lvs. simple, ovate usually cordate, entire, 3–10 in. long, rarely ternate: fls. 1–1½ in. across, brownish tomentose outside, purple inside, in axillary panicles: achenes with long feathery tail. B.M. 4259. F.S. 2, pt. 12:3. G.C. III. 30:466. —*C. songàrica,* Bunge. Allied to C. recta. Shrubby, upright: lvs. simple, thickish, grayish green, usually lanceolate, entire or sparingly serrate: fls. yellowish white, in terminal and axillary cymes; sepals glabrous inside. Turkestan, Mongolia. Var. *Gebleriàna,* Kuntze (C. Gebleriana, Bong.). Lvs. thinner, more serrate, green. —*C. Suksdòrfii,* Robins. Allied to C. ligusticifolia. Lfts. 5, ovate, to ovate-oblong, 1–1½ in. long: fls. in axillary racemes or panicles, white, 1 in. across; sepals reflexed: achenes few. Brit. Col. G.F. 9:255.—*C. Thúnbergii,* Steud. Climbing, pubescent or glabrous: lvs. pinnate with ovate to lanceolate, often 3-lobed or 3-parted lfts.: fls. in axillary panicles; sepals spreading, lanceolate; filaments hairy at the base. S. Afr. G.C. III. 50:253.

K. C. Davis.
Alfred Rehder.†

CLEMATIS, MOCK: *Agdestis clematidea.*

CLEMATOCLÉTHRA (*Clematis* and *clethra,* referring to the similarity of the flower to that of Clethra and to the climbing habit). *Dilleniàceæ.* Shrubs grown for the profusely produced fragrant flowers and the attractive black or red berries.

Deciduous climbing plants: branches with solid pith: winter-buds conspicuous, free, with several imbricate scales: lvs. petioled, usually serrate: fls. in axillary cymes or panicles, sometimes solitary, white; sepals 5, imbricate, persistent; petals 5, imbricate; stamens 10, short; ovary 5-celled, each cell with 10 ovules; style simple, cylindric: fr. berry-like, with thin flesh, subglobose, usually 5-seeded.—About 12 species in Cent. and W. China. Closely allied to Actinidia which is easily distinguished by its numerous stamens, many styles, many-seeded fr. and in the winter state by its winter-buds being hidden by a swelling of the tissue around their base. Several species have been recently intro., but the names of most of them have not yet been determined. They are apparently hardier than the Chinese actinidias and superior from an ornamental point of view on account of their profusely produced fls. and frs. though the foliage as a rule is smaller and not quite so handsome. Prop. by seeds and probably, like actinidias, by greenwood cuttings in summer and also by hardwood cuttings and layers.

Hémsleyi, Baill. Climbing, to 20 ft.: young branches pubescent at first, soon glabrous: lvs. slender petioled, ovate to oblong-ovate, acuminate, denticulate, glabrous above, brownish pubescent on the veins beneath, 2–4 in. long: fls. white, about ½in. across, 4–12 in stalked axillary cymes: fr. globose, black, about ⅓in. across. Cent. China. H.I. 29:2808.

integrifòlia, Maxim. Quite glabrous: lvs. ovate to ovate-lanceolate, acuminate, finely serrulate or entire, dark green above, glaucous beneath, 1½–3 in. long:



993. Cleome spinosa.

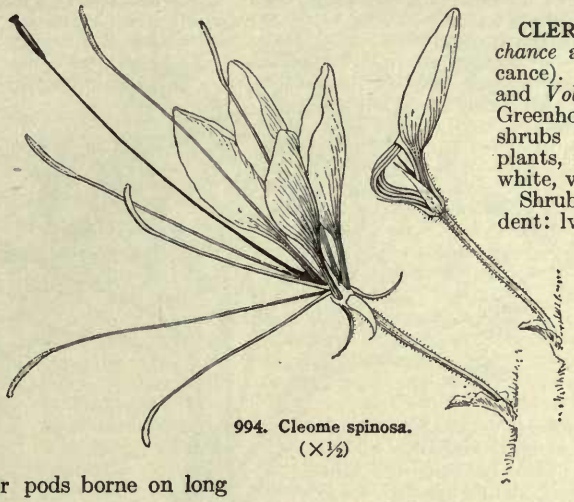
fls. solitary or in 2- or 3-fld. cymes on slender stalks, white, ⅓–½in. across: fr. globose, black. W. China.

ALFRED REHDER.

CLEÒME (meaning uncertain). *Capparidàceæ.* Odd spider-flowered plants sometimes grown in the flower-garden.

Sub-shrubs or annual herbs, simple or branched, glabrous or glandular, with simple lvs. or 3–7 lfts., and white, green, yellow or purplish fls. borne singly or in racemes; petals entire, with claws.—Seventy tropical species, in both hemispheres. The genus is distinguished from Gynandropsis by its short torus, which often bears an appendage, and by the 4–6, rarely 10, stamens.

The garden cleomes are chiefly interesting for their long purple spidery stamens and showy rose-colored petals. They succeed in sandy soils and sunny situations, and can be used like castor-oil plants to fill up large gaps in a border. *C. spinosa* is the best, and has lately been planted considerably in public parks amongst shrubbery. Propagated by seeds, which are produced freely in long slender pods borne on long stalks.



994. Cleome spinosa. (×½)

A. *Lfts. more than 3.*

spinòsa, Jacq. (*C. púngens,* Willd. *C. gigantèa,* Hort., not Linn.). GIANT SPIDER PLANT. Figs. 993, 994. Clammy, strong-scented, 3–4 ft. high: lfts. usually 5, sometimes 7, oblong-lanceolate, with a pair of short stipular spines under the petioles of most of the lvs., and in the tropics some little prickles on the petioles also: fls. rose-purple, varying to white; petals 4, obovate, clawed, ½in. long; stamens 2–3 in. long, blue or purple. N. C. to La. (naturalized from Trop. Amer.) and escaped from gardens. B.M. 1640. G.C. III. 45: 115.—A tender biennial north, but annual in the tropics. The plant recently intro. as *C. gigantea* is not the true species, which is a green-fld. S. American plant as yet apparently unknown in the trade in this country. *C. spinosa* differs widely in the extent and character of its spines. The fls. vary in the development of the style; Fig. 994 shows a fully perfected style.

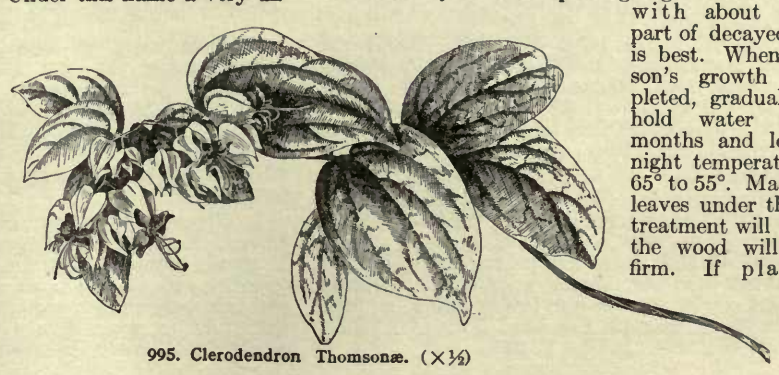
speciosíssima, Deppe. Annual or half-shrubby, sometimes 5 ft. high: sts. strongly hairy without spines; lfts. 5–7, lanceolate, dentate, narrowed at the base, conspicuously hairy on both sides: fls. light purple or purplish rose. July to fall. Mex. B.R. 1312.—Said to be the showiest of cleomes. Under this name a very different plant is passing, the lfts. of which have only minute hairs but rather numerous spines.

AA. *Lfts. 3.*

serrulàta, Pursh (*C. integrifòlia,* Torr. & Gray). ROCKY MOUNTAIN BEE-PLANT. Glabrous, 2–3 or even 6 ft. high: lfts. 3, lanceolate to obovate-oblong, entire, or rarely with a few minute teeth: bracts much narrower than in *C. spinosa:* petals rose, rarely white, 3-toothed; receptacle with a flat, conspicuous appendage. Along streams in saline soils of prairies.—In cult. over 30 years as a bee-plant.

C. dendroídea, Schult. Tree-like, 10–14 ft.: fls. blackish purple. Brazil. B.M. 3296.—*C. gigantèa,* Linn. Shrubby, 3–5 ft., downy: lfts. 7, lanceolate, lance-oblong or oblanceolate, the entire lf. shorter than petiole: fls. greenish; petals linear, 2 in. or more long, cohering by their margins and opening only on one side; sepals long-linear, glandular, becoming revolute. Trop. Amer. B.M. 3137.—*C. speciosa,* HBK=Gynandropsis.

N. TAYLOR.†



995. Clerodendron Thomsonæ. (×½)

CLERODÉNDRON (Greek, *chance* and *tree:* of no significance). Includes *Siphonántha* and *Volkamèria. Verbenàceæ.* Greenhouse climbers and hardy shrubs and other ornamental plants, grown for the showy white, violet or red flowers.

Shrubs or trees, often scandent: lvs. opposite or verticillate, mostly entire or not compound: fls. in mostly terminal cymes or panicles; calyx campanulate or rarely tubular, shallowly 5-toothed or 5-lobed; corolla-tube usually slender and cylindrical, the limb 5-parted and spreading, the lobes somewhat unequal; stamens 4, affixed on the corolla-tube, long-exserted and curved; style exserted, 2-cleft at the end; ovary 4-loculed: fr. a drupe inclosed in the calyx.—About 100 species, in the tropics, mostly of the eastern hemisphere.

Clerodendrons are divided into two garden sections,—those with a shrubby habit, and the twining kinds. The culture is about the same for both kinds. They may be grown from seeds or from cuttings of the half-ripened wood. In either case, use 2-inch pots filled with a mixture of equal parts of leaf-mold or peat and good sharp sand. Place a cutting or a seed in each pot, and press moderately firm. Leave the pots in a tight case with a temperature of 70°, and keep the soil at all times fairly moist. When the pots are filled with roots, shift into a 4-inch pot, using a compost consisting of fibrous loam two parts, leaf-mold and sand one part each, and a fifth part of well-rotted manure. Pot rather firm, as this insures a stronger growth, and during the growing season keep in a night temperature of 65°.—Clerodendrons may be flowered in any size pot desired, and some of the species, notably *C. Balfourii* (or properly *C. Thomsonæ*), can be had in flower from Easter until late September. This species is probably the best and most useful, either for decorative work or exhibition purposes; when it is grown in large pots, a good rough material may be used for potting. A good stiff fibrous loam with about one-third part of decayed manure is best. When the season's growth is completed, gradually withhold water for two months and lower the night temperature from 65° to 55°. Many of the leaves under the above treatment will drop and the wood will become firm. If plants are wanted in flower about Easter,

give them a thorough soaking with water about January 1, and raise the temperature again to 65° by night, letting it rise during the day to 75° to 80°. Syringe the plants two or three times a day, which will encourage the young growths to start all over the ripened wood. When this takes place, the plant will either have to be repotted or fed liberally with liquid manure and fertilizers, repotting usually resulting in larger panicles of flowers. If feeding is resorted to, a handful of green cow-manure to a watering-pot containing two and a half or three gallons of water is sufficient; and if any of the popular fertilizers are used for a change, a small handful to the same amount of water will answer. Water twice in between with clean water. Plants for a succession may be started when the first are beginning to show the crimson at the end of the flower, and so on until the end of July or first of August. —Clerodendrons are not subject to insect pests if kept thoroughly syringed during their growing season. If this is neglected, the shrubby kinds may become affected with brown-scale or mealy-bug, which should be immediately treated with the usual hydrocyanic gas fumigation. (George F. Stewart.)

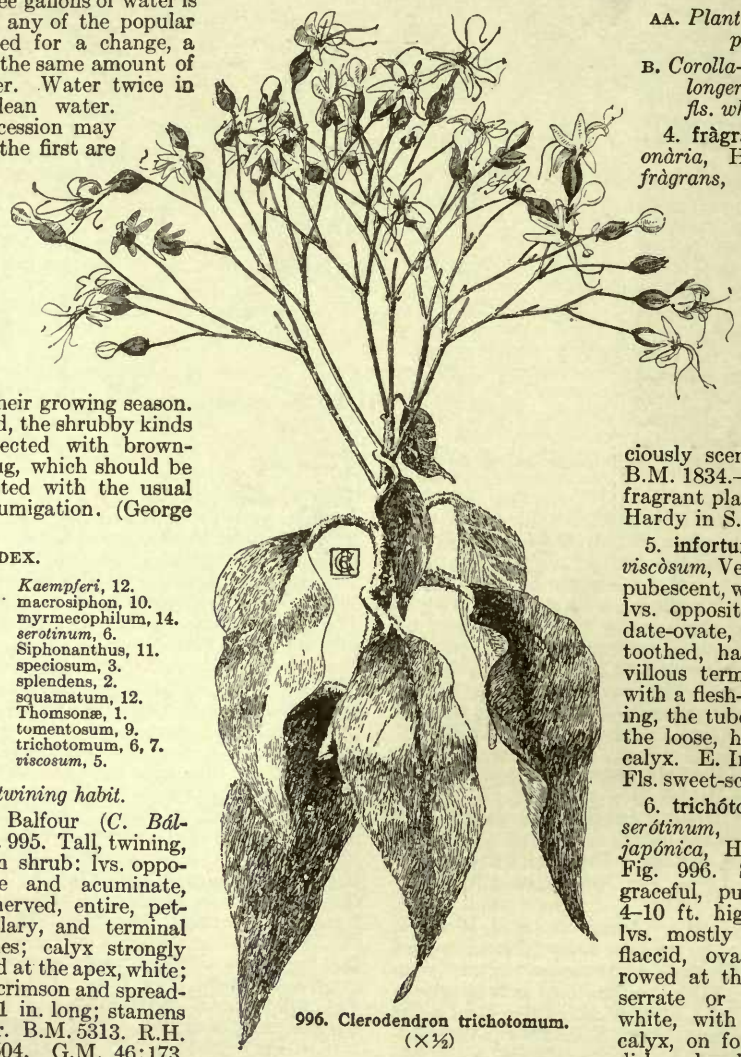
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A. *Plant of twining habit.*

1. **Thómsonæ,** Balfour (*C. Bálfouri*, Hort.). Fig. 995. Tall, twining, glabrous evergreen shrub: lvs. opposite, oblong-ovate and acuminate, strongly several-nerved, entire, petioled: fls. in axillary, and terminal forking lax cymes; calyx strongly 5-angled, narrowed at the apex, white; corolla-limb light crimson and spreading; corolla-tube 1 in. long; stamens ¾in. long. W. Afr. B.M. 5313. R.H. 1867:310; 1902:504. G.M. 46:173. G.W. 4, p. 439; 8, p. 173; 13, p. 340. F.E. 28:261.—A warmhouse plant of great merit, and the most popular of the tender species. Blooms profusely on the young wood. Var. **delèctum,** Hort. (*C. delèctum* and *C. delicàtum*, Hort.). Fl.-clusters very large; calyx pure white or green-tinged; corolla large, rose-magenta.

2. **splèndens,** Don (*Siphonánthus splèndens*, Hiern). A most excellent stove climber: sts. slender, woody, glabrous, slightly angled: lvs. opposite, variable, oblong-cordate, or elliptic, 4–6 in. long, dark green; petiole rather short: fls. in dense many-flowered cymes on leafy growths from the ripened wood of the previous year, bright scarlet passing into bright yellow, an inch or more in diam.; stamens 1 in. long. Trop. Afr. B.R. 28:7. R.H. 1902:504. H.U. 5, p. 325.



996. Clerodendron trichotomum. (×½)

3. **speciôsum,** Hort. A garden hybrid between *C. splendens* and *C. Thomsonæ*, intermediate in habit and foliage: the fls. are produced in profusion, are dull red, and are continuously borne throughout the summer months; old calices more or less persistent, and ornamental pale red after fls. are past.—As figured in R. H. 1873, 471 and Gn. 1877, 404, this recedes very little from typical *C. splendens*, according to Baker, but the *C. speciosum hybridum* of I. H. 1869, t593 is intermediate between *C. splendens* and *C. Thomsonæ*.

AA. *Plant of erect or self-supporting habit.*

B. *Corolla-tube not much if any longer than the large calyx: fls. white or light blush.*

4. **frà grans,** Vent. (*C. coronària*, Hort.? *Volkamèria frà grans*, Vent.). Pubescent, half shrubby, with angled branches, 3–5 ft.: lvs. broadly ovate, with truncate or cordate base, acuminate, coarsely toothed: fls. white or blush, in terminal, compact, hydrangea-like corymbs, usually double, deliciously scented. China, Japan. B.M. 1834.—Very desirable and fragrant plant for the coolhouse. Hardy in S. Lvs. ill-scented.

5. **infortunàtum,** Gaertn. (*C. viscòsum*, Vent.). Height 5–7 ft., pubescent, with square branches: lvs. opposite and stalked, cordate-ovate, acuminate, entire or toothed, hairy: fls. in a loose villous terminal panicle, white, with a flesh-colored center, flaring, the tube projecting beyond the loose, hairy, large, 5-angled calyx. E. Indies. B.M. 1805.—Fls. sweet-scented. Greenhouse.

6. **trichôtomum,** Thunb. (*C. serótinum*, Carr. *Volkamèria japónica*, Hort., not Thunb.). Fig. 996. Slender but erect, graceful, pubescent sub-shrub, 4–10 ft. high or even higher: lvs. mostly opposite, soft and flaccid, ovate-acuminate, narrowed at the base, very closely serrate or entire, hairy: fls. white, with a reddish brown calyx, on forking, slender, reddish peduncles, the corolla-tube sometimes twice as long as the calyx; segms. of calyx turning red and affording pleasing contrast to bright blue frs. Japan. B.M. 6561. Gn. 43:504; 51, p. 320; 75, pp. 67, 447. G. 26:492. J.H. III. 55:355. F.E. 29:653. R.H. 1867, p. 351.—A very handsome, hardy shrub or small tree. In the N. it kills to the ground, but sprouts up if the crown is protected.

7. **Fàrgesii,** Dode (*C. trichótomum* var. *Fárgesii*, Hort.). A recent shrub, reported as being hardy in England, rapid-growing: lvs. dark green or purplish, opposite, petioled, the blade ovate and acute or acuminate, strongly veined, abruptly narrowed at the base, entire: fls. in panicles in summer, whitish, fragrant; sepals lance-ovate, becoming reflexed: fr. globular,

size of a sweet pea seed, peacock-blue, set on the purple or crimson old calyx. China. G.M. 54:817. R.H. 1911, p. 522, 523.

8. **inérme,** Gærtn. Tall shrub or becoming small tree: lvs. opposite or ternate, obovate or elliptic, entire, scentless, privet-like, 1½ in. or less long: fls. white, fragrant, on 3–7-fld. axillary peduncles; corolla-tube ¾in. long, the lobes very short: fr. ½in. long, smooth, separating into 4 parts. India, where it is said to be used for hedges.—Offered in S. Calif.



997. Clerodendron fallax. (×⅓)

BB. *Corolla-tube markedly longer than the small calyx (usually 2–3 times or more longer).*

C. *Fls. white.*

9. **tomentòsum,** R. Br. Shrubby and erect (often becoming a small tree), pubescent, often purplish: lvs. opposite and petioled, ovate-elliptic to sub-lanceolate, short-acuminate, 2–4 in. long, entire or sparingly toothed, pubescent on both sides, but thickly so on the under side: fls. in opposite, forking compact clusters, the calyx not enlarged, the slim, corolla-tube long-exserted (3–4 times length of calyx), and the clear white corolla-lobes reflexed-curled; anthers yellow, protruding. Austral. B.M. 1518.—Cult. in S. Calif.

10. **macrósiphon,** Hook. f. (*C. incìsum* var. *macrósiphon,* Baker). Elegant erect shrub, finely pubescent: lvs. opposite, oblanceolate-oblong, acuminate, notched or pinnatifid: fls. in a nearly sessile terminal cyme or head, pure white; calyx green, very small; corolla-tube very narrow, 4–5 in. long, hairy, the limb 1-sided, ½in. long; filaments 2 in. long, red. E. Afr. B.M. 6695.—Warmhouse plant of merit, but the handsome fls. are short-lived.

11. **Siphonánthus,** R. Br. (*Siphonánthus índica,* Willd.). Turk's Turban. Tube-Flower. Shrub, 2–8 ft. high, open-branched: lvs. opposite or verticillate, nearly sessile, narrowly lanceolate, entire or nearly so: fls. long-tubed and white (tube 3–4 in. long) in very large terminal racemes, the lobes ⅔in. long, obovate-oblong: fr. a showy, red and purple berry, which persists a long time. E. Indies. Hardy in Fla.

CC. *Fls. red, orange or distinctly lilac.*

12. **squamàtum,** Vahl (*C. Kaémpferi,* Sieb.). Shrub 6–10 ft., thinly pubescent: lvs. large, opposite, round-cordate, entire or denticulate, acuminate: infl. and fls. brilliant scarlet; fls. with small red calyx and reflexed, spreading, unequal corolla-lobes; corolla-tube 1 in. or less long, very slender: drupe blue-black or greenish blue, rather fleshy. China. B.R. 649. R.B. 22:253. Gn. 42:562. Gt. 5:352.—Very showy. Cult. in warm greenhouses, and in the open in S. Calif. and S. Fla. The fls. are in an erect branchy, panicle-like cluster.

13. **fállax,** Lindl. Fig. 997. A highly ornamental species: st. erect, shrubby, branching after flowering, bluntly 4-angled: lvs. large, cordate-ovate, hairy, rich dark green, often 1 ft. in length and supported by a stout hairy petiole: infl. erect, often 18 in. or more in length; fls. bright scarlet, numerous, 1½–2 in. diam., tube narrow, lobes reflexed. Java. G.C. III. 45:324. Gn. 59, p. 179, desc. G.W. 10, p. 247.—Should be in every collection of warmhouse plants, as it may be induced to bloom practically all the year round; it should be given a fairly light position, with slight shade from strong sun.

14. **myrmecóphilum,** Ridley. Shrub, sparingly branched, 3 ft., with terete sts. and white bark: lvs. opposite and alternate, 1 ft. long, linear-oblong, shining dark green, with a dozen pairs of conspicuous nerves, short-petioled: fls. yellow-red, in a large, showy terminal pubescent panicle; calyx about ⅓in. long; corolla-tube considerably longer than calyx; corolla-lobes ½in. long, obovate to oblong and obtuse; filaments red, much exserted. Singapore. B.M. 7887. G.C. III. 33:291; 35:237. R.H. 1907, p. 443. G. 26:359. G.M. 47:259. Gng. 13:376. A.F. 25:78.—The hollow sts. afford nesting-places for ants, whence the name *myrmecophilum* ("ant-loving").—Blooms well in 6-in. pots in a warmhouse, producing panicles 8 in. long on plants 2 ft. high.

15. **fœtidum,** Bunge (*C. Búngei,* Steud.). Shrub, 3–6 ft., pubescent, spiny, of a dwarf spreading habit, sparsely branched: lvs. opposite, broad-ovate and acuminate, stalked, coarsely toothed, often 1 ft. long, dark green above and red-hairy beneath: fls. rosy-red, ¾in. across, tube 3–4 times as long as calyx, in a dense capitate corymb 4–8 in. across. China. B.M. 4880. F.S. 9:863. G. 27:452; 30:361.—Cool greenhouse; hardy in middle and southern states. August. Killed to the ground in the latitude of Philadelphia, but sprouts up and blooms. Fls. not fetid, but name given because of the odor of the bruised lvs. Spreads by suckers from the root, and soon forms a mass of beautiful free flowering growths. L. H. B.

CLÉTHRA (ancient Greek name of the Alder, transferred to this genus on account of the resemblance of the leaves). *Clethràceæ.* White Alder. Shrubs or small trees grown for their handsome spikes of white fragrant flowers appearing in summer.

Leaves alternate, usually serrate, deciduous or persistent: fls. white, in terminal often panicled racemes; petals 5, erect; stamens 10: caps. splitting into 3 valves, many-seeded.—About 25 species in Amer., E. Asia, Madeira. Only a few hardy deciduous species are generally cult.; valuable for their showy spikes of white fragrant fls., appearing late in summer. They grow best in a moist, peaty or sandy soil. Prop. by seeds, sown in spring in pans in sandy and peaty soil, and by greenwood cuttings under glass, growing best if taken from forced plants in early spring and placed in slight bottom heat; also, in-



998. Clethra tomentosa. (×½)

creased by layers and by division of large plants. Handsome when forced under glass.

A. *Lvs. deciduous: stamens exserted.*

B. *Racemes usually solitary; stamens pubescent.*

acuminàta, Michx. Tall shrub or small tree, to 15 ft.: lvs. petioled, oval or oblong, acuminate, rounded or narrowed at the base, sharply serrate, pubescent beneath at least on the veins, 3–7 in. long: racemes usually solitary, nodding; sepals acute; style glabrous. July–Sept. Alleghany Mts., Va. to Ga. L.B.C. 15:1427.

BB. *Racemes usually panicled.*

C. *The lvs. with 7–10 pairs of veins, 1½–4 in. long: sepals obtusish; stamens glabrous.*

tomentòsa, Lam. (*C. alnifòlia* var. *tomentòsa,* Michx.). Fig. 998. Shrub, 2–8 ft.: lvs. short-petioled, obovate, acute or short-acuminate, cuneate, serrate usually above the middle, pubescent above, tomentose beneath, 2–4 in. long: racemes few or solitary; style pubescent. Aug., Sept. N. C. to Fla. and Ala. B.M. 3743. G.F. 4:65 (adapted in Fig. 998). R.H. 1912, p. 519.

alnifòlia, Linn. Sweet Pepperbush. Shrub, 3–10 ft.: lvs. short-petioled, cuneate, obovate or oblong, sharply serrate, mostly glabrous or nearly so, 2–4 in. long: fls. fragrant, in erect, usually panicled racemes. July–Sept. Maine to Fla. M.D.G. 1890:65; 1903: 473, 474. G. 26:63. J.H. III. 31:375. Em. 426. Var. **paniculàta,** Arb. Kew. (*C. paniculàta,* Ait.). Lvs. cuneate-lanceolate, less toothed, green and glabrous on both sides: racemes panicled. Var. **ròsea,** Rehd. With pinkish fls.

CC. *The lvs. with 10–15 pairs of veins, 3–6 in. long.*

barbinérvis, Sieb. & Zucc. (*C. canéscens,* Authors, not Reinw.). Shrub or tree, to 30 ft.: branches glabrous: lvs. petioled, cuneate, obovate or oblong-obovate, acuminate, sharply dentate-serrate, pubescent beneath at least on the veins, 3–6 in. long: racemes panicled; fls. fragrant; pedicels about as long as the fls.; sepals obtuse; filaments glabrous. July–Sept. E. Asia. Gt. 19:654.

Fàrgesii, Franch. Shrub, to 12 ft.: young branchlets tomentose or nearly glabrous: petioles ½–1 in. long: lvs. oblong-ovate or elliptic-oblong, acuminate, broadly cuneate or rounded at base, sharply serrate, slightly pubescent beneath or nearly glabrous, 3–6 in. long: fls. white, in panicled racemes 5–7 in. long; sepals pointed; filaments hairy, style glabrous. Cent. China. —One of the most ornamental species on account of its very long racemes.

AA. *Lvs. evergreen: stamens included.*

arbòrea, Ait. Shrub or small tree, to 20 ft.: lvs. cuneate, narrow-elliptic, acuminate, serrate, almost glabrous, shining above, 3–4 in. long: racemes panicled; fls. fragrant. Aug.–Oct. Madeira. B.M. 1057. G.C. III. 52:100. J.H. III. 64:245. G.M. 49:97; 52:127. Gt. 52, p. 209. Gn. 76, p. 428.—It stands only a few degrees of frost.

C. monostàchya, Rehd. & Wilson. Allied to C. Fargesii. Lvs. cuneate, elliptic-oblong to oblong-lanceolate, glabrous or nearly so: racemes usually solitary; style appressed pilose. Cent. China.—*C. quercifòlia,* Schlecht. Shrub: lvs. obovate-oblong, tomentose beneath: racemes panicled. Mex. B.R. 28:23.—*C. tinifòlia,* Swartz. Shrub: lvs. oblong, entire, tomentose beneath: racemes panicled. Jamaica.—The last two are evergreen and hardy only in subtropical regions.

Alfred Rehder.

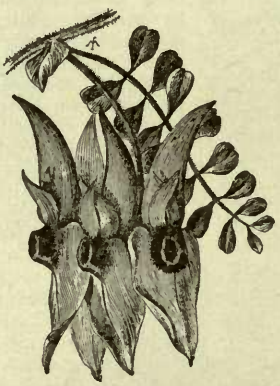
CLEYÈRA (after Andrew Cleyer, Dutch physician of the seventeenth century). *Ternstræmeàceæ.* Greenhouse evergreen shrubs distinguished by the petals free or scarcely coalesced, the pilose anthers, numerous ovules, and scarcely bracted fls.: sepals 5, with 2 bractlets; petals 5; stigmas 2–3: berries 2–3-celled.—About 9 species.

ochnàcea, DC. (*C. japónica,* Sieb. & Zucc.). Height about 6 ft.: lvs. oval-oblong, acute at both ends, veined above, entire. Himalayas.—A tender shrub rarely cult. in northern greenhouses. In the S. it is cult. outdoors. It has glossy foliage, numerous creamy white, fragrant fls., borne in June, and red berries, which last all winter.—*C. japónica* was distinguished by DeCandolle by its oblong-lanceolate lvs., which are veinless, and minutely serrate at the apex. Var. **trícolor,** Hort., has dark green lvs., with grayish markings, and a margin of white and rose, the variegation being more brilliant in younger lvs.

Wilhelm Miller.

CLIÁNTHUS (Greek, *glory-flower*). *Leguminòsæ.* Glory Pea. Glory Vine. Parrot's Bill. Tender half-trailing shrubs, with large, showy flowers of unique appearance. Swainsona is an allied genus, but its general appearance is very different and it has acuminate, not obtuse petals. Interesting plants, with pinnate lvs. of many lfts., and fls. in racemes; scarcely papilionaceous: pod stalked, many-seeded.—Two or 3 species.

Clianthus Dampieri is somewhat difficult to grow on its own roots. In Germany, a method has been found whereby it is as easy to succeed with this species as with the better-known *C. puniceus.* The method consists of using small seedling plants of *Colutea arborescens* as stocks; these are cut over near the soil and seedlings of *C. Dampieri,* while in the cotyledon stage, are separated from the root, the base cut wedge-shape and inserted in a cut made in the colutea stock. While the union is taking place, the pots should be placed under a bell-jar. *C. puniceus* is an old-fashioned greenhouse plant, grown sometimes to cover rafters or trellis work, but more frequently trained around sticks placed about the edge of the pot. The flowers, not very unlike those of the common Erythrina, are freely produced in hanging clusters. Cuttings rooted in early spring may be grown into good-sized plants during the summer. Water should be given sparingly during the dull months. Pruning, repotting and tying the shoots should be done just before the growth begins. A sharp lookout should be kept for the red spider, frequent syringings being the only remedy for this pest. Propagated by seeds and cuttings. (G. W. Oliver.)



999. Clianthus Dampieri. (×⅔)

Dampièri, A. Cunn. Glory Pea. Fig. 999. Height 2–4 ft.: plant glaucous and hoary, with long whitish silky hairs: sts. slightly tinged with red: petioles longer than in *C. puniceus;* lfts. 15–21, nearly opposite, sessile, usually acute; stipules larger than in *C. puniceus:* fls. 4–6 in a raceme, large, drooping, about 3 in. long, rich crimson or scarlet, with a handsome velvety, purple-black area on the raised center. Austral. B. M. 5051. R.H. 1868:230. Gt. 48, p. 272. Gn. 20:86. Var. **germânicus,** Hort., is also sold, and is probably var. **marginàtus,** Hort., which has one petal white, margined scarlet. See Gn. 37:298 and p. 299 for an account of grafting this species on stocks of *C. puniceus.* Var. **trícolor,** Hort. Keel white except the tip, which is bright scarlet. Gn. W. 20:409 (desc.).

puníceus, Banks & Soland. Parrot's Bill. Red Kowhai. Height 3–6 ft., much branched: plant glabrous: lfts. 16–28, each with a very short petiole, alternate (at least toward the end of the lf.), blunt or

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XXVIII. Stowell Evergreen sweet corn.

slightly notched: fls. 8 or more in a raceme, crimson, fading with age, at least 3 in. long. New Zeal. B.M. 3584.—Cult. in eastern greenhouses, and a favorite Californian outdoor shrub. Blooms all winter in Golden Gate Park, San Francisco. A white-fld. form has been grown in Calif., but is not so popular as the type. It is commonly cult. in New. Zeal. Var. **magnificus**, Hort. Clusters of bright scarlet fls.

WILHELM MILLER.
N. TAYLOR.†

CLIDÈMIA (old Greek name). *Melastomàceæ*. About 100 Trop. American species of horticulturally rather unimportant plants in a family famous for its foliage plants. Lvs. broad, entire, 5–7-nerved, opposite, petioled: fls. in panicles or axillary clusters, white, pink, or purple; petals 5 or 6; stamens 10 or 12: branching shrubs, mostly hairy. **C. vittâta**, Lind. & André, has large, oval, pointed lvs. with 5 strong nerves, and a narrow band of white down each side of the midrib. I.H. 22:219. R.H. 1876, p. 233.

CLIFF BRAKE: *Pellæa*.

CLIFTÒNIA (after Dr. Francis Clifton, an English physician, d. 1736). *Cyrillàceæ*. BUCKWHEAT TREE. Glabrous evergreen shrub or small tree, rarely cult. for its early appearing racemes of white or pinkish fragrant fls.: lvs. alternate, short-petioled, without stipules, entire: fls. in terminal racemes; sepals and petals 5–8; stamens 10, shorter than the petals, the filaments flattened below; ovary superior, 3–4-celled, with a 3–4-lobed nearly sessile stigma: fr. indehiscent, ovoid, with 3–4 wings and as many seeds. The only species is **C. monophýlla**, Sarg. (*C. ligústrina*, Spreng. *C. nítida*, Gaertn. *Mylocáryum ligústrinum*, Sims). Occasionally 50 ft. tall: lvs. oblong-lanceolate, obtuse, cuneate at the base, dark green above, 1½–2 in. long: racemes 1–2½ in. long; fls. white or pinkish, fragrant, about ⅓in. across: fr. ¼in. long. Feb., March; fr. in Aug., Sept. Ga. to Fla. and La.; swamps. S.S. 2:52. B.M. 1625.—Little known in cult. and now not in the trade, but well worth cult. for its early, delicate and fragrant fls.; also the buckwheat-like frs. are attractive. Hardy as far north as Philadelphia. Thrives best in humid sandy and peaty soil. Prop. by seeds and probably like Cyrilla by cuttings of half-ripened wood under glass with slight bottom heat.

ALFRED REHDER.

CLIMBERS are distinguished from twiners by having some means of attachment, as tendrils or other special devices, while twiners rise by twisting their stems round their support. In a wider sense, the word is often used synonymously with "vines," including all plants that use other plants or other objects for support, by whatever mechanism or method. By "trailers," nurserymen commonly mean low-growing vines, and by "climbers," tall-growing vines. See *Vines*.

CLIMBING FERN: *Lygodium*. **Climbing Fumitory:** *Adlumia fungosa*. **Climbing Hempweed:** *Mikania scandens*. **Climbing Lily:** *Gloriosa superba*.

CLINOSTÍGMA (Greek, *inclined stigma*). *Palmàceæ*, tribe *Arèceæ*. Low spineless palms with the habit and somewhat the appearance of small kentias; feather-leaved.

Trunks not over 8 ft., usually conspicuously ringed: lvs. usually 3–4 ft. long, rarely more, and pinnate; lfts. scythe-shaped, or lanceolate, 2-parted or obliquely truncate at the apex, not revolute at the base; rachis scaly, convex beneath, grooved above: fls. monœcious in the same spadix, sessile along its branches, the male usually 2 together, the female solitary; spadix long and usually much branched; in the male there are 3 imbricate outer segms. and 3 valvate inner segms. to the perianth, with 6 stamens surrounding an abortive ovary: fr. obliquely globular.—Species 3, one from Austral., one from Samoa, and another from Fiji. Only the following is known in cult., and it is a rare palm. Its graceful lvs. and convenient dwarf habit should commend it to the trade. For cult. see *Kentia*.

Mooreànum, F. Muell. (*Kéntia Mooreàna*, F. Muell.). Dwarf palm, 3–4 ft. high: lvs. 3–4 ft. long; segms. numerous, about 1 ft. long, longitudinally plicate when young: spadix at first closely sessile, very much branched when older. New S. Wales, confined to Lord Howe's Isl.—This graceful and recent palm resembles *Howea Forsteriana* somewhat in habit of growth, but its arching lvs. spread wider, and its sts. are dark purplish, and its pinnæ tough and leathery. The palm is free and clean in growth.

N. TAYLOR.

CLINTÒNIA (after DeWitt Clinton, the famous Governor of New York and promoter of the Erie Canal). *Liliàceæ*. A small group of low-growing, herbaceous plants of North America and Asia, with a few tufted, broad shining leaves, and usually umbels of flowers.

Perianth-segms. equal or nearly so; stamens 6, inserted at the base of the perianth-segms.: ovary 2–3-celled with 2 to several ovules in each cavity: fls. on scapes: root-stocks slender: fr. a globose or oval berry. For *C. pulchella* and other species of the abandoned genus Clintonia of Hort., see *Downingia* a very different genus belonging to Campanulaceæ.

Clintonias grow in cool, moist woods, and fanciers can secure them from some dealers in native plants. It is difficult to tell the species apart by the leaves.

A. *Scape bearing an umbel of fls.*

B. *Fls. greenish yellow.*

boreàlis, Raf. Height 1–2 ft.: fls. 3–6, nodding, green, margined yellow. Labrador to Winnipeg and south to N. C. B.M. 1403 (as *Smilacina borealis*).—This is one of the choicer plants of cool, moist woods, known to plant lovers chiefly by its handsome umbels of blue berries found in autumn, which are borne above the large, dark green, shining lvs. The commonest species, but not easily grown below elevations of 1,000 ft.

BB. *Fls. white, with green spots.*

umbellulàta, Torr. Fls. 10–20 or more, smaller than in *C. borealis*, erect or nearly so, white, with green or purplish spots. Alleghany Mts. from N. Y. to Ga. B.M. 1155 (as *Smilacina borealis*).—This species has the smallest fls. of the group, and is the only one that has but a single pair of ovules in each cell of the ovary.

BBB. *Fls. deep rose.*

Andrewsiàna, Torr. One to 1½ ft. high, bearing 4 sessile, oblong, acute lvs., and 20 or more nearly erect fls. which are in dense umbels. Calif., to S. Ore., in deep, cool woods, in clayey soil rich in mold. B.M. 7092.—The showiest of the group. Cult. to some extent.

AA. *Scape bearing 1 white fl.*

uniflòra, Kunth. The only species in which the scape is shorter than the lvs.: fls. nearly erect; rarely there are 2 fls.: lvs. narrow, obovate-lanceolate, hairy. Calif. to Alaska.

WILHELM MILLER.
N. TAYLOR.†

CLITÒRIA (derivation recondite). *Leguminòsæ*. BUTTERFLY-PEA. Glasshouse vines with pea-like flowers; and also hardy perennials.

A widespread and variable genus of 30 species allied to Centrosema, and characterized by the calyx-tube being cylindrical and longer than the lobes: standard narrowed at the base, not appendaged on the back; stamens in one group, the anthers all alike; style often bearded. The most important garden plant is *C. Ternatea*, a warmhouse annual twiner, reaching 15 ft., and requiring no special cult. It has very showy blue fls.

A. *Lfts. 5.*

Ternatèa, Linn. (*C. cærùlea,* Hort. *Ternatèa vulgàris,* HBK.). Lfts. 5, oblong, obtuse, short-petioled: fls. 1 in. or more long, rich blue, with beautiful markings, especially on the standard. B.M. 1542. Gn. 38:132. P.M. 7:147 and 13:79.—Name from Ternate, one of the Molucca Isls. and not from ternate, meaning 3-leafleted.



1000. Clivia miniata.

Hardy in Cent. Fla., where it is usually a biennial. **C. álba,** Hort., is a white form. More or less double forms have been known for over a century.

AA. *Lfts. 3.*

mariàna, Linn. Hardy perennial, smooth, erect, or slightly twining, 1–3 ft. high: lfts. 3, obovate or ovate-lanceolate: fls. light blue, 2 in. long, on short peduncles: pod straight, few-seeded. Summer. Dry banks, N. Y. to Fla. and west to Mo. Also India and Burma.—Rarely sold by dealers in native plants.

arborêscens, Ait. St. shrubby, the rusty colored branches twining: lvs. trifoliolate, the lfts. elliptical or oval: fls. racemose, showy, purple, the standard more than 2 in. long. Trop. Amer. B.M. 3165.—An excellent warmhouse climber, grown chiefly in botanic gardens.

WILHELM MILLER.
N. TAYLOR.†

CLÌVIA (after a Duchess of Northumberland and member of the Clive family). Syn., *Imantophýllum. Amaryllidàceæ.* Tender bulbous plants with handsome evergreen foliage and showy, bright red or red and yellow flowers in large umbels.

Bulb imperfect, mostly of old lf.-bases: perianth funnelform, curved or straight, the segms. much longer than the tube; ovules 5–6 in each cell: fr. a berry, differing in this from the capsular fr. of Nerine.—Three species from S. Afr. J. G. Baker, Amaryllideæ, p. 61.

Clivias make excellent house plants, but, like amaryllis, are too costly to be very popular. They have the advantage over amaryllis of having attractive foliage all the year round, and are more certain to bloom well. They have thick, fleshy roots, like an agapanthus. All the species are well worth growing, because of their handsome umbels of flowers, produced during the spring and early summer months. *Clivia miniata* is the species most commonly grown. There are several distinct forms of this, with larger and deeper colored flowers. Established plants may be grown in the same pots for several years, if the plants are fed during the growing period with weak liquid manure. In potting, the soil given should be of a lasting nature, not easily soured, nor likely to become sodden. In arranging the drainage, place one large piece, concave side down, over the hole, and around this arrange several smaller pieces. Over these place one or two handfuls of pieces small enough to go through a No. 2 sieve. The best time to pot is after the flowers have been produced. The plants should then be kept for some time in a humid atmosphere to encourage growth, receiving an abundance of water after they are well started. After growth has been completed, they will winter safely in an ordinary greenhouse temperature (not under 40°), if kept rather dry at the root. For propagation, choose old plants which have become crowded in their pots, so that the entire plant can be pulled to pieces. After trimming the roots, put the growths in small pots and keep in heat, to encourage root action. Clivias are well suited for planting permanently in the front part of greenhouse borders. The soil for this purpose should be rich and well firmed about the roots. Withhold water as much as possible during the resting period, or the plants will produce leaves at the expense of the flowers. (G. W. Oliver.)

A. *Fls. erect; perianth broadly funnel-shaped.*

miniàta, Regel (*Imantophýllum miniàtum,* Hook.). Fig. 1000. Lvs. 16–20, in a tuft, sword-shaped, tapering to a point, 1½ ft. long, 1½–2 in. broad: fls. 12–20, in an umbel; perianth erect, bright scarlet, with a yellow throat; tube broadly funnel-shaped, longer than *C. nobilis;* segms. about 2 in. long, the inner ones broader than the outer; stamens shorter than the segms.; style not exserted: berries ovoid, bright red, 1 in. long. Natal. B.M. 4783. R.H. 1859, pp. 126–7; 1869:250, and 1894, p. 572. F.S. 9:949; 23:2373. I.H. 26:343; 36:80; 37:102; 40:177.—*I. cyrtanthiflòrum,* Van Houtte (F.S. 18:1877), is a hybrid between this species and the next. It has a curved perianth, with the inner segms. of the limb twice as broad as the outer; stamens longer than the corolla. R.H. 8:259 (desc.). Var. **aùrea,** Hort. Fls. yellow with a deeper shade at base of the segms. Var. **striàta,** Hort. Lvs. freely variegated.

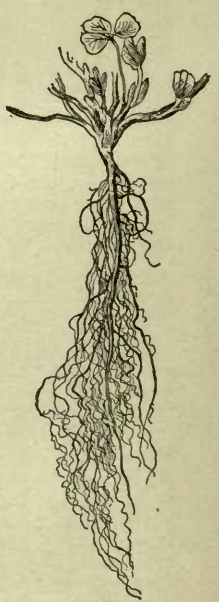
AA. *Fls. pendulous; perianth narrowly funnel-shaped.*

nóbilis, Lindl. (*Imantophýllum Aitoni,* Hook.). Lvs. about 12, strap-shaped, very obtuse, with a roughish edge: fls. 40–60, in an umbel; perianth curved and drooping; tube narrowly funnel-shaped, shorter than in *C. miniata;* segms. tipped with green, about 1 in. long; stamens as long as the segms.; style exserted. Cape Colony. B.M. 2856. L.B.C. 20:1906. Intro. to cult. 1828.—*I. cyrtanthiflòrum,* Van Houtte (F.S. 18:1877), said to be a hybrid between this and the above, shows little if any influence of *C. miniata.* It has the narrow-tubed, pendulous fls. and the greenish tinge of *C. nobilis.* R.H. 1894, p. 573.

C. Gárdenii, Hook. Very much as in C. nobilis but with the corolla-lobes obviously spreading: stamens as long as the perianth-segms.; anthers oblong, yellow. B.M. 4895.—A desirable plant.

WILHELM MILLER.
N. TAYLOR.†

CLOTBUR, a weed: *Xanthium.*



1001. Trifolium pratense. Root-system.

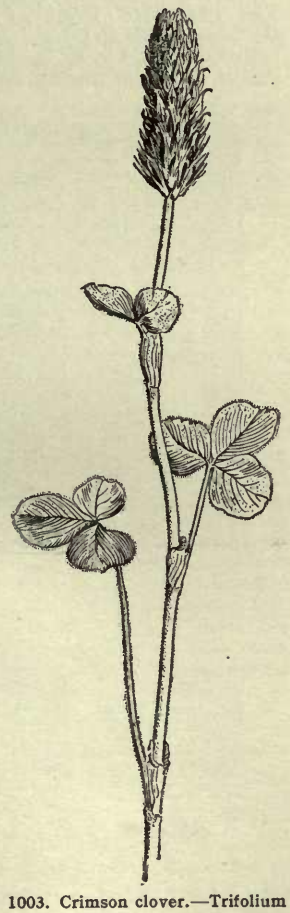
CLOVE PINK: The carnation, *Dianthus Caryophyllus.*

CLOVER. Species of *Trifòlium* (Leguminosæ), particularly those that are useful in agriculture. The word is also applied to species of related genera, as Medicago. The sweet clover is Melilotus. Bush and Japan clover are Lespedezas. Prairie clover is a Petalostemon.

About 300 species of Trifolium have been described. These are widely dispersed in temperate climates. The flowers are papilionaceous but small, and are disposed in dense heads or spikes. The leaves are digitately or palmately 3-foliolate. The common European red clover is *T. pratènse,* Linn., now thoroughly naturalized in North America, but supposed not to be native here. It is valuable both for stock feed (as pasturage and hay), and also as a green manure. As a manure crop, to be plowed under, it is particularly useful because of its deep root-system and its power (in common with other leguminous plants) of fixing the nitrogen of the air by means of its roots. Fig. 1001 illustrates the root system. Fig. 1002 shows the root of a fifteen-months-old plant that grew in hard clay soil. It is 22 inches long, and some of the root was left in the ground. The mammoth red clover (*T. mèdium,* Linn.) is perhaps an offshoot of *T. pratense.* It is usually a larger plant, with zigzag stem, entire and spotted leaflets, and longer-stalked head. White clover, or shamrock, is *T. rèpens,* Linn., introduced from Europe, and supposed to be native to North America as well. Alsike clover, *T. hýbridum,* Linn., is of Old World nativity. The crimson or scarlet clover (*T. incarnàtum,* Linn.), Fig. 1003, an annual from southern Europe, is now much grown as a catch- or cover-crop in orchards. See *Cover-crops.* It is also highly ornamental, and is worthy the attention of the florist. For agricultural discussion of the clovers, see Vol. II, Cyclo. Amer. Agric. L. H. B.



1002. The penetrating root of the red clover.



1003. Crimson clover.—Trifolium incarnatum. (×⅓)

CLOVES are the dried flower-buds (Fig. 1004) of a handsome tree of the myrtle family *Jambosa Caryophyllus* or *Eugenia caryophyllata,* better known as *Caryophyllus aromaticus,* a native of the Spice Islands, but now cultivated in the West Indies and elsewhere. See *Eugenia.* Caryophyllus, the ancient name of the clove, means "nut-leaf." The carnation, or "clove pink," was named *Dianthus Caryophyllus* because of its clove-like odor, and it has become the type of the great order Caryophyllaceæ, which, however, is far removed botanically from the Myrtaceæ. The word "gilliflower" is a corruption of caryophyllus, and, until Shakespeare's time and after, was applied to the carnation, but now-a-days it usually refers to certain cruciferous plants of the genera Cheiranthus and Matthiola.



1004. Clove.
1. Spray of leaves and flowers; 2. The expanded flower; 3. An unopened bud, or clove.

The clove bark of pharmacy is secured from *Dicypellium caryophyllatum,* of Brazil, one of the Lauraceæ.

The word clove is used among gardeners for a small secondary bulb employed for propagating, specially for the little bulb that forms in a scale-axil of a larger bulb.

CLUB-MOSS: *Lycopodium.*

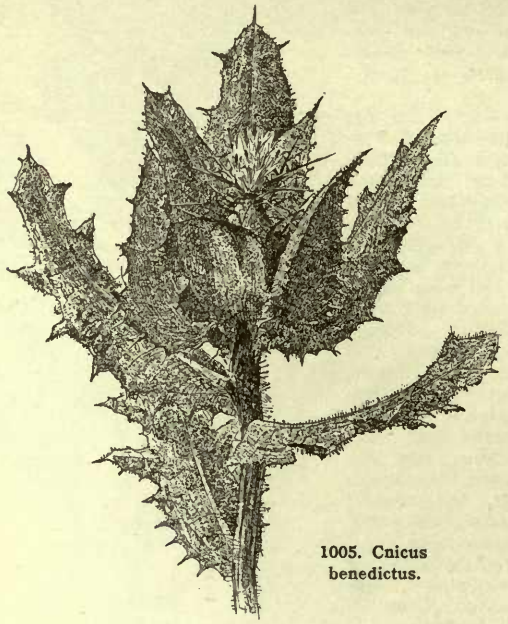
CLÙYTIA (after Cluyt, Dutch botanist of 16th century). *Euphorbiàceæ.* Evergreen greenhouse shrubs from S. Afr., rarely cult., chiefly in botanical gardens. Habit often ericoid: lvs. alternate, small, entire: fls. clustered in the axils, staminate with petals; calyx imbricate; stamens about 5; ovules 3. Prop. by cuttings. **C. pulchélla,** Linn., is a small shrub: lvs. ovate and somewhat acute, petioled, glabrous, entire: fls. axillary, small, white. B.M. 1945.

J. B. S. Norton.

CLYTÓSTOMA (Greek *klytos,* splendid or beauteous, and *stoma* mouth; alluding to the beautiful flowers). *Bignoniàceæ.* Ornamental vines, grown for their beautiful flowers.

Evergreen shrubs, climbing by leaf-tendrils: lvs. opposite, with 1 pair of short-stalked entire lfts., the rachis elongated into a slender simple tendril, sometimes wanting: fls. in 2's, axillary, or terminal or in panicles; calyx campanulate with 5 small or subulate teeth; corolla funnelform-campanulate with imbricate rounded lobes; stamens 4, with spreading anther-cells; disk short; ovary conical, warty, 2-celled, with

the ovules in 2 rows: caps. compressed, prickly, septicid, with numerous nearly orbicular winged seeds.—About 8 species in S. Amer., usually described under Bignonia in horticultural writings. Closely related to Bignonia, from which it differs chiefly in its simple



1005. Cnicus benedictus.

slender tendrils, the short disk, the small or subulate calyx-teeth and the prickly pod. Suited for cult. in subtropical or tropical regions only, or as a stove plant in the N. For cult. and prop., see *Bignonia*.

callistegioìdes, Bur. & Schum. (*Bignònia callistegioìdes,* Cham. *B. speciòsa,* Graham. *B. pìcta,* Lindl. *B. Lindleyi,* DC.). Large climber: lfts. elliptic-oblong, acuminate, undulate, glabrous, lustrous, reticulate below, about 3 in. long: fls. on 2-fld. terminal peduncles; calyx campanulate, with subulate teeth; corolla pale purple, streaked, about 3 in. long, the tube yellowish streaked purplish, limb 2–3 in. broad, with the lobes spreading, broadly oval, obtuse and wavy; disk crenate. Spring and early summer. S. Brazil, Argentina. B.M. 3888. B.R. 28:45. H.U. 3:227. P.M. 10:125. F.S. 9:907.—Will stand a little frost, when grown in the open in the S.

purpùreum, Rehd. (*Bignònia purpùrea,* Lodd.). Large climber: lfts. sometimes 3, ovate-oblong or obovate-oblong, short-acuminate, bright green above, paler below, entire, occasionally toothed, about 3 in. long: fls. on axillary 2-fld. peduncles or sometimes in clusters; calyx tubular-campanulate, with short triangular teeth; corolla mauve-colored with white eye, with a rather slender tube 1 in. long, lobes spreading, orbicular-obovate. Uruguay. B.M. 5800. G.C. III. 24:399.

ALFRED REHDER.

CNÌCUS (Latin name of Safflower, early applied to thistles). *Compósitæ.* BLESSED THISTLE. A monotypic genus allied to Centaurea, and distinguished from it botanically by its heads being quite sessile and surrounded just below by bristly leaves. Its habit in the garden is very different from the bachelor's button, being thistle-like, and more interesting than ornamental. A hardy annual low-growing herb, rough, branching and pilose. Once thought to counteract poison. Culture easy. Fit for wild gardens and rockeries.

benedíctus, (Linn. *Cárduus benedictus,* Authors. *Centaurèa benedícta,* Linn. *Carbènia benedícta,* Adans.). Fig. 1005. Height 2 ft.: lvs. alternate, sinuate-pinnatifid, oblong, the lobes and teeth spiny: heads terminal, yellow, 1 in. wide, the fls. exclusively tubular. Medit. regions and Caucasus. Sometimes cult.; also seen in waste places of S. Atlantic states and Calif. as a weed adventive from Eu.

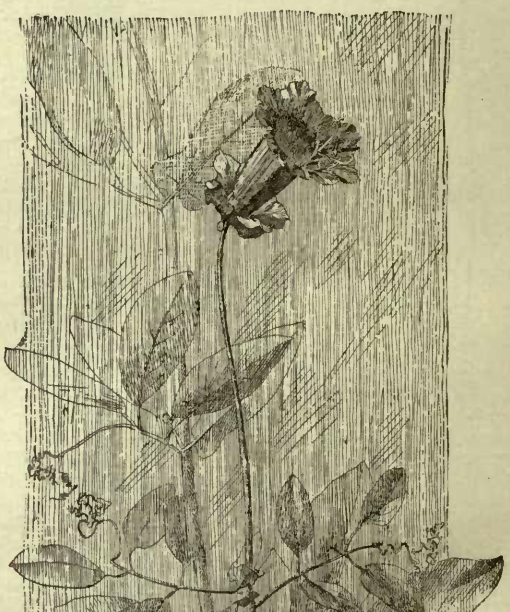
C. rhaphilèpis, Hemsl., S. Mex., has recently been cult. abroad. It is described as a handsome plant with deeply cut spiny-toothed lvs. about 2 ft. long, gray-tomentose beneath: st. colored, much branched: fl.-heads 3–3½ in. long, the involucral bracts scarlet and spine-tipped; fls. scarcely exserted, the filaments carmine. Under the above definition of Cnicus, this plant must fall in another genus. It has been placed in Carduus by E. L. Greene, as C. raphilepis.

N. TAYLOR.†

COBÆA (after Father Cobo, Spanish Jesuit of the seventeenth century, naturalist, and resident of America for many years). Syn. *Rosenbérgia.* Sometimes incorrectly spelled Cobœa. *Polemoniàceæ.* Attractive climbers, one or two species commonly grown in the open and under glass for the large bell-shaped flowers.

Shrubby plants climbing by lf.-tendrils, but known in cult. as herbs: lvs. alternate, pinnate: calyx large, 5-parted; corolla bell-shaped, the limb 5-lobed: caps. 3-valved, angled: fls. solitary on long peduncles, bracted at the base.—A genus of about 10 Trop. American climbers (monographed by Brand in Engler's Pflanzenreich, hft. 27, 1907), of which *C. scandens,* a tender perennial plant, is amongst the dozen most popular vines commonly treated as annuals. This is the only genus of climbers in the order. Prop. by seeds which should be placed in moist earth, edge down. It is a rapid grower.

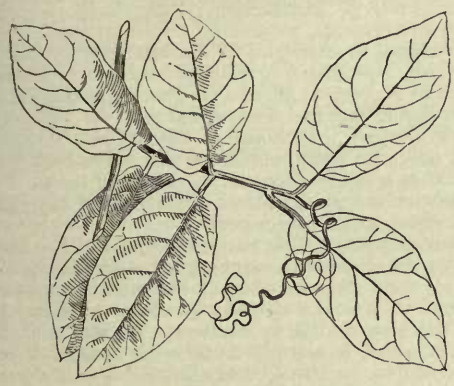
scándens, Cav. (*Rosenbérgia scándens,* House). Figs. 1006–1008. Height 10–20 ft.: lfts. in 2 or 3 pairs, the lowest close to the st., and more or less eared: fls. bell-shaped, 1–1½ in. across, light violet or greenish purple, with protruding style and stamens: tendrils



1006. Cobæa scandens. (×⅓)

branched. Mex. B.M. 851. F.S. 14:1467.—There is a white-fld. form (*C. álba*, Hort.), and one with variegated lvs., var. *variegàta*, Hort.—The terminal lft. is represented by a tendril (Fig. 1007). Sometimes there are indications of tendrils on other lfts. (Fig. 1008), making the plant an interesting one for students of morphology.

stipulàris, Benth. (*Rosenbérgia stipulàris*, House). Resembles the preceding species but the sepals ovate, tapering to a broadly acuminate apex (the sepals of *C. scandens* being broadly ovate or suborbicular). Mex.



1007. Normal leaf of Cobæa scandens.

macrostòma, Pav. (Sometimes erroneously written *macrostema* and *macrostemma*.) Sts. climbing 6–10 ft.: lvs. alternate, of 3 pairs of obovate lfts.: fls. solitary, on a 2-lvd. long peduncle, the petals yellow-green; stamens at least 1½ in. longer than the corolla. Guatemala. B.M. 3780.

C. minor. Marten &. Galleotti. A small vine of which little is known, but cult. in Amer. in botanic gardens and fanciers' collections. It has small fls., borne on stalks shorter than the lvs. Mex.—*C. Pringlei*, House (Rosenbergia Pringlei, House). A glabrous, high-twining vine: lfts. 6, the basal pair oblong-lanceolate, hastately clasping: peduncles 4–5 in. long; calyx-lobes green, herbaceous, scarcely 1 in. long and half as broad; corolla pure white, 2 in. long; stamens exserted less than ½in. Mex.

WILHELM MILLER.
N. TAYLOR.†

COBNUT: *Corylus.*

COBÚRGIA: *Stenomesson.*

COCA. The leaves of *Erythroxylon Coca*, used in medicine. Sold chiefly as a fluid extract. Cocaine is the famous local anesthetic. See *Erythroxylon.*

COCCÍNIA (Latin, *scarlet;* referring to the ornamental gourds). *Cucurbitàceæ.* Tender perennial vines, usually with tuberous roots, grown for ornament mostly indoors.

Leaves angled or lobed, sometimes glandular: fls. white or yellowish, large, staminate and pistillate on different plants or sometimes on different branches of the same plant; calyx short, often campanulate: fr. a small, scarlet gourd, sometimes marbled, with an insipid pulp.—Twenty species from the tropics of Asia and Afr. A. Cogniaux in DC., Mon. Phan. 3:528. *C. cordifolia* is treated as a tender annual, requiring an early start and no special cult. The genus is sometimes referred to Cephalandra.

A. *Tendrils simple: male fls. solitary: lvs. small.*

cordifòlia, Cogn. (*C. indica*, Wight & Arn.). Height about 10 ft., perfectly smooth: lvs. small, 1–2 in. long, glossy, ivy-like, short-petioled, obtusely 5-angled: fl. white, bell-shaped, the staminate solitary: fr. roundish at both ends, about 2 in. long, 1 in. thick. India.

AA. *Tendrils bifid: male fls. in racemes: lvs. large.*

palmàta, Cogn. (*Cephalándra palmàta*, Lond.). Attaining 30 ft.: lvs. large, 3–4 in. long and wide, long-petioled, palmately 5-lobed: fls. yellowish: fr. ovate, acute. Natal.—Intro. by P. Henderson & Co., 1890. A rare greenhouse plant.

C. Dinteri, André, with palmate lvs. and handsome scarlet frs., may be in cult. S. Afr. R.H. 1900:268.

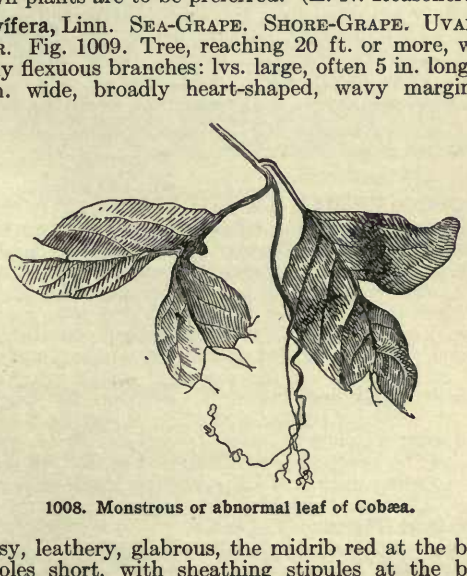
WILHELM MILLER.
N. TAYLOR.†

COCCÓLOBA (Greek, *lobed berry*, referring to the ends of the pear-shaped fruit). Sometimes spelled *Coccolobis.* Including *Campdèria. Polygonàceæ.* Tropical shrubs, trees or rarely tall woody climbers, grown for their fruits and usually large glossy leathery leaves.

Leaves alternate, always entire: fls. small, in axillary or terminal spike-like racemes, usually some shade of green or yellow-green; sepals 5, herbaceous; petals 0; stamens 8, exceeding the perianth: fr. berry-like, with a small stone, often edible.—About 125 species in the American tropics and reaching to Fla. *C. platyclada* is now referred to *Muehlenbeckia*, which see.

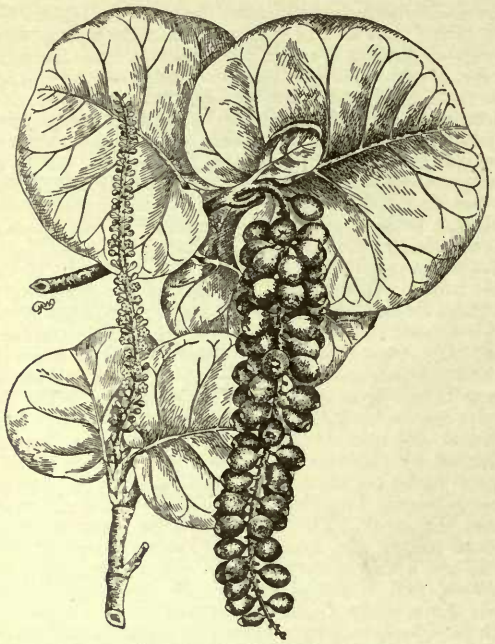
Coccoloba uvifera, the sea-grape or shore-grape of the West Indies, bears an edible fruit, and has particularly beautiful foliage. It is the most important of the genus and is offered by dealers in tropical plants. It will not stand the frost and its cultivation out-of-doors is limited to the frostless region of California and Florida. It can be easily grown in any greenhouse North. All species are easily propagated by seeds, which are very plentiful with most of the species. Some species may be increased by cuttings of ripe wood, which root easily in sand under the usual conditions, in a frame or propagating-house. Layering may also be employed to increase the stock. The various species grow naturally in both clayey and sandy soils, preferring moist rich earth, and a high temperature. *C. uvifera* frequents the seashore, and is found growing in sand and broken shells apparently lacking altogether in plant-food. Rich sandy soil of a light character seems to be best for all the species so far known in cultivation. Plants are readily transplanted from the open ground, but pot-grown plants are to be preferred. (E. N. Reasoner.)

uvífera, Linn. SEA-GRAPE. SHORE-GRAPE. UVADEL MAR. Fig. 1009. Tree, reaching 20 ft. or more, with many flexuous branches: lvs. large, often 5 in. long by 7 in. wide, broadly heart-shaped, wavy margined, glossy, leathery, glabrous, the midrib red at the base; petioles short, with sheathing stipules at the base: racemes 6 in. long, erect in fl., nodding in fr.; fls. 1½ in. across, white, fragrant; petals 5; stamens 8; styles 3: berries 9 or more in a raceme, small, about ¾in. long, pear-shaped, reddish purple, dotted green, sweetish acid: nut roundish, with a short, sharp point on top, and vertical wrinkles. Sandy seashores of Trop. Amer. especially S. Fla. and W. Indies. B.M. 3130.—The wood is used in cabinet-work, and, when boiled, gives a red color.



1008. Monstrous or abnormal leaf of Cobæa.

floridàna, Meissn. (*C. laurifòlia,* Jacq.). PIGEON PLUM. Tree, 25–30 ft.: lvs. 1½–3 in. long, 1–2 in. wide, ovate or elliptical, glabrous, narrowed at both ends, obtuse, margin slightly recurved: berries small, ⅓in. long, pear-shaped, edible, but not marketable. S. Fla., the Bahamas, and northern coast of S. Amer.



1009. Coccoloba uvifera. (×⅙)

pubéscens, Linn. (*C. grandifòlia,* Jacq.). A high, sparingly branched tree: lvs. cordate-orbicular, 3–6 in. long, rusty-pubescent beneath, chiefly on the prominent veins: fls. racemose: fr. berry-like, about ¾in. diam. Trop. Amer. April. B.M. 3166.

C. caracasàna, Meissn., or a closely related species, has recently been intro. to the trade by Franceschi, of Santa Barbara, Calif. It is described as having "larger frs. than other known species, like a good-sized plum." Venezuela.

WILHELM MILLER.
N. TAYLOR.†

COCCOTHRÌNAX (a *berry* and *Thrinax,* in reference to the berry-like fruit). *Palmàceæ.* Small or medium-sized palms, with fan-leaves.

Trees (or rarely stemless) with slender sts., clothed above with the persistent petiole-sheaths,: lvs. terminal, pale beneath, thin and brittle, divided into narrow, acute, 2-parted obliquely folded lobes; petioles compressed, slightly rounded and ridged on the 2 surfaces, thin and smooth on the margins: spadix interfoliar, paniculate, shorter than the petioles: fls. perfect, minute, solitary; perianth cup-like, obscurely 6-lobed, deciduous; stamens 9, exserted; ovary superior, ovoid, 1-celled: fr. berry-like, subglobose, 1-seeded, in ripening becoming thick and juicy, shining black or purple-black; albumen channeled.—A genus of a few species, made from Thrinax; Fla. and S.

Gárberi, Sarg. (*Thrìnax Gárberi,* Chapm. *T. argéntea* var. *Gárberi,* Chapm.). SILVER-PALM. Stemless: lvs. only 10–12 in. across, fan-shaped, silvery beneath. An attractfve dwarf palm, early showing its characteristic form, native on shore of Biscayne Bay, Fla.; perhaps a depauperate form of *C. jucúnda,* Sarg. (*Thrìnax argéntea,* Chapm., not Roem. & Sch.), which has lvs. 20–32 in. across; it bears the fls. on rigid spreading short pedicels, the perianth is white, anthers light yellow, and ovary orange: fr. ¾in. or less diam., becoming succulent and bright violet and later almost black and shining, ripening 6 months after the flowering: petiole slender, flexible, rounded on upper side and obscurely ribbed on lower side, extending as a thin undulate rachis that ends in a short obtuse point.

L. H. B.

CÓCCULUS (diminutive of *kokkos,* berry; the fruit being berry-like). Syn., *Cébatha, Epibatèrium. Menispermàceæ.* Shrubs grown for their handsome foliage and the ornamental red or black fruits.

Twining or erect: lvs. alternate, petioled, entire or lobed, with entire margin, deciduous or persistent, palminerved: fls. inconspicuous, diœcious, in axillary panicles or racemes, sometimes terminal; sepals, petals and stamens 6: carpels 3–6, distinct, developing into berry-like, 1-seeded drupes; seed reniform.—About 12 species in N. Amer., E. and S. Asia, Afr. and Hawaii, chiefly in tropical and subtropical regions. Only a few species are cult., thriving in almost any somewhat moist soil; the evergreen kinds are sometimes grown in pots, in a sandy compost of peat and loam. Prop. by seeds or by cuttings of half-ripened wood in summer, under glass, with bottom heat.

"Cocculus indicus" is the trade name of the berries used by the Chinese in catching fish. The berries contain an acrid poison, which intoxicates or stuns the fish until they can be caught. The berries are imported from the East Indies to adulterate porter, and "Cocculus indicus" is a trade name with druggists, not a botanical one, just as "Cassia lignea" is a trade name of a kind of cinnamon bark, derived, not from a cassia, but from a species of Cinnamomum. The name "Cocculus indicus" was given by Bauhin, but binomial nomenclature began later, with Linnæus, in 1753. The plant which produces the berries is *Anamirta Cocculus.*

carolìnus, DC. (*Cébatha carolìna,* Brit. *Epibatèrium carolìnum,* Brit.). CAROLINA MOONSEED. A rapid-growing, twining shrub, attaining 12 ft., with pubescent branches: lvs. long-petioled, usually ovate, sometimes cordate, obtuse, entire or 3-, rarely 5-lobed, pubescent, glabrous above at length: petals emarginate: fr. red, ¼in. diam. Along streams from Va. and Ill. to Fla. and Texas.—Decorative in fall, with its bright red fr. Not hardy north of N. Y.

trílobus, DC. (*C. orbiculàtus,* Schneid. *Cébatha orbiculàta,* Kuntze. *C. Thùnbergii,* DC.). Slender climber with pubescent branches: lvs. broadly ovate to oblong-ovate, truncate or subcordate at the base, obtuse, often emarginate, usually entire, pubescent on both sides: petals bifid at the apex: fr. bluish black, about ¼in. thick, in short-stalked axillary clusters. Japan. B.M. 8489. I.T. 6:231.—Quite hardy at the Arnold Arboretum; keeps its lvs. green until very late in autumn.

C. diversifòlius, Miq., not DC.=Sinomenium acutum.—*C. heterophýllus,* Hemsl. & Wilson=Sinomenium acutum.—*C. japónicus,* DC.=Stephania hernandifolia.—*C. laurifòlius,* DC. Erect shrub, to 15 ft., glabrous: lvs. evergreen, oblong, acute at both ends. Himalayas. Decorative, with its bright green, shining foliage. Only hardy in subtropical regions.

ALFRED REHDER.

COCHLEÀRIA (Greek, *cochlear,* a spoon; referring to the leaves). *Crucíferæ.* More or less fleshy seaside small herbs, including scurvy-grass and related things; scarcely cultivated.



1010. Cochlearia danica.

Annual or perennial: lvs. simple: fls. small, white, yellowish or purplish, in racemes: fr. an inflated silicle, with very convex valves, the seeds several in each cell and usually 2-rowed.—About 15 species in Eu. and N. Amer. Formerly the horse-radish was referred here, but it is now placed by some in Radicula, by others in Roripa, and by still others in Nasturtium.

officinàlis, Linn. SCURVY-GRASS. Hardy biennial, 2–12 in. high, but cult. as an annual: root-lvs. petioled, cordate; st.-lvs. oblong, more or less toothed and sometimes with a short-winged petiole: fls. early spring; calyx-lobes erect. Arctic regions.—Prop. by seed, which is small, oval, slightly angular, rough-skinned, reddish brown. The germinating power lasts 4 years. The green parts of the plant are strongly acrid, and have a tarry flavor. The seed is sown in a cool, shady position, where the plants are to stand. The lvs. are rarely eaten as salad, but the plant is mostly grown for its anti-scorbutic properties. Not to be confounded with water-cress.

dánica, Linn. Fig. 1010. Annual, scarcely 6–8 in. high: lvs. rounded, kidney-shaped, scarcely 1 in. long in large specimens, usually much smaller. North temperate and arctic regions. L.B.C. 15:1482.—It is covered in early summer with a profusion of small white fls. A valuable plant for ornament northward.

N. TAYLOR.†

COCHLIÒDA (Greek for *spiral*, in reference to the structure of the lip). *Orchidàceæ.* A small group of orchids found at high elevations in South America, little grown, requiring treatment given Odontoglossum.

Pseudobulbous: fls. bright rose-color or scarlet, in long racemes; sepals equal or the side ones more or less joined; petals all much alike; lip clawed, the blade spreading and the side lobes rounded and perhaps reflexed, the middle lobe narrow.—Some of the species are retained by various authors in Odontoglossum and Mesopinidium.

Noetzliàna, Rolfe. Pseudobulbs ovate-oblong, compressed, about 2 in. long, monodiphyllous: lvs. linear: peduncles arcuate; fls. numerous, in graceful racemes, orange-scarlet, about 1 in. across; sepals oblong; petals rather ovate; labellum 3-lobed, disk yellow, otherwise similar in color to the petals. Andes. B.M. 7474. Gt. 43:1403. G.C. III. 16:71. O.R. 12:309.

rósea, Hort. Plants similar to *C. Noetzliana:* fls. rose-color. Peru. B.M. 6084. I.H. 18:66.

vulcánica, Benth. & Hook. Peduncles more or less erect: fls. larger than in the preceding, bright rose-color; labellum 3-lobed, provided with 4 ridges. Peru. B.M. 6001.

C. brasiliénsis, Rolfe. Pseudobulbs tufted, oblong: lvs. oblong-lanceolate: scapes erect or arching, with 6–13 greenish fls. Brazil.—*C. Flóryi,* Rolfe. Natural hybrid between C. Noetzliana and C. rosea. Fls. cinnabar-red with yellow crest; sepals lanceolate; petals elliptic oblong.

OAKES AMES.

COCHLIOGLÓSSA. *Orchidàceæ.* A garden hybrid between *Cochlioda Noetzliana* and *Odontoglossum sceptrum* or *O. prænitens,* known as *Cochlioglossa moortebeekiensis.* Fls. star-shaped, the petals and sepals yellow with pale brown spots; lip has the characters of that of *Odontoglossum sceptrum,* but a little longer and less attractive. Shows no marks of *Cochlioda Noetzliana.*

COCHLIOSTÈMA (Greek, *spiral stamens*). *Commelinàceæ.* Curious and gorgeous plants cultivated under glass.

Cochliostemas are epiphytes, with the habit of Billbergia and great axillary panicles of large fls. of peculiar structure and beauty. They are stemless herbs from Ecuador, with large, oblong-lanceolate lvs., sheathing at the base, and fls. which individually last only a short time, although a succession is produced for several weeks; sepals 3, oblong, obtuse, concave; petals 3, nearly equal, wider than the sepals, margined with long hairs; staminodes 3, villous, 2 erect, linear, the third short, plumose; staminal column hooded, with incurved margins, inclosing 3 spirally twisted anthers; style slender, curved.—Gardeners recognize 2 species, although they are considered by some botanists as forms of one. Recorded as the most beautiful cult. plants of the family.

These are handsome stove-flowering perennial plants, closely related to the commelinas, and are of comparatively easy culture, thriving well in ordinary stove temperature in a mixture of two parts loam and one part fibrous peat, with a little well-decayed cow- or sheep-manure added when potting mature plants. They like a copious supply of water at the roots during the summer months, and at no season must they be allowed to become dry. Propagation is effected by division of the plants in early spring, or by seeds, to obtain which the flowers must be artificially fertilized. —They seed freely when fertilized at the proper time. Only a few of the stronger or larger flowers should be allowed to bear seed. Sometimes a simple shaking of the flower-stalk will accomplish the necessary work of fertilizing, but it is safer to employ the regular method to insure thorough impregnation. The seeds ripen within six weeks' time, and they can be sown soon thereafter, in shallow pans of light, peaty soil, and placed in a warm, close atmosphere until germinated. As soon as the seedlings are large enough, they should be potted singly into thumb-pots, and shifted on as often as they require it, when they will flower in six to twelve months. The chief reason why cochliostemas are grown in America so little is, probably, that it is necessary to keep a much more humid atmosphere in stove-houses than in England, and this is very much against all stove-flowering plants, causing the season of blossoming to be very short. (Edward J. Canning.)

A. *Lvs. red beneath: panicle hairy; fls. very fragrant.*

odoratíssimum, Lem. Lvs. lighter green above than in *C. Jacobianum,* and deep purplish red beneath, narrower, and with a similar margin: fls. very numerous; sepals more leaf-like, hairy, green, with a reddish tip. I.H. 6:217. R.H. 1869, p. 170.

AA. *Lvs. green beneath: panicle not hairy; fls. less fragrant.*

Jacobiànum, C. Koch and Lind. Height 1–3 ft.: lvs. in a rosette, spreading or recurved, dilated and sheathing at the base, margined brown or purplish, 3–4 ft. long, 6 in. broad at the base, 4 in. broad at the middle: peduncles stout, white, tinged purple, 1 ft. long: bracts large, opposite and whorled, 3–4 in. long, acuminate, concave: panicle-branches 4–6 in. long; fls. 2–2½ in. across; sepals purplish; petals violet-blue. Autumn. B.M. 5705. R.H. 1868:71. G.C. 1868:323,desc. F.S. 18:1837–9.

WILHELM MILLER.

COCHLOSPÉRMUM: *Maximilianea.*

COCKLE. In North America, a name for *Lychnis Githago,* or corn-cockle, a familiar handsome-flowered weed of wheat-fields. The name is also applied to the darnel, *Lolium temulentum.*

COCKLE-BUR: *Xanthium,* a weed.

COCKSCOMB: *Celosia.*

COCKSFOOT GRASS: Barnyard Grass, *Panicum Crus-Galli.*

COCOA: Products of *Theobroma Cacao.*

COCOA PLUM: *Chrysobalanus Icaco.*

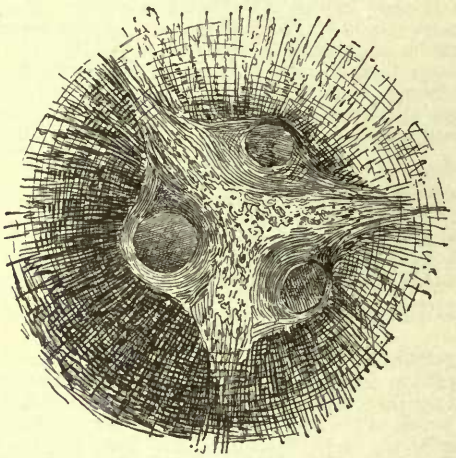
COCO-GRASS: *Cyperus rotundus.*

COCONUT. Plate XXVII. Figs. 1011, 1012, 1014, 1015. The coconut, *Cocos nucifera,* is the most important of cultivated palms. Its nearest relatives, whether or not regarded as in the same genus, are natives of tropical America. For this and for other reasons which have been presented by Cook, it must be believed that the coconut is a native of America, and that it was carried westward across the Pacific in prehistoric times. While the nut will float and retain its power of germination for a considerable time, its propagation from island to island in known cases has practically always been the deliberate work of men, and it is probable that men were

also responsible for its crossing the Pacific. It was a cultivated plant in Polynesia and Malaya, and in many places the chief crop, at the time of the discovery of this part of the world by Europeans. But it reached Ceylon recently enough so that its introduction is a matter of fairly reliable legend. It is now grown in all tropical countries except the interior of continents. Its cultivation extends somewhat beyond the tropics, both north and south, but its growth at these extremes, in Florida, India and Madagascar, is not thrifty enough to give it any industrial importance. Within the last two decades, the rise in the price of oils and the discovery of new uses for coconut-oil have caused a tremendous increase in the area devoted to the plantation and cultivation of coconuts.

Climatic conditions favorable for the coconut.

The coconut makes on the climate the characteristic demands of a typically tropical plant. It thrives where the mean annual temperature is 72° F. or higher, and where there are no great differences in temperature between seasons. Except where supply of ground water



1011. End of a mature coconut. The nut sprouts usually from the largest eye.

makes it independent of local rainfall, the coconut demands an annual rainfall of at least one meter (about 40 in.); and this precipitation should be well distributed through the year. In most of the best coconut countries, the rainfall is considerably more than one meter. The coconut can endure exceedingly drying conditions for short periods, and is accordingly adapted to the intense light of the seashore, to resisting strong winds, and to enduring salt water about its roots for short periods of time. Moreover, it will live through prolonged droughts. But long dry seasons cut down the crops; and the damage done by droughts lasts for as much as two or three years after the return of rain. A dry season of five or six months every other year will keep the crop at all times down to not more than 40 per cent of what it would be if the supply of water were constant. If there is an ample supply of soil-water, dryness of the atmosphere is favorable to the best production. Seacoasts usually have higher land back of them, and the ground-water from the higher country circulates through the soil toward the sea. Near the shore it comes near enough to the surface to be reached by the roots of the coconut. For this reason, coconuts thrive on the seashore under climatic conditions that prevent good development in the interior. This is the principal ground for the idea that coconuts thrive only near the sea. Around the bases of volcanoes in the interior, similar soil conditions are met with, and such localities are admirably adapted to this crop.

Propagation and cultivation.

The coconut is produced only by seed. Nuts for this purpose should of course be selected from conspicuously good trees. They are usually planted in seed-beds, although, on a small scale, there are various other local methods of handling them during germination. The best treatment is to take them from the seed-bed when the plumule is not more than 6 inches high, which will usually be after about six months. To avoid the expense of keeping the groves clean while the trees are small, it is common practice to leave the nuts for a longer time in the seed-beds, but the transplanting of older seedlings, even with the greatest practicable care, sets them back for several months. In the Jaffna district of northern Ceylon, the nuts are transplanted from the first seed-beds to others in which they have more room, and are not put in their permanent places until they are three or four years old.

In the first years after the coconuts are transplanted, it is good policy to raise catch-crops between the trees. But these crops should be so chosen that they will not compete with the coconut for light or water; and from the profit they pay, a return should be made to the soil of fertilizers at least sufficient to replace what they have removed. By the time the grove is four years old, the coconuts will shade the ground and it will no longer be possible to raise catch-crops on a large scale. Then, but not before this time, it is good practice to use the grove for pasture. The returns from live-stock should be at least sufficient to pay for keeping the plantation in good condition and cattle will themselves do a large part of the work in keeping down the other vegetation. Pasturing of other live-stock in coconut groves is in general not to be recommended. It is not customary anywhere in the tropics to give to coconut plantations such cultivation as is given to orchards in temperate countries. It has even been believed that any but the most shallow cultivation would be detrimental by destroying the roots near the surface, and that machine-cultivation was likely to be too expensive to be profitable, in view of the time that it would have to be kept up before the coconut begins to pay returns. Limited experience in the Philippines indicates that real cultivation produces very much the same results with coconuts as it does with other crops. Coconuts respond, as do other crops, to the application of manures containing potash, nitrogen, and phosphorus. So far as the very limited evidence shows, the demand for these three fertilizing elements is in the order given. With ordinarily good treatment, coconuts come into bearing in seven or eight years. Single trees of standard varieties will bear fruit in five years, while others will require ten. If the coconut is treated as a wild crop, which is by no means uncommon, and little or no attention is given it after the first three years, it will be ten or fifteen years, as a rule, before a full crop is produced and even then the crop will be an inferior one.

Pests.

With the increase in the industry in the tropical world, and with the increase in commerce, there have been created conditions favorable to the development and spread of pests. Twenty years ago, serious coconut pests were practically unknown, and only eight years ago, Prudhomme, in an excellent general treatment of the coconut industry, listed as serious pests only two or three insects and no other organisms. There are now known as serious pests various species of Rhynchophorus, known as palm weevils; Oryctes, called the rhinoceros beetle; a scale, *Aspidiotus destructor*, closely related to the San José scale; at least two fungi, and the organisms causing bud-rot. The latter have been determined in the West Indies to be *Bacillus Coli*, and in India to be a fungus, *Pythium palmivorum*. Besides these, there are a large number of minor or local pests, including weevils and other beetles, the

larvæ of moths and butterflies, insects of other groups, and fungi. Damage is also done in places by crustaceans, and by rats and other higher animals. Forests made up of one kind of tree practically do not exist in nature in the tropics; and when such forests are made, as has been done with the coconut, the prevention of devastation by pests will be accomplished only by greater care than is ordinarily demanded to protect the crops of temperate lands.

Varieties.

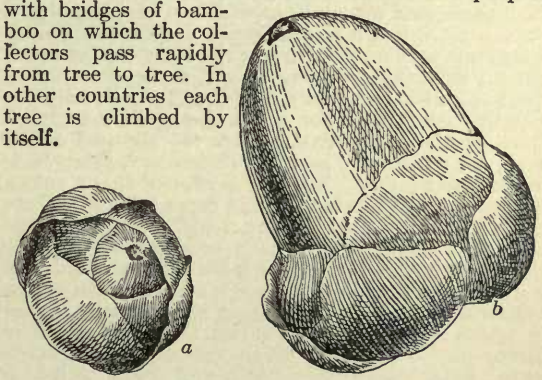
A very large number of varieties of coconuts is known in different parts of the tropics, but a careful comparative study of their merits has never been made on a large scale and with nuts from many different sources. The best experiment began less than a decade ago in Madagascar. In several localities in the Philippines, there are strains of very large nuts, of which, as a plantation average extending over years, 3,300 produce a ton of copra. In favorable seasons the production has been at the rate of a ton from 2,800 nuts. There are reports of similar large nuts from other countries, but no data as to their yield on a plantation scale. In the parts of the Philippines having the greatest coconut industry, it requires 5,600 to 6,000 nuts to produce a ton of copra, and the same figures apply to Ceylon and various other coconut countries. In still other places the nuts are so small that 7,000 are required to the ton. There are varieties characterized by shape and by color, but these characteristics seem not to be related to the yield either of copra or oil. The nuts of the Laccadive and Maldive Islands are reputed to produce a particularly good fiber. Throughout the eastern tropics, coconuts are locally used to produce liquor. For this purpose, early maturing varieties that are likely also to produce very small nuts, but numerous clusters, are selected. There are varieties in Ceylon and the Philippines which bear at the age of four years, while the varieties in extensive cultivation and used for the production of copra can none of them be relied upon to produce a crop in less than seven years and not in less than ten years unless properly treated. A Philippine variety known as Makapunó has the interior of the nuts completely filled with a soft, sweet tissue, used as a table delicacy. Such nuts sell locally for about 10 cents, while the ordinary nut is worth 2 or 3 cents.

Uses and products of the coconut.

The local uses of the coconut are almost unlimited. Besides being of practical utility in a very large number of ways to the people of the Malay-Polynesian region, it has, as a result of its practical importance, acquired a prominent place in the rites and superstitions of the people of this part of the world. Thus Murray tells of a tribe of Papuans, among whom it is not proper for a man to eat a person whom he has killed, this privilege being reserved for his associates; but a man may eat the heart of his own victim if he sits on one coconut and balances himself with his feet on two others while he prepares and devours it.

The products of great industrial importance are toddy and its derivatives, coir, and copra and its products.

Toddy is an usual English name of the fresh beverage obtained from the unopen flower-clusters. In the Philippines it is known as "tubâ." The mode of securing it differs somewhat in the three countries in which it is secured on an industrial scale, the Philippines, Java and Ceylon. In all of them, the spathe is bent down gradually and the tip is then cut off. A thin slice is afterward cut off with a sharp knife, usually twice a day. After a few days of this treatment, the irritation results in a flow of sap from the cut surface. This sap falls into a jar or bamboo tube from which it is collected, as a rule twice a day, and a very thin slice is removed from the end at each time of collection. This continues until the whole inflorescence has been removed by the series of slices. The amount of toddy collected depends on the vigor of the tree, on the weather, and on the skill of the workman. Under fairly favorable conditions, a good workman will secure a quart or more a day from one inflorescence. The technique of this business seems to be better developed in the Philippines than elsewhere, with the result that more toddy is secured in a given time from the tree. The toddy is used as a fresh beverage or as a source of alcohol, or less frequently of sugar, or still more rarely of vinegar; it is also a common source of yeast in the East Indies. The toddy, as it falls from the cut branch, contains about 16 per cent of sucrose. This inverts very rapidly if permitted to do so, and the invert sugar is in turn rapidly fermented to alcohol. In parts of the Philippines, the production of strong liquor in this way is a business of some importance. If sugar is to be produced, care is taken to keep the vessels clean and approximately sterile, and the inversion is often prevented by the use of tanbark from one of the mangroves, usually Bruguiera. If alcohol is the product desired, the same bamboo tubes are used over and over without cleaning. In the Philippines it is common practice to connect the trees used for this purpose with bridges of bamboo on which the collectors pass rapidly from tree to tree. In other countries each tree is climbed by itself.



(Nat. size at this stage.) (Nat. size.)

1012. Stages in the growth of a coconut.

Coir is produced for local use in many parts of the world, but as an article of commerce comes chiefly from Ceylon. This fiber was the old staple cordage material of the Polynesian region. As a fiber material, it is conspicuous for its elasticity, being able to stretch 20 or 25 per cent without exceeding the limit of elasticity. It is also remarkable for lightness, for resistance to decay, and for the short length of the individual cells. It is accordingly a valuable fiber for use in ropes subject to abrupt strains, for calking boats, and for a stuffing fiber. Its stiffness and durability make it especially serviceable for the manufacture of mats, and this is its chief commercial use.

Copra.—The principal coconut product exported from most producing regions is copra, which is the dried meat or hard endosperm of the fruit. To produce the best copra, nuts should be thoroughly and uniformly ripe, and this condition is best guaranteed by permitting them to ripen on the trees until they fall, and then to collect and use them at frequent intervals. However, it is far more common practice to harvest them before they fall, going through the groves at regular intervals. This is most commonly done every three months. The nuts are cut down in various ways. The simplest method is the use of a long pole made of detachable joints of bamboo and bearing at the top a sharp and recurved knife. A nut-gatherer then goes from tree to tree and cuts down the nuts that are ready, without leaving the ground. This method is the local one used in certain parts of the Philippines.

Elsewhere in the Philippines and in many other places, the practice is to climb each tree, using notches cut at convenient heights for this purpose. If these notches are cut with sufficient care, it probably can be done without real damage to the tree, but in practice such care is not usually taken, and the notches are very often centers from which decay of the trunk begins. In other places the nut-gatherers climb the trees without notches. To do this easily, they usually bind their ankles together with a thong, or pass a rope around the hips and around the tree, or use both of these devices. The old story of the harvesting of coconuts by the use of monkeys is not altogether a myth. In the Sunda islands and in Sarawak, monkeys are sometimes trained for this purpose; and from Sarawak, these trained monkeys are occasionally exported to the Straits settlements. In some of the islands of the south seas, the entire nuts, husk and all, are split into halves with an axe, and in Ceylon a machine for this purpose has come into limited use. Elsewhere, the first step in the preparation of copra is the removal of the husks. This is usually done with the aid of a piece of iron, three cornered and moderately sharp, mounted on an erect stick and standing at about the height of the knee. This implement is in universal use in the Philippines, and elsewhere in the East, and has of late years come into use in the tropics of the New World. A machine to remove the husks has also been invented, but the most that is claimed for it is that a workman can husk a thousand nuts a day, and this is only the standard day's work for a nut-husker in the Philippines by the old method. After the removal of the husk, the nut is split into two halves by a sharp blow with a heavy knife. The water is allowed to run out on the ground.—Methods of drying copra fall under three heads: sun-drying, grill-drying, and kiln-drying. Centrifugal dryers have also been tried and are said to give good results. Sun-drying is the oldest method, and is a good one where the climate is such that the drying can be trusted to go on without interruption. Under favorable conditions it produces the finest grade of copra, Cochin sun-dried being the standard of excellence. Most Philippine copra is grill-dried. A hole is dug in the ground on which is placed a grating usually made of bamboo, and the whole protected by a roof. Coconut husks and shells are used for fuel. The heat and smoke rise directly from the fire to the coconuts. Sun-drying takes usually five to nine days; if more than this is required, the method is unsafe. Smoke-drying is finished as a rule in a single day or in parts of two days. Smoke-dried copra is unsuited for the manufacture of food products and accordingly sells at a lower price than the best copra. It is a good way of making poor copra; for if any copra is imperfectly dried or is even in part the product of unripe nuts, it ferments with a considerable loss of oil, and this fermentation is decidedly checked by smoking. Kilns for drying coconuts are of various patterns in different countries, and if properly handled always produce a high grade of copra. There is one kiln in the Philippines which handles more than three tons of copra at a charge, and dries it in six or eight hours. By all methods, it is customary to make two stages of the drying, one immediately after the nuts are opened, and the other after the meat has shrunk enough to be easily removed from the shells. The ultimate use of copra is the manufacture of oil, an industry which has been developed to the greatest extent in France. In all coconut countries there is a local business in manufacturing oil. This is done by various primitive methods, some of which produce a food or toilet product of the highest possible quality. In the manufacture of such oil, the utmost care is taken and the product is of purely local use. Oil for wider distribution is manufactured with less care, by methods characteristic of the different countries. To prepare oil for world commerce, such establishments as have long been used in European countries, and to a less extent in the United States, have more recently been founded in the producing lands. The oil has a variety of uses. It was formerly consumed almost entirely in the manufacture of soap and candles. Principally during the last decade, methods of refining and separation have been developed, by which excellent butter-substitutes are made. As the butter produced in this way is palatable and most digestible, and is cheaper than real butter, these products have found a ready sale, with the result that there has been a great increase in the demand for good grades of copra and a consequent improvement in the general quality produced in most countries, and an increase in the price of all grades. It seems probable that the market will for some time continue to increase more rapidly than the supply.

Other products.—A well-known product is desiccated coconut. Among producing countries, Ceylon is the only one which has taken up the manufacture of this article. It is prepared directly from the fresh meat of ripe nuts. Very large numbers of coconuts are also put upon the market of temperate countries as "coconuts," usually after the removal of the husk. The United States is the chief market for these nuts and the export of them is accordingly a conspicuous feature of the business in lands situated where delivery in the United States is economically possible, that is in the West Indies and to a much less extent in the islands of the Pacific. An exportation of this kind is also assuming large proportions with Australia as a market. For all kinds of coconut produce, Ceylon long held first place and the business of producing coconuts, copra and oil, as well as coir, and desiccated coconut, has reached a better development in Ceylon than anywhere else. However, during the last few years, the Philippines have far outstripped Ceylon in the production of copra. The export from the Philippines in the year ending June 30, 1912, was more than 160,000 tons. In this year, copra was for the first time the foremost export of the islands, taking from abacá the place which it has held almost without interruption for the last fifty years. E. B. Copeland.

CÒCOS (Portuguese, *monkey*, from the nut, which suggests a monkey's face). *Palmàceæ*. This genus includes the coconut tree, *C. nucifera*, and a few pinnate palms cultivated for ornament in the North under glass, and in southern Florida and southern California as avenue and ornamental trees. See page 3567.

Low or tall palms, with slender or robust ringed spineless trunks, often clothed with the bases of the lvs.: lvs. terminal, pinnatisect; segms. ensiform or lanceolate, equidistant or in groups, 1- to many-nerved, entire at the apex, or with 1 lateral tooth, or more or less deeply lobed, the margins smooth, recurved at the base; rachis 3-sided, acute above, convex on the back; petiole concave above, smooth or spiny on the margins; sheath short, open, fibrous: spadices erect, at length drooping, the branches erect or drooping; spathes 2, the lower one the shorter, split at the apex, the upper one fusiform or clavate, woody, furrowed on the back; bracts variable; fls. white or yellow: fr. large or medium, ovoid or ellipsoidal, terete or obtusely 3-angled, often fibrous-coated as in the coconut.—Species 56 in Trop. and Subtrop. S. Amer., 1 in the tropics around the world. The genus is allied to Maximiliana and Attalea, and distinguished by its male fls. having lanceolate petals, 6 included stamens, and a 1-seeded fr. G.C. II. 23:439.

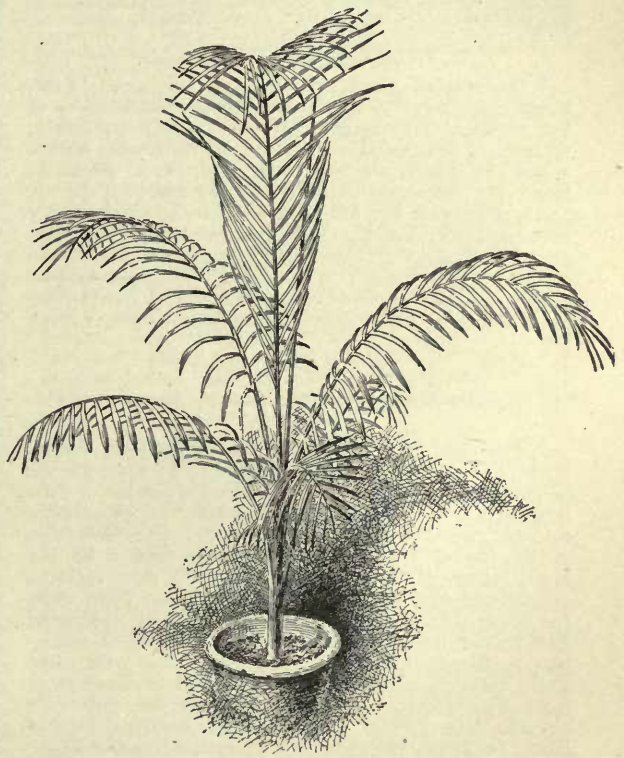
The coconut is the example most commonly cited of dispersal of seeds by water. Its buoyant, impervious husk is said to enable it to cross an ocean without losing its germinating power. Its structure is interesting and at first puzzling. Although it is a dry, indehiscent, one-seeded fruit, it seems very unlike an achene, as

for example, in the Compositæ. Structurally, it is more like a drupe, for the fibrous husk is formed from the outer part of the pericarp, and the hard shell inclosing the meat from the inner. In other words the husk is exocarp and the shell endocarp. The milk of the coconut is unsolidified endosperm. In the cereal grains it is the endosperm which affords most of the material used for human food. Only a part of the liquid matter of the coconut solidifies, and the milk is left in the center. The eyes of the coconut (Fig. 1011) mark the positions of the micropyles, and germination takes place only through the larger one. Palm pistils are three-carpelled and each carpel in Cocos has one ovule. The marks of the three carpels are seen in Fig. 1011, but only one ovule develops into a seed. Fig. 1012 tells the story of the growth of a coconut. In *a*, the young nut is enveloped by three petals and three sepals. At *b*, the pericarp has far outgrown the sepals and petals. Sometimes the floral envelopes remain when the nut is picked. Coconuts, like many other fruits, often grow to a considerable size without pollination, and then perish.

Of the species cultivated for ornament, *C. Weddelliana* is by far the most important. It is sold in great quantities from 3- and 4-inch pots when the plants are 12 to 15 inches high. They are favorite house-plants, as their culture is easy, and they grow slowly and retain their beauty a long while. They are much used in fern-dishes. As a house-plant, *C. Weddelliana* is probably the most popular species of all the smaller palms. It is especially suitable for table decoration. In distinguishing tropical from subtropical regions, the coconut is an excellent guide. It flourishes best where frost is never known, although there are magnificent specimens at Miami and Palm Beach, Florida, both places having rare but sharp frosts. The oil extracted from the nuts is an important article of commerce. The fiber refuse is much used by florists and gardeners. Being open, spongy, very retentive of moisture, clean and easily handled, it is a favorite material in which to root bedding-plants and to start very small seeds; but it is not used for permanent potting. See U. S. Dept. Agric., Bull. of Div. of Ent. (new series) 38:20–3, for a report of diseased coconuts. For culture of Cocos under glass, see *Palms*.

Cocos in Florida.—The species of the *C. australis* group (as known in the trade) are dry-land palms, the best and most beautiful palms adapted to poor sandy soils in Florida. In moist and rich ground they are subject to diseases, particularly to blight. On dry land, they thrive with great vigor, and although slow growers, they are strikingly beautiful specimens when only a few years old. They look best in groups of five or even a dozen planted together (about 12 to 15 feet apart). After they have formed trunks 5 to 10 feet high they are very impressive, particularly when the background consists of tall bamboos or dark evergreens such as *Magnolia grandiflora* or live-oaks. All the species of this group have leaves more or less glaucous, silvery white or bluish green. The leaflets are often very hard to the touch—very rigid. The petiole at its base is provided with short blunt spines. The roots are brown and quite numerous, but the root-system is very shallow, the trunks do not rest deep in the ground as is the case with the Sabal and Phœnix species, and for this reason they are easily blown over or they acquire a leaning disposition. In planting these palms, they should be set in a saucer-like cavity, which can be filled up gradually. Both young and old plants are easily transplanted in November and December, but it is always advisable to plant only young specimens. Few palms require so little care and fertilizer as these Cocos species. A good application of stable manure as a mulch when the rainy season begins helps them along wonderfully, or they many be fertilized with a combination consisting of equal parts of ammonia, phosphoric acid and potash. The flowers are always inclosed in a club-like spathe varying in size from a large walking-stick to a baseball club. These spathes burst open with a crack and reveal the much-branched flower-spike, varying in color from a creamy white, yellowish, lavender-crimson to a deep violet. The fruits also vary in size and color. Some of them are not larger than a large pea, others as large as a plum, some are yellowish and others orange and red in color. (H. Nehrling.)

Cocos in California.—After passing through a severe test during the first week in January of the year 1913, the several species of Cocos palms are in a condition in which one may safely judge of their comparative hardiness. In the Cocos palms found in local gardens are two very distinct groups. These two groups may each contain but one species having several varieties, or they may consist of several species as they are known "in the trade," and it is upon the latter basis they are here dealt with. (1) The dwarf group is commonly and widely represented by the one known as *C. australis* and the other and less-known kinds are catalogued as *C. Alphonsi*, *C. Bonnettii*, *C. campestris*, *C. Gaertneri*, and *C. Yatay*. Occasionally two others, *C. odorata* and *C. pulposa*, are listed. All those named are quite hardy and may safely be planted from Los Angeles to San Francisco without fear of losing them through freezing, though in places some may get "scorched" while young. With age all become quite hardy. (2) To a taller and more striking group, belong those of which *C. plumosa* is the best known and, unfortunately, most widely planted type. These are *C. botryophora*, *C. coronata*, *C. Datil*, *C. flexuosa*, *C. plumosa*, and *C. Romanzoffiana*. Of these six four have proved quite tender and three quite hardy, the latter lot resistant to at least a half-dozen degrees more of cold than the former. The tender ones are: *C. botryophora*, *C. coronata*, *C. plumosa*, and *C. Romanzoffiana*. Those proving hardy over all of southern California in 1913 were *C. Datil* and *C. flexuosa*, the latter the



1013. Cocos Weddelliana.

only one at all common. To these may be added the true *C. australis*, not known here in the trade at all, a tall-growing species, and not the dwarf one commonly sold under this name. J. Harrison Wright, of Riverside, has grown this novel species and assures the writer of its hardiness in his garden where *C. plumosa* succumbs in comparatively mild winters. These notes are based upon a close study of these species and varieties as observed during the past few winters in the gardens of Los Angeles and Pasadena in Southern California. (Ernest Braunton.)

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A. *Filaments present on the rachis.*

1. **eriospàtha,** Mart. St. 9–15 ft. high, 10–14 in. thick, capitately thickened with the persistent bases of the petioles: lvs. ample, glaucous, finely pectinate; margins of the rachis with excurrent filaments; segms. about 1 in. apart, the lower elongated, linear, 20–24 in. long, very long-acuminate, the upper narrowly linear, short, attenuate, 1 ft. long, 2 lines wide, all rigid, faintly nervose-striate: spadix thick, branched but very compact. S. Brazil.—"The hardiest of the genus and one of the hardiest palms in S. Calif. Fronds bluish: fr. pulp tastes like apricots."—F. Franceschi, Santa Barbara. Some of the *C. australis* of the trade may belong here.

AA. *Filaments absent.*

B. *Rachis abruptly contracted above the insertion of the lowest lfts.*

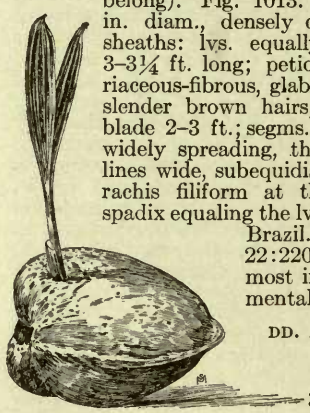
2. **flexuòsa,** Mart. St. 9–12 ft. high, 2–3½ in. diam., arcuate-ascending, naked just above the base, thence densely clothed with dead petiole bases: lvs. lax, 3–6 ft. long; petiole flat above, arcuate, at first tomentose, later smooth; rachis abruptly narrowed above the insertion of the lowest lf.-segm., thence linear-filiform at the apex, excurrent; segms. 70–90 on each side, rigid in opposite groups, the middle 10–14 in. long, ⅓in. wide, the upper 4 in. long, $\frac{1}{12}$in. wide: spadix long-peduncled and rather loose. Brazil.—Cult. in northern greenhouses. Similar in habit to *S. plumosa*, but with more finely cut lvs., and in S. Eu. considered to stand more frost. Probably the *C. flexuosa* planted in this country is not the true species *C. flexuosa* of Martius, but of Hort., a hardy form of *C. Romanzoffiana*, Cham., which latter according to the late Barbosa-Rodriguez is a polymorphic species including, besides this *flexuosa* type, all our garden forms known as *C. plumosa*, Hook., *C. coronata*, Hort., not Mart., *C. botryophora*, Hort., *C. Datil*, Griseb. & Drude, and *C. australis*, Mart. The foregoing description has been drawn from Martius and not from cult. specimens. The true *C. flexuosa* of Martius is a slender-stemmed palm from tropical Brazil. The true *C. australis* of Martius is native in Paraguay; it is like *C. plumosa* in appearance but hardier.

BB. *Rachis not abruptly contracted.*

C. *Lfts. flaccid.*

D. *Arrangement of lfts. equidistant.*

3. **Weddelliàna,** Wendl. (*Glaziòva Martiàna*, Glaz., to which genus Martius considers the species to belong). Fig. 1013. St. 4–7 ft. high, 1¼ in. diam., densely covered with persistent sheaths: lvs. equally pectinate-pinnatisect, 3–3¼ ft. long; petiole 8–20 in.; sheath coriaceous-fibrous, glabrous or tomentose, with slender brown hairs, at length evanescent; blade 2–3 ft.; segms. about 50 on each side, widely spreading, the middle 5 in. long, 2 lines wide, subequidistant, glaucous beneath; rachis filiform at the apex, brown-scaly: spadix equaling the lvs., stiff and erect. Trop. Brazil. R.H. 1879, p. 434. I.H. 22:220. A.G. 16:345.—The most important of small ornamental palms for the N.



1014. Coconut germinating.

DD. *Arrangement of lfts. in groups of 2–4.*

4. **plumòsa,** Hook. St. 30–36 ft. high, 10–12 in. thick, ringed at intervals of a foot, clothed near the apex with remnants of the dead petioles: lvs. erect-spreading, 12–15 ft. long, recurving; petiole a third to half as long as the blade; segms. linear-acuminate, sparse, solitary or mostly in groups of 2–4, 1½ ft. long, deflexed near the apex: spadix usually 3 ft. long and much branched, the branchlets pendular. Cent. Brazil. B.M. 5180.—The chief avenue palm of the genus. A quick grower, ultimately 50 ft. high in S. Fla. and Calif. The slender smooth lobes and heads of graceful recurving lvs. make this a very attractive tree.

CC. *Lfts. rigid.*

D. *Form of lfts. sword-shaped.*

5. **butyrâcea,** Linn. Sts. very tall, naked: lvs. pinnate; lfts. simple: spathe cylindrical-oblong, 4–6 ft.; spadix as long as the spathe, 4–6 ft.; branches of the spadix about 1 ft., thickly clustered and somewhat pendulous. Venezuela.—Rare and perhaps confused with *Scheelea butyracea*. Little known, although long ago described.

6. **Romanzoffiàna,** Cham. Sts. 30–40 ft. high, somewhat fusiform above: lvs. about half as long as the caudex, the withered ones deflexed, pendent, the upper spreading, often arching; segms. conduplicate at the base, ensiform: spadix about 6 ft. long, at first inclosed in a stout pendulous spathe which appears among the lowest lvs. S. Brazil near the sea; according to recent characterizations, it comprises a wide variety of forms, as explained under No. 2.



1015. Coconuts.

DD. *Form of lfts. linear: apex obtuse: petiole glaucous.*

7. **australis,** Mart. PINDO PALM. Height about 30 ft.: st. erect, columnar, equal, strongly annular above: lvs. 9–12 ft. long, the sheath fibrous and glabrous; petiole naked; segms. linear, glaucous, rather rigid: fr. as large as a pigeon's egg, outer pulp sweet, edible, seed oily. Paraguay. G.C. III. 18:739. A.F. 5:515; 7:805. R.H. 1876, p. 155.—A good grower. Cult. under glass and outdoors in Fla. and Calif.

8. **nucifera,** Linn. COCO PALM. COCONUT TREE. Figs. 1014 (adapted from Cook), 1015. Caudex 40–100 ft. high, flexuous, thickened at the base: lvs. 12–18 ft. long; lfts. linear-lanceolate, 2–3 ft., coriaceous, flaccid; petiole 3–5 ft., stout. Seashores within the tropics and at Miami and Palm Beach, Fla. Indigenous to Cocos or Keeling Isls. of the Indian Ocean, but recently thought to be native of Trop. Amer. See O. F. Cook, Contr. U. S. Nat. Herb., 7:257–93 (1901); 14:271–342 (1910). R.H. 1895, p. 457. Mn. 2:171. G.F. 7:15.—Produces the coconuts of commerce. Var. **aurea,** Hort., is a form remarkable for its orange-yellow sheaths, petioles and midribs." It is known in cult. only in England.

DDD. *Form of lfts. narrowly lanceolate.*

E. *Lvs. long, 6–15 ft. in mature specimens.*

F. *Petiole spinose-serrate: segms. of lf. less numerous.*

9. **Yatay,** Mart. St. 12–15 ft. high, over 1 ft. diam., naked below, covered with dead sheaths above: lvs. recurved, spreading 6–9 ft.; sheath 1 ft. long, fibrous at the mouth; petiole 1½ ft. long, spinose-serrate, the spines increasing in length towards the lower end of petiole; segms. 50–60 on a side, crowded below, then equidistant, linear-lanceolate, the uppermost long-setaceous filiform, the middle ones 2½ ft. long, 2–5 in. wide, the upper 20 in. long, ¼in. wide, all rigid, glaucous beneath: spadix about 4½ ft. long with at least 150 branches. Brazil, Argentina.

FF. *Petiole not spinose-serrate: segms. of lf. very numerous.*

10. **Datil,** Drude & Griseb. St. 30 ft. high, 8–12 in. diam.: lvs. 12–15 ft. long; sheath about 16 in. long; petiole 1½ ft. long, 1⅔ in. wide, ⅔in. thick; segms. linear-acuminate, glaucous, densely crowded in groups of 3 or 4, 150–160 on each side, the lowest 2 ft., middle 2⅓ ft. and apical 1 ft., the uppermost filiform, all narrow, stiff and rigid, the dried lvs. glaucous green or whitish: spadix 3–3½ ft. long with at least 300 spirally twisted branches. Argentina; isls. and river banks.—The frs. are edible, resembling those of the date palm. Hardier in S. Calif. than *C. plumosa, C. flexuosa,* and *C. Romanzoffiana.*

11. **coronata,** Hort., not Mart. Trunk at length 18–30 ft. high, 8 in. diam., erect, deeply ringed: lvs. erect-spreading, 6–9 ft. long, short-petioled, arranged in a close, 5-ranked spiral, the long-persistent bases of the petioles forming a spiral-twisted column below the crown; lf.-segms. in groups of 2 or 3, folded together from the base (conduplicate), linear-lanceolate, coriaceous, densely crowded, about 100 on each side; midrib 4-sided below, 3-sided above: spadix about 2½–3 ft. with not more than 60 branches. Brazil.

EE. *Lvs. shorter, 3–4½ ft. in mature specimens.*

F. *Apex of lfts. obtuse.*

12. **campestris,** Mart. St. 8–10 ft. high, thickened, scaly: lvs. spreading-recurved, rigid, 3–4½ ft. long; rachis elevated, triangular above, convex below; segms. narrowly lanceolate, 30–40 on each side, obtuse at the apex and shortly cordate-acuminate: spadix about 2½ ft. long, with 10–14 branches. Brazil.—Hardier than *C. nucifera,* but scarcely known in cult. in N. Amer. Perhaps hardy as far north as N. C.

FF. *Apex of lfts. acuminate.*

13. **insignis,** Mart. (*Glaziova insignis,* Hort.). St. 3–6 ft. high, 1½ in. diam.: lvs. 4½–6 ft. long; sheath densely brown-lanate; petiole shorter than or equaling the sheath, a fourth or fifth as long as the rachis; segms. equidistant, 50 on each side, narrowly lanceolate, obliquely acuminate and caudate, silvery glaucous beneath: spadix about 3 ft. long, with about 50 branches. Brazil.

The following are trade names of rare or botanically little-known plants not sufficiently described: *C. Alphonsei.*—*C. Arechavaletana,* Barb., is described as somewhat like C. Romanzoffiana but taller and making larger crowns. It is a native of Uruguay.—*C. Blumenavi*=C. eriospatha.—*C. Bonnetii.*—*C. Gaertneri*=(?).—*C. Geriva,* Hort. G.C. III. 27:293 figures C. Geriva, a remarkable Cocos (?) with 4 branches. Nothing further is known of this plant. It may be C. Geriba, Rodr.=C. botryophora, Mart.—*C. Maximiliana,* Hort.=(?).—*C. odorata,* Rodr. St. short: lfts. in 3's or 5's, linear-lanceolate; petioles spiny: fr. yellowish green or pink, pulp scented. Brazil. R.H. 1893, p. 345.—*C. pulposa,* is supposed to be very like C. eriospatha. This species is scarcely known in this country.—*C. Yurumajnas*=(?).

N. TAYLOR.†

CODIÆUM (probably from Greek for *head,* the colored leaves being used for crowning-wreaths, or from the Malayan name). *Euphorbiaceæ.* CROTON. VARIEGATED LAUREL. Tropical shrubs or trees grown for the variegated and interesting foliage, as greenhouse plants or for summer bedding outdoors.

Leaves alternate, simple, somewhat thick and leathery, pinnately veined, glabrous: juice somewhat milky: fls. monœcious, in slender axillary racemes; staminate fls. with petals, calyx imbricate, stamens 20–30, erect in the bud; pistillate fls. apetalous, ovary 3-celled, 3-ovuled.—Six species of Malaya and Pacific Isls., not closely related to any other commonly cult. Euphorbiaceæ. Differs from the true crotons in the erect stamens, glabrous foliage and more or less milky juice.

The almost endless variety of codieums (or crotons of gardens) are probably all from one botanical species, greatly varied by selection and crossing. Although a great many of these bear Latin binomials they intergrade so that it is often difficult to separate them or to make a reliable classification; however, they may be grouped conveniently as below. Totally different leaf forms and color variations often appear on the same plant. The latest botanical treatment is by Pax in Das Pflanzenreich, hft. 47, and is followed in this article.

The crotons are prized chiefly for the varied and brilliant markings of the leaves. The young leaves are usually green and yellow, changing later to red, although in some the markings remain yellow or with red only in the petiole. They are usually kept not over 2 to 3 feet high, but if given opportunity will grow into considerable trees in the greenhouse. They are good subjects for massing in the open and develop most brilliant colors in our bright hot summers; however, they will not stand frost.

Codieums (or crotons, as they are popularly known in America) are beautiful plants with many forms of handsome and odd foliage of the most brilliant coloring. The colors range from almost pure white to light and deep yellow, orange, pink, red and crimson, in the most charming combinations. In some cases one color predominates, as in Carrierei (yellow), Czar Alexander III. (crimson), Hawkeri (light yellow). These varieties of distinct coloring make beautiful specimen plants for jardinieres; and their beauty is enhanced when used in jardinieres of appropriate color. As exhibition plants they are very effective, and may be grown to specimens 5 or 6 feet high, or even larger. In smaller sizes, codieums are much used as table plants, for which purpose well-colored tops are rooted and grown on until they are from 12 to 15 inches high. The narrow-leaved varieties are most used for this purpose. Codieums are very attractive in vases and window-boxes and for mantel and table decorations. They are also

very valuable as bedding plants. Planted in clumps or masses, the effect of the combination of rich colors is charming. They should be planted in any good, rich, not too heavy soil, and regularly syringed to keep down red spider. They color best when fully exposed to the sun, and should not be planted out until about the 10th of June in the neighborhood of New York and Philadelphia. If something is needed to make the beds look attractive early in the season, it is a good plan to plant pansies in April, to remain until it is time to plant the codieums. Some of the tender varieties, such as Reedii, albicans, and a few others, are inclined to burn in the extremely hot weather, but nearly all the sorts do well bedded out. Among the very best for this purpose are Queen Victoria, Dayspring, Baron Rothschild, Andreanum, Lady Zetland, Carrièrei, Barryi, Hawkeri, fasciatum, anietumense.—The house culture of codieums is very simple. It is neces-



1016. Codiæum variegatum Baronne de Rothschild. (An example of form platyphyllum.)

sary that a night temperature be maintained of 70° to 75°, and that the air be kept moist by frequent syringings. Cuttings of half-ripened wood may be easily rooted at any time from October until June, a bottom heat of 80° being just what they need. When very fine specimens are desired, root strong and shapely tops by making an incision in the stem and tying moss around the wounded part; it will be rooted ready to pot in about three weeks. By this method all the foliage may be retained, and a perfect plant will result. The more light the plant receives, the better will be the color; but with some kinds of glass it is necessary to shade lightly to prevent burning of the leaves. They may be grown finely in a house glazed with ground glass, which admits the light and does not require shading. It is well to syringe two or three times a week with tobacco water, to kill mealy bug and red spider. Little's Antipest, or any emulsion of coal-oil, is a good insecticide for codieums. New varieties from seed, the result of crossing existing sorts, are continually being raised. Seed ripens freely under glass in North America, and there is no doubt that the list of about eighty choice varieties now in cultivation will be largely added to in the near future. (Robert Craig.)

variegàtum, Blume, var. **pictum,** Muell. Arg. (*C. mèdium,* Baill. *C. variegàtum* var. *genuìnum,* Muell. Arg., in part. *C. pictum,* Hook. *Cròton variegàtus,* Linn. *Cròton pictus,* Lodd. *Phyllaùrea Codiæum,* Lour.). Lvs. ovate to linear, marked with various colors, entire or lobed.—Cult. throughout the Old World tropics as well as in Eu. and Amer. The wild form with green lvs. is var. *molluccànum,* Muell. Arg. (*C. moluccànum,* Decne.). B.M. 3051. L.B.C. 9:870.

A. *Foliage plane or recurved, entire, not appendiculate.*

B. *Lvs. 2–3, rarely 4 times as long as broad, usually broadest above the middle. Form* **platyphyllum,** *Pax.*

C. *The lvs. with practically no red coloration.*

Hort. vars.: aureo-maculatum, aureo-marmoratum, Baron Frank Seilliere, Barryi, Bergmanii, Bruce Findlay, Carrièrei, Delight, Exquisite, fasciatum, fucatum, Golden Queen, grande, Hawkeri, Henryanum, Hookeri, invictum, Jamesii, lacteum, magnolifolium, maximum, medium variegatum, Orvilla, ovalifolium, Princess Waldeck, superbiens, tournfordensis, Truffautii.

CC. *The lvs., at least when older, red colored.*

Hort. vars.: Andreanum, acubæfolium, Austinianum, Baronne James de Rothschild (Fig. 1016), B. Compte, Beauty, Dayspring, Dormannianum, Hilleanum, Le Tzar, Magnificent, Marquis de Guadiaro, Me. Lucien Linden, Mortii, Mrs. Iceton, Nestor, Newmannii, Pennincki; pictum, Pilgrimii, Prince Henry, recurvifolium, Reidii, Reginæ, roseo-pictum, Stewartii, Williamsii.

CCC. *The lvs. broad, color not specified.*

Hort. vars.: Compte de Germiny, d'Haenei, Dr. Friedenthal, Hendersonii, Kreutzeanum, Makoyanum, marmoratum, Prince Royal, Sanderi, Seemannii, Sinai, Stroemeri, verum, Watsonii.

BB. *Lvs. lanceolate to narrowly lanceolate, 5 or more times as long as wide. Form* **ambiguum,** *Pax.*

C. *The lvs. with practically no red coloration.*

Hort. vars.: albo-lineatum, angustissimum, anietumense, bellulum, Burtonii, concinnum, Countess, Crown Prince, Davisii, Duvalii, eburneum, elongatum, eminens, Goednoughtii, irregulare, latimaculatum, maculatum, Monarch, Mooreanum, Mrs. Swan, volutum, Weismanii, Wilsonii.

CC. *The lvs., at least when older, red-colored.*

Hort. vars.: albicans, amabile, Broomfieldii, Challengerii, Chantrieri, chrysophyllum, Cooperi, Drouetii, Duvivieri, Flamingo, Hanburyanum, imperiale, inimitabile, insigne, Jubilee, Lady Zetland, lancifolium, Macfarlanei, magnificum, Massangeanum, multicolor, musaicum, Nevilliæ, princeps, Queen Victoria, recurvatum, Sunshine, triumphans, triumphans Harwoodianum, Vervætii, Victory, Veitchii, Youngii.

CCC. *The lvs. medium width, lanceolate, color not specified.*

Hort. vars.: Boucheanum, Eckhautei, Eclipse, Excellenz, Flambeau, Gaerdtii, Grusonii, Imperator, Leopoldii, Margarete Daniel, marginatum, neriifolium, Oberstleutnant Brode, Ohlendorffii, Pres. Chereau, Said Pascha, Spindlerianum, splendidum, undulatum.

BBB. *Lvs. linear, 1 cm. (⅔in.) or less broad. Form* **tæniosum,** *Muell. Arg.*

C. *The lvs. with practically no red coloration.*

Hort. vars.: aigburthiense, aureo-punctatum, Dodgsonæ (in part), elegantissimum, Elvira, gloriosum, Hermon, Johannis, Phillipsii, superbum, Van Oosterzeei.

CC. *The lvs. with red color, at least when old.*

Hort. vars.: Bragæanum, elegans, majesticum, Mrs. Dorman, nobile, Princess of Wales, Rodeckianum, ruberrimum, sceptre.

CCC. *The lvs. narrow linear, color not specified.*

Hort. vars.: Donai, Fascination, Grayii, Klissingii, lineare, pendulinum.

AA. *Foliage lobed, or with margin crisped or spirally twisted, or with a hair-like or lf.-like apical appendage.*

B. *Lvs. entire, with margin crisped, or the whole lf. spirally twisted, without appendage. Form* **crispum**, *Muell. Arg.*

Hort. vars.: caudatum tortile, Chelsonii, Cronstadii, Elysian, Eyrei, Katharina, Madam Seilliere, Rex, spirale (in part) (Fig. 1019), Warrenii.

BB. *Lvs. more or less 3-lobed, at least constricted in the middle (panduriform). Form* **lobatum**, *Pax.*

C. *The lvs. panduriform or indistinctly lobed.*

Hort. vars.: Bismarckii, irregulare, lyratum, montifontainense, multicolor, Princess Matilda, Russelii, Thomsonii.

CC. *The lvs. distinctly 3-lobed.*

Hort. vars.: Craigii, Disraeli, Evansianum, Fred Sander, Goldiei, hastiferum, illustre, Lord Derby, maculatum Katonii, trilobum.

BBB. *Lvs. entire or nearly so, the midrib projecting, usually below the apex, as a horn-like appendage. Form* **cornutum**, *André.*

Hort. vars.: appendiculatum, chrysophyllum (in part), cornutum, excurrens, Mrs. McLeod, paradoxum, Prince of Wales, spirale (Fig. 1019).

BBBB. *Lvs. constricted to the midrib, or with the apically projecting midrib, bearing a second or even third plane, or cucullate, lamina. Form* **appendiculatum**, *Celak.*

Hort. vars.: Dodgsonæ, interruptum (Fig. 1018), elegans, irregulare, Laingii, Mrs. McLeod (in part), multiforme, mutabile, picturatum, Rodeckianum (in part), Sinitzianum.

The following varieties are in the American trade or frequently cultivated in this country. A great many variations in spelling of names occur, chiefly due to different terminations to agree with either Croton or Codiæum. Such slightly different forms of names have been omitted. The brief descriptive phrases do not include the more important characters given in the above classification. When yellow and red are both mentioned, the foliage is generally at first yellow-marked and later the yellow changing to red with ground-color green or dark red-green. The measurements are approximate, and of course, more or less unreliable and show respectively width and length of leaves in inches. It is intended here to account for the Latin-form names, that might be confused with tenable species-names; but practically all the prevailing vernacular names have been inserted.



1017. Codiæum Disraeli. (An example of form lobatum.)

Aigberth Gem (= following?).

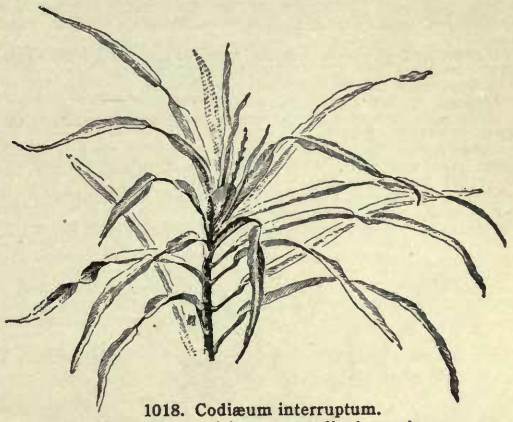
Aigburthiense. Yellow midrib and spots, ⅓×11. A.F. 16:255. Gng. 9:19.

Albicans. White variegated, crimson beneath, 3×18.

Albo-lineatum. Yellow center changing to white, 1×12. A.F. 16:255. Gng. 9:19.

Amabile ("often called variabile"). Lvs. often distorted and curved to one side, variegated with yellow and two distinct shades of green and red, 1½×11.

Andreanum. Yellow to red veins, 2½×9. I.H. 22:201. A.F. 23:241. Gng. 13:81. R.H. 1876, p. 234.



1018. Codiæum interruptum. (An example of form appendiculatum.)

Angustissimum (Angustifolium). Yellow margin and ribs, ¼×15. G.C. 1871:612.

Anietumense. Yellow midrib and cross veins, 1×11.

Aucubæfolium. Yellow, red-blotched, 2½×8. I.H. 19, p. 327.

Aureo-maculatum. Yellow-spotted, 1½×3½.

Aureum. Yellow-marked.

Baron Adolph Seilliere. Lvs. large, veins pale yellow, soon white.

Baronne James de Rothschild (Baron Rothschild, etc., Baron A. de Rothschild (?)). Fig. 1016. Yellow, red veins, etc., 2½×7. A.F. 23:242. R.H. 1879:450; 1898:180. F.E. 18:379. I.H. 26:365.

Barryi. Yellow, changing to white, midrib, veins and dots, 2×7.

B. Compte. Large, yellow, red blotches, 2½×7.

Beauty. Yellow to pink center, margin and mottling, ovate, 2×6.

Bergmanii. Cream-yellow with green blotches. I.H. 27:389.

Broomfieldii. Various yellow marks, midrib red-tinted, 2×10.

Burtonii. Yellow mottled, lanceolate, 3×15.

Carrierei. Margin, midrib, dots and some veins yellow, oblong, 1½×11. I.H. 27, p. 90, desc.

Caudatum tortile. Yellow variegated with some red, long, narrow, spiral lvs. R.B. 35:240. Gn. 11, p. 83. Gt. 33:9.

Challenger (Challengerii?, Imperator?). Midribs creamy white changing to red.

Chelsonii. Yellow, red midrib and mottling, ⅓×10. A.F. 16:255. Gng. 9:19.

Chrysophyllum (perhaps two vars. under this name). Irregular, large, yellow, red blotch, 2×12.

Compte de Germiny. Lvs. broad.

Cooperi. Yellow, red center and spots, ¾×10. Gn. 10, p. 139.

Cornutum. Yellow midrib and dots, often wavy, spiral or even lobed, ¾×4. I.H. 19, p. 188.

Countess (Countess Superba?). Yellow spotted, tapering, ⅔×14.

Cronstadtii. Yellow variegated, tapering, spiral, ⅔in. wide. A.F. 16:255; 23:275. Gt. 31:309.

Crown Prince. Yellow veins, 2×16.

Czar Alexander III. See Le Tzar.

Davisii. White midrib and variegation, ¾×12.

Dayspring. Yellow, red-mottled, margin green, ovate, 1½×8.

Delight. Yellow changing to white, with green margin, lanceolate, 2×8.

Disraeli. Fig. 1017. Variously lobed, yellow, red veins and spots, 3×12. Gn. 10, p. 141. F.M. 1876:207.

Dodgsonæ. Yellow midrib, margin and spots, often spiral, excurrent midrib often foliacious, ⅔×12.

Dormannianum. Lvs. small, bronze-red and yellow.

Earl of Derby. See Lord Derby.

Earlscourt.

Edmontonense. Lvs. narrow, brilliantly colored.

Elegans (Parvifolium, see Interruptum). Yellow, red midrib and margin, ½×6.

Elegantissimum. Yellow center and dots, petiole red, rarely with apical seta, ½×14. I.H. 29:469.

Elvira. Yellow center and variegation, sometimes with apical seta and twisted, ⅓×10.

Elysian. Yellow midrib and dots, ⅔×14, twisted.

Evansianum. Yellow, red-veined and mottled, 3-lobed. Gn. W. 4:409.

Excelsior.

Excurrens. Greenish yellow variegated, oblong, midrib projecting.

Euterpe.
Fasciatum. Yellow veins, broad ovate. A.F. 23:241.
Flambeau. Medium width, lanceolate.
Flamingo. Irregular yellow central stripe, 1½×8.
Gloriosum (Prince of Wales). Lvs. long-narrow, variously yellow-marked, sometimes spiral and appendaged. Gng. 9:19. Gn. 14, p. 543. A.F. 16, p. 255.
Golden Ring.
Goldiei. Yellow veins, 3-lobed, 3×10.
Grande. Yellow veins and spots.
Grayii. Resembling Majesticum.
Hanburyanum. Yellow, rose marks and blotches, 2½×15. Gng. 7:324.
Harwoodianum (Triumphans Harwoodianum). Yellow, crimson midrib.
Hawkerii. Light yellow, green margins and tips, broad-lanceolate, 6 in. long. J.H. III. 61:129. G.Z. 23, p. 265.
Henryanum. Yellow-mottled, ovate, 3×9.
Hermon. Yellow midrib and spots, ½×10.
Hilleanum. Purplish green, crimson marks, oblong or spatulate, 3×9. I.H. 19, p. 326.
Hookerianum (Hookeri). Irregular yellow center and blotches, broad lance-ovate. G.C. 1871:1067. Gn. 3, p. 45. I.H. 19, p. 40. G. 7:137. F. 1871, p. 199.
Illustre. Yellow markings, 3-lobed, midrib excurrent. G.Z. 28:2.
Imperator. See Challenger.
Inimitabilis. Yellow, red midrib and veins all dark red, 1×6.



1019. Codiæum spirale. (An example of forms crispum and cornutum.)

Insigne. Yellow midrib and veins, margin red, narrow-oblong.
Interruptum. Fig. 1018. Yellow, red midrib, ¾×12. Sometimes distorted or spiral, midrib excurrent. I.H. 19, p.170. F. 1872. p. 209 A.F. 16:1510. Journ. Bot. 19:220.
Invicta. Lemon-color, broad lf.
Irregulare. Lf. form irregular, often contracted below middle, midrib and spots yellow. I.H. 19, p. 135.
Jamesii. Irregular yellow blotch changing to white, 3×10.
Johannis (Taeniosum). Center and margin yellow: lvs. long, narrow. F. 1872, p. 161. Gng. 9:19. I.H. 19, p. 169. F.S. 19, p. 12. Gt. 34:24. A.F. 13:1070.
Katonii (Maculatum Katonii). Lvs. partly trilobed, yellow-spotted. F. 1879. p. 27.
Lady Zetland. Yellow, red margin, midrib and veins, ¾×11.
Laingii. Lf. base yellow, remainder green to dark red, spiral, midrib excurrent or appendaged.
Le Tzar. Lf. broad, veins and most of lf. yellow, red. I. H. 35:70.
Lord Derby (Earl of Derby?). Trilobed, base and center yellow, red, ½–4×8.
MacFarlanei. Yellow, red-blotched, 1×12.
Maculatum Katonii. See Katonii.
Madam Seilliere. Lvs. lanceolate, spirally twisted, variegated. A.F. 13:1068.
Magnolifolium. A few yellow spots and veins, 3×6.
Majesticum. Yellow, red margin, midrib and mottling, linear, 15 in. long. G.Z. 18, p. 97. G. 2:163. F. 1876, p. 53. F.M. 1874:103.
Makoyanum. Broad lvs. chocolate and carmine marking.
Marquis de Castellane.
Maximum. Border and veins yellow or yellow with green blotches, 12 in. long. I.H. 14, p. 534; 19, p. 168. B.H. 19:65.
Memphis.
Montefontainense (Montfortiense?). Somewhat 3-lobed, veins yellow, red, 1½×6.
Mortii. Midrib and veins yellow, light red, 3×10.
Mrs. Chas. Heine.
Mrs. Craige Lippincott. Lvs. lance-ovate, veins colored. A.F. 23:274. Gng. 13:98.
Mrs. Dorman. Midrib scarlet, margins green, linear, ½×12. A.F. 16:255. Gng. 9:19.
Mrs. H. F. Watson. Lvs. large, variously marked with yellow and red.
Mrs. Iceton. Very dark red with rose mottling, 2×4½.
Mrs. McLeod. Constricted in middle, midrib yellow, red, projecting, ½×10.
Mrs. Swan. Central yellow stripe and blotch, petioles red, 1×12.
Multicolor. Like Irregulare but with red coloration developed. I.H. 19, p. 120. F. 1872, p. 89.
Musaicum. Yellow, red-veined and mottled, or with green blotches on colored ground, 1½×8. R.H. 1882:240.
Nestor. Serrated central yellow, red blotch and spots, 2½×12.
Nevilliæ. Green-red mottling on yellow.
Newmannii. Lvs. short, broad, dark crimson.
Nobile. Lvs. linear, yellow, red variegated. A.F. 16:255. Gng. 9:19. F. 1878, p. 133.
Orvilla. Green mottling on yellow, 1×4½.
Ovalifolium. Yellow variegated. Gt. 24, p. 221. F. 1875:8.
Pictum. Lvs. broad oblong-acuminate, less than 10 inches long, blotches of green and blackish on red. B.M. 3051.
Picturatum. Similar to Interruptum. Gt. 25:375.
Pilgrimii. Yellow-blotched, overspread with pink, 3×9.
Princeps (mutabile). Yellow, red midrib and margins, lvs. narrow, variable in form, sometimes appendaged. F. 1879, p. 69. Gn. 13:621, desc.
Princess Matilda. Lvs. subtrilobed, yellow, red blotch, base nearly white, petioles red.
Princess of Wales. Yellow midrib and mottling, changing to white, with pink reverse, linear, ½×12. Gng. 13:84. A.F. 23:275.
Punctatum.
Queen Victoria. Yellow, red veins and mottling, 1½×10. A.F. 23:241.
Recurvifolium. Lvs. acuminate, recurved at the tip, yellow, red veins and blotches.
Reginæ. Lvs. short and broad, yellow, crimson and brown colored. F. 1879, p. 59.
Reidii. Yellow, red variegation and veins, rose tints, 4×8. A.F. 23:242.
Rodeckianum. Variously mottled and marked with yellow and red, ¾×12, sometimes twisted and appendaged.
Roseo-pictum. Yellow, red, with green blotches between veins. I.H. 26:364; 43, p. 159.
Ruberrimum. Crimson marked with creamy white, linear.
Rubro-lineatum. Yellow, with crimson tints, oblong-lanceolate, "1 in. to 1¼ in. long."
Rubro-striatum.
Sceptre. Lvs. linear, yellow spots, red midrib.
Sinitzianum. Yellow spots changing to white, projecting midrib appendaged, ½×10. Gt. 30:278. G.Z. 26:145. J.H. III. 48:435.
Sollerii.
Spirale. Fig. 1019. Midrib yellow, red or green, lvs. spiral, midrib excurrent, ⅔×10. V. 9, p. 203. F. 1874, p. 211. F.M. 1874:126. A.F. 23:242. Gt. 24:26.
Splendens. "Lvs. broad, yellow and dull red on green."
Stewartii. Yellow veins and margin, midrib and petiole red.
Sunshine (Sunbeam?). Yellow, red veins and mottling, 2×9.
Superbissimum.
Superbum. Lvs. linear, drooping, green and yellow mottled. A.F. 16:255; 23 p. 275; 21:674. Gng. 12:471; 9:19.
Thomsonii. Irregular central yellow area or all yellow, subtrilobed, 2×6.
Tortilis. See Caudatum tortile.
Tricolor. Lvs. oblong spatulate, margin sinuous, center yellow, lower surface reddish.
Triumphans. Lvs. oblong, green and red.
Undulatum. Lvs. long and broad, undulate, veins red to purple. I.H. 19, p. 265. F. 1870, p. 207. G. 9:106. Gn. 3, p. 118.
Veitchii. Yellow, red midrib and wide veins, some mottling, 1½×10. Gn. 17, p. 565. F. 1870, p. 206. I.H. 19, p. 134. R.H. 1867, p. 190. V. 9, p. 203.
Victory. Yellow, red midrib and blotches, 2½×12.
Volutum. Yellow midrib and veins, 1×6, with long tip rolled backward. Gt. 24:61. V. 9, p. 202. F. 1874, p. 138. G.Z. 20, p. 33. F.M. 1875:154.
Warrenii. Yellow, red variegated, 1×20 spiral. P.F.G. 1882: 111. G. 11:123; 13:705. A.F. 16:255. G.W. 12:62. Gn.W. 6:457. Gn. 36, p. 337.
Weismanii. Yellow midrib and veins, petiole red, margin undulate, 1×10. I.H. 20, p. 80. F.S. 19, p. 14. F. 1873:55. Gt. 22, p. 149.
Williamsii. Yellow, red and pink variegated, ovate-oblong, 3×12.
Wilsonii. Green overspread with yellow, linear lanceolate, 1×18.
Youngii. Irregular yellow, red blotches, 1×15. Gn. 4, p. 129.

Others not in American trade: *appendiculatum.* Horned, green. G.Z. 21:241. [F. 1879, p. 67. R.H. 1877, p. 88. F.W. 1877, p. 136.—*aureo-lineatum.* Yellow margins and veins.—*Baron Frank Seilliere.* Yellow to white veins on reddish green. I.H. 27, p. 72, desc. Gn. 21, p. 289.—*bellulum.* Yellow, green margins. I.H. 22:210.—*Bragæanum.* Yellow and green, red midrib, linear, 18 in. long.—*Chantrieri.* Linear, yellow red spots. I.H. 27, p. 73, desc.—*contortum.*

Lvs. ovate, tips recurved, veins and margins yellow.—*Craigii.* 3-lobed. Gng. 13:97. A.F. 23:238.—*Cræsus.* Oblanceolate, yellow-blotched.—*Drouetii.* Linear, border and veins yellow, red. I.H. 27, p. 73, desc.—*Duvalii.* Lvs. lance-linear, veins light yellow. I.H. 27, p. 73, desc.—*Duvivieri.* Short-oblong, chiefly red. —*eburneum.* Central irregular, white band.—*elongatum.* Narrow lanceolate, yellow veins, margins, and spots. I.H. 24:299.—*eminens.* Lanceolate, midrib and pair of veins white.—*Exquisite.* Broad-ovate, margins and variegation yellow.—*Eyrei.* Recurved and spiral, yellow variegated, petiole red.—*Fascination.* Long-linear. A.F. 23:243. Gng. 13:119.—*formosum.* Yellow, red-spotted.—*fucatum.* Obovate, yellow blotched, petiole red.—*Goedenoughtii.* Yellow variegated.—*Golden Queen.* Yellow midrib and few veins and dots, petiole red, 2½×9.—*hastiferum.* Two acute lobes at broad base, yellow veins and blotches. I.H. 22:216. *heroicum.* Yellow, red.—*imperiale.* Oblong, yellow, red margins and veins, horned. F. 1876, p. 209.—*interruptum elegans.* I.H. 27, p. 90, desc. R.H. 1880:170.—*Jubilee.* Center, veins and margins, yellow, red, 2×13.—*Junius.* Long, narrow, yellow and red-colored. —*Katharina.* Spiral, red variegated, 2×10.—*lacteum.* Oblanceolate, margin sinuous, midrib and veins yellow. F.S. 19, p. 8.—*lancifolium.* Lanceolate, yellow- and red-marked, 1½×15.—*latimaculatum.* Lanceolate, yellow-marked, petiole red. I.H. 27, p. 73, desc.—*limbatum.* Yellow margins and spots.—*Lord Belhaven.* Lanceolate, Gng. 7:323. F.E. 18:379.—*lyratum.* Slightly 3-lobed, yellow veins. I.H. 24:293.—*maculatum.* Lanceolate, 12 in. long, yellow-spotted.—*magnificum.* Yellow, red irregular central mark. I.H. 29:447.—*Magnificent.* Central part yellow, red, 2½×7.—*Marquis de Guadiaro.* Irregular yellow, red center. I.H. 37:96.—*Massangeanum.* Lanceolate, 10 in. long, yellow, red, with green blotches. I.H. 26:347. S.H. 1:124.—*medium variegatum.* Ovate, margins and veins yellow.—*Me. Lucien Linden.* Yellow, red-variegated. I.H. 38:140.—*Monarch.* Lanceolate, 2½×12, yellow spots.—*Mooreanum.* Oblanceolate, yellow edge and veins. G.Z. 22:25.—*ornatum.* Yellow, red center, veins and blotches.—*paradoxum.* Horned, yellow variegated. F. 1879, p. 68.—*Pennincki.* Obovate, red with green marks. R.B. 33:304.—*Phillipsii.* Lance-linear, base and center yellow, ¾×9.—*Prince Henry.* Tip recurved, variously red- and yellow-marked.—*Princess Waldeck.* Ovate, 4 in. long, yellow center.—*recurvatum.* Tip recurved, yellow along the red midrib.—*Rex.* Spiral, yellow, red mottled, ⅔×10.—*Russellii.* Constricted in the middle, yellow, red spots and veins. J.H. III. 27, p. 493.—*Sanderi.* Ovate, large, irregular blotches. G. 22:197.—*splendidum.* Lvs. broad, lanceolate, yellow, red.—*superbiens.* Oblong, yellow, red-variegated. Gng. 13:84.—*Torquetum.*—*Torrigianum.* Yellow, red veins, ribs and margins.—*tournfordense.* Ovate, wide yellow center and base. Gn. 65, p. 42. —*trilobum.* Lobed, yellow blotched. R.H. 1877, p. 89. F. 1877, p. 56. G.Z. 21:97.—*Truffautii.* Yellow to white veins, lvs. broad.—*Van Oosterzeei.* Lance-linear, yellow-spotted. I.H. 30:502.—*Vervætii.* Yellow, red midrib and spots, lanceolate. I.H. 23:253.—*vittatum.* Irregular yellow center, petiole red.—*Wigmannii.* Yellow blotches, ½×9.

J. B. S. NORTON.

CODLIN. Used in England to mean a small, green, half-wild, inferior apple. It is used in distinction to grafted or dessert fruit. It is about equivalent to the American popular use of the word "crab." The word is also used in England as the name of a particular variety or group of varieties, as Keswick Codlin. The word codlin is known in America only in connection with the apple-worm insect, the codlin-moth. Sometimes written *Codling.*

CODONÁNTHE (Greek for *bellflower*). *Gesneràceæ.* A dozen or more trailing or scandent herbs or subshrubs of Brazil, Guiana, Cent. Amer., and W. Indies, 1 or 2 of which may be found in choice collections of stove plants. Plants with long branches, opposite entire and fleshy or thick mostly small lvs., and whitish fls. borne singly in the axils: corolla with a declined or curved tube, the throat broad or open, and the limb with 5 rounded nearly equal lobes, exceeding the 5 narrow lobes of the calyx; stamens attached in corolla-tube, not exserted: fr. berry-like. *C. grácilis,* Hanst., with creamy white spotted orange fls. and lvs. often blotched red beneath, is the species most likely to be seen. Cult. of Gesneria and similar things. L. H. B.

CODONÓPSIS (Greek, *bell-like,* alluding to the shape of the flowers). *Campanulàceæ.* Twining or decumbent perennials, more or less hardy in the open, with showy blue, whitish or greenish flowers.

Herbs, with tuberous rhizomes: lvs. alternate or irregularly opposite, petiolate, mostly crenate: fls. axillary or terminal, stalked; calyx-tube hemispherical, the limb 5-parted and the lobes leafy; corolla-tube broadly tubular or bell-shaped, 5-parted (rarely 4- or 6-parted); stamens free, the filaments dilated at base; stigma 3–5-lobed: fr. a dry or somewhat fleshy 3–5-valved caps.—Eighteen or 20 species in Cent. and E. Asia. A few of the species may occur in choice border-collections; they need protection N.

ovàta, Benth. Six to 12 in., decumbent and branches becoming erect: lvs. ovate, small (¾in. or less long), both alternate and opposite, acute or obtuse, hairy, short-petioled: fls. pale blue, speckled inside, 1¼in. or less long, broadly bell-shaped, on long terminal peduncles. Himalayas.—Offered in England; half-hardy to hardy.

C. clematídea, Schr. Two to 3 ft., from mts. of Asia; one of the hardiest: lvs. ovate-acuminate, petioled: fls. white tinged blue. Much like C. ovata.—*C. convolvulácea,* Kurz. Sts. thin and wiry: fls. bright blue, 1 in. across, numerous. Upper Burma.—*C. lanceolàta,* Benth. & Hook. (Campanumæa lanceolata, Sieb. & Zucc.). Twining, 2–3 ft.: fls. hanging, greenish white and purple-veined, 1–2 in. long and 1 in. wide, in a short simple raceme: lvs. alternate, oblong-lanceolate, nearly or quite entire. Burma, China. F.S. 9:927.—*C. Tángshen,* Oliver. Climbing, with long thickened rhizome, the sts. slender and 2 ft. or more long: lvs. ovate or broad-lanceolate, toothed: fls. solitary, stalked, bell-shaped, 1½ in. long, greenish, spotted and striped purple inside. China. B.M. 8090. Root used in China as a tonic.—*C. vinciflòra,* Fedde. Allied to C. convolvulacea: twining, slender: lvs. mostly opposite, ovate or oblong-acuminate, sinuate-dentate: fls. solitary, very long-pedunculed, rather small, rotate, and deeply parted, lilac. W. China.—*C. viridiflòra,* Maxim. Small climber, free-flowering: fls. bell-shaped, whitish green, gray and violet. E. Asia.

L. H. B.

CŒLIA (Greek, *koilos,* hollow: referring to the pollen masses). *Orchidàceæ.* Epiphytic orchids of minor importance; culture of Epidendrum.



1020. Cœlia Baueriana.

The cœlias are divided into 2 strongly marked groups with widely different kinds of infl. *C. macrostachya* is a type of the first section, with long racemes of numerous small, horizontal fls., which are much exceeded by the long spreading bracts, and the base of the column short. *C. bella* is typical of the second section, with the fls. few, larger, erect, in groups of about 3, longer than their bracts, and the base of the column produced to twice its own length, which gives the fls. a tubular appearance.—A half-dozen species in Cent. and S. Amer.

A. *Fls. small, in a long raceme.*

macrostàchya, Lindl. Pseudobulbs 2½ in. long, almost round, with brown scales at the base: lvs. about 3, from the top of the pseudobulb, 1 ft. or more long, lanceolate, arching, broader than in *C. bella,* and not channeled: sepals red; petals white. Mex. R.H. 1878:210. B.M. 4712. J.F. 4:423.

Baueriàna, Lindl. Fig. 1020. Pseudobulbs 1–2 in. long, 2–3-lvd.: lvs. 10–18 in. long, linear, acute: racemes of numerous small white fragrant fls.; ovary 3-winged; sepals ovate-lanceolate, the petals ovate-oblong; lip with the claw yellow, the blade triangular. W. Indies and Mex. B.R. 28:36.

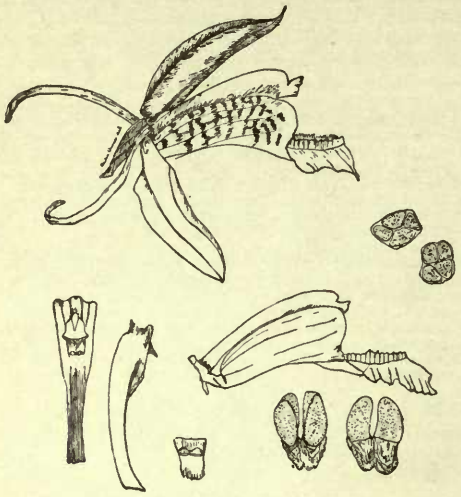
AA. *Fls. white, tipped purple, few, large.*

bélla, Reichb. f. Pseudobulbs smaller and more constricted at the top: lvs. 6–10 in. long, narrower, chan-

neled above, arching: fls. 2 in. long, erect, 3 or 4 in number, with the mid-lobe of the lip orange-colored. Guatemala. B.M. 6628.

C. densiflòra, Rolfe. Characterized by a dense-fld. raceme, wingless ovary and oblong mentum. Cent. Amer.

GEORGE V. NASH.†

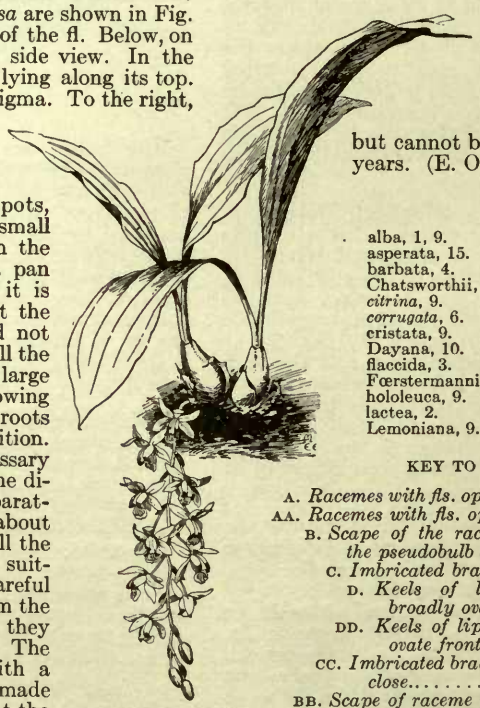


1021. Details of Cœlogyne speciosa.

CŒLÓGYNE (*hollow pistil*). *Orchidàceæ*. Popular epiphytic warmhouse orchids of the eastern hemisphere.

Pseudobulbs tufted or at intervals on the st.: fls. in racemes, opening simultaneously or in succession; sepals and petals similar, spreading or reflexed; lip 3-lobed, the lateral lobes erect, inclosing the slender column, the middle lobe flat or recurved, keeled; column slightly curved, winged above; pollinia 4.—Species about 115, distributed from N. India to Ceylon, middle China, and in the islands of the Indian Ocean. The botanical details of *Cœlogyne speciosa* are shown in Fig. 1021. At the top is a general view of the fl. Below, on the left, is the column, front and side view. In the center is the lip, with the column lying along its top. Below the lip, on the left, is the stigma. To the right, on the bottom row, are the pollinia, front and back view; and at the right center are separate pollen masses.

Cœlogynes may be grown in pots, baskets or pans, using pots for small plants, and larger receptacles when the plants require them; but when a pan larger than 12-inch is necessary, it is best to use perforated ones so that the material may be well aërated and not become unsuitable for the roots. All the species are of rambling habit and large specimens may soon be had by growing on, provided the material at the roots is kept in a sweet healthy condition. When, however, it becomes necessary to divide a plant, this is best done directly after flowering, carefully separating the running shoots, cutting off about three of the last-made bulbs with all the roots attached, planting these in suitable-sized receptacles, being very careful to point the growing end away from the edge, or toward the center, so that they will not so readily outgrow again. The material to use is osmundine with a little sphagnum moss if it can be made to grow, packing all very firm about the roots so that too much water will not be held about the roots. Place in the shady part of a warm house until root-action begins; but, during the hot summer months, the varieties of *C. cristata* may with great benefit be placed in a frame in a shady place outdoors, there to remain until danger of frost in October. Treated in this way, the plants will bloom much better. They should all be placed on inverted pots when outside to exclude vermin. When brought indoors the bulbs will be finishing up for bloom, and as they are terrestrial plants, weak manure-water should be given at every watering. A glance at the roots and their structure will show how they differ from the epiphytal orchids such as the cattleyas. Cœlogynes, being evergreen, should never be quite dry at the roots, or shriveling will result; this always is the case after flowering or repotting; but, when growth commences, they soon plump up again. It is often desired to grow these plants in baskets. Space can then be made for them overhead in the cool-houses in winter, bringing a few at a time into warmth, thus having succession of bloom for three months for cutting, house or conservatory decoration, where they last a long time. There are more than 100 kinds of cœlogynes, many of which are but of botanical interest. *C. pandurata*, *C. Dayana* and *C. Sanderiana* are warm-house plants and should be kept at a minimum temperature of 60° in winter. *C. nervosa*, *C. flaccida*, *C. nitida*, and *C. Massangeana* are coolhouse plants, often grown in collections; but *C. cristata* and its forms are the most valued, especially the variety *maxima* once so scarce, but now plentiful; this makes large bulbs and longer spikes of bloom. The Chatsworth variety, by some considered the same as *maxima*, *hololeuca* or *alba* as it is most often known in gardens, is a pure white form, perhaps the whitest of all orchids. This is inclined to ramble, owing to the length of rhizome between each bulb or growth, and needs attention in repotting frequently; it is also the latest to flower. *C. Lemoniana* has a pretty lemon-yellow blotch on the lip instead of the usual orange and is very pretty by contrast with the other forms. When it is desired to increase the stock of plants, the back bulbs taken off at potting time may be planted similar to the other pieces and will grow on, but cannot be expected to bloom for two years. (E. O. Orpet.)



1022. Cœlogyne Massangeana. (×⅙)

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KEY TO THE SPECIES.

A. *Racemes with fls. opening in succession.* 1. **speciosa**
AA. *Racemes with fls. opening all at once.*
B. *Scape of the raceme naked between the pseudobulb and lowest fl.-bract.*
C. *Imbricated bracts below fls. none.*
D. *Keels of lip extending into broadly ovate front lobe.....* 2. **lactea**
DD. *Keels of lip not extending into ovate front lobe.....* 3. **flaccida**
CC. *Imbricated bracts below fls. several, close.....* 4. **barbata**
BB. *Scape of raceme with 1 or few scales between pseudobulb and lowest fl.-bract.*

c. *Lip with a large eye-like spot*.... 5. **nitida**
cc. *Lip with no eye-like spot.*
d. *Keels of lip lacerated or fimbriated.*
e. *The scape arising from large lvs.*
f. *Fl.-bracts persistent*..... 6. **nervosa**
ff. *Fl.-bracts deciduous*..... 7. **Sanderiana**
ee. *The scape without large lvs.*
f. *Sepals about as long as broad; keels of the lip only slightly cut*..... 8. **Fœrstermannii**
ff. *Sepals about twice as long as broad; keels of lip strongly cut*..... 9. **cristata**
dd. *Keels of lip warty.*
e. *Peduncle, rachis and ovaries tomentose.*
f. *The scape arising from large lvs*.....10. **Dayana**
ff. *The scape without large lvs.*
g. *The keels in middle lobe of lip papillose*.....11. **tomentosa**
gg. *The keels in middle lip cut into tooth-like segms*.....12. **Massangeana**
ee. *Peduncle, rachis and ovaries glabrous.*
f. *Pseudobulbs elliptic to ovate-oblong, compressed.*
g. *Middle lobe of lip separated from lateral lobes by a distinct claw*.....13. **pandurata**
gg. *Middle lobe of lip sessile.*14. **Mayeriana**
ff. *Pseudobulbs fusiform, 4-sided.*
g. *Raceme many-fld., nodding*.....15. **asperata**
gg. *Raceme few-fld., erect*..16. **Parishii**

1. **speciòsa,** Lindl. (*C. salmonícolor,* Reichb.). Pseudobulbs ovoid, distinctly angled, 2–3 in. long, 1-lvd.: lvs. up to a foot long: racemes with 1, 2 or 3 fls.; sepals oblong, translucent, pale yellow-brown; petals pale yellow-brown, linear, reflexed; lateral lobes of lip erect, reticulated, with dull copper-brown on a blush-salmon ground, mid-lobe roundish, partly broad-margined with white; disk with 2 fringed ridges and umber-brown markings. Java. B.M. 4889. Gn. 49, p. 62. B.R. 33:23. C.O. 3. Var. **álba,** Hort. A light-colored form.

2. **láctea,** Reichb. f. Pseudobulbs ovate, somewhat 4-sided, sulcate, 2-lvd., 3 in. long: lvs. up to 10 in. long, 2 in. broad: fls. 6–12; sepals and petals spreading, cream-white, the sepals oblong-ovate, acuminate, the petals much narrower, linear-lanceolate; lip about as long as petals, the lateral lobes semi-ovate, truncate, the middle lobe about equaling one-half the whole length of the lip, triangular at the apex, acute, reflexed; keels 3, undulate, extending to the center of middle lobe. Burma.

3. **fláccida,** Lindl. Pseudobulbs ovate, angulate, 2–3 in. long: lvs. lanceolate, about 8–10 in. long: raceme 7–12-fld., cream-white, the sepals oblong, the petals linear-oblong; fls. 1½ in. across; sepals and petals pendulous; lip with 3 ridges, the lateral lobes white, streaked red-brown inside, the middle lobe reflexed, acute, a bright yellow blotch on the disk. Nepal. B.M. 3318. B.R. 27:31. C.L.A. 6:166.

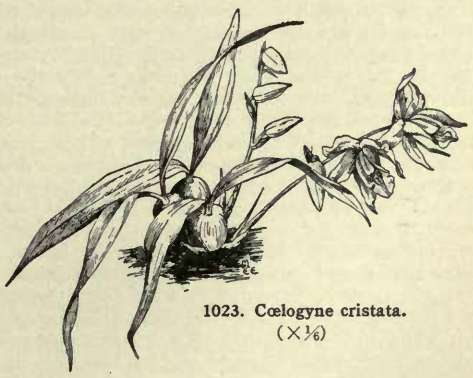
4. **barbàta,** Griff. Pseudobulbs about 2 in. long, ovate: lvs. broadly lanceolate, 10–12 in. long: raceme 6–10-fld.; sepals and petals white, the sepals ovate-oblong, the petals linear; mid-lobe of lip brownish inside, curiously fringed with brown; crests 3. Khasia hills.

5. **nítida,** Hook. f. (*C. ocellàta,* Lindl.). Pseudobulbs pyriform or nearly so: lvs. up to 1 ft. long, narrowly lanceolate: racemes erect, 5–8-fld.; fls. 2 in. across, white, the sepals oblong, the petals linear-oblong; lip with bright orange-yellow spots on each of the lateral lobes and 2 smaller spots at the base of the mid-lobe; disk with 3 keels, the front lobe of lip with 5. Himalayas, at an elevation of 7,000 ft. B.M. 3767. C.L.A. 1:55. Var. **máxima,** Reichb. Racemes longer; fls. larger. J.H. III. 52:25.

6. **nervòsa,** A. Rich. (*C. corrugàta,* Wight). Pseudobulbs ovate-pointed, 2½–3 in. long: lvs. 6–12 in. long: racemes 3–6-fld.; fls. white, 2–2½ in. across; sepals and petals nearly equal, oblong and acute; lip with the lateral lobes striped red inside, the middle lobe ovate, acuminate; disk yellow, with 3 white fringed keels. India. B.M. 5601.

7. **Sanderiàna,** Reichb. f. Pseudobulbs ovate and wrinkled or costate, 2–3 in. long: lvs. a foot long: fls. about 6 in a pendulous raceme, 2–3 in. across, white; sepals lanceolate-acuminate; petals narrower; lip with the side lobes striped with brown inside and with a yellow blotch, the middle lobe oblong, acute, reflexed, undulate; disk bright yellow, with 6 fringed keels. India. J.H. III. 44:75.

8. **Fœrstermannii,** Reichb. f. Pseudobulbs cylindric or fusiform: lvs. up to 1½ ft. long: racemes many-fld.; fls. 2 in. across, white; sepals and petals lanceolate; lip with 3 denticulate keels, the middle lobe elliptic, acute; disk marked with yellowish brown. India.



1023. Cœlogyne cristata. (×⅙)

9. **cristàta,** Lindl. Fig. 1023. Pseudobulbs 1½–2 in. long, ovoid-oblong, scattered on a scaly rhizome: lvs. 8–12 in. long: racemes 5–9-fld., drooping; fls. white; sepals and petals lanceolate-oblong, undulate, acute, with 5 orange fringed keels, the lateral lobes slightly incurved, the mid-lobe transversely oval, denticulate. Nepal. J.H. III. 31:349. P.G. 1:55. A.G. 14:331; 15:513. A.F. 4:497; 6:87; 9:1111; 13:1133; 16:1445. C.L.A. 6:163. F.E. 9:331. B.R. 27:57. G.C. III. 47:40. O.R. 18:169. Gng. 2:393; 4:225. Var. **hololeùca,** Hort. (var. *álba*), has white fls., labellum without yellow. C.O. 1*a*. Var. **Lemoniàna,** Hort. (var. *citrìna,* Hort.), has citron-yellow fringes. J.H. III. 57:537. Var. **Châtsworthii,** Hort., has large pseudobulbs and large fls. of good substance. Var. **máxima,** Hort., has very large fls.—*C. cristata* is one of the best and most popular of orchids. It is one of the easiest to grow. Can be grown with cattleyas.

10. **Dayàna,** Reichb. f. Pseudobulbs cylindricfusiform, 5–10 in. long: lvs. up to 2½ ft. long, oblong-lanceolate: racemes many-fld., pendulous; fls. 2–2½ in. across; sepals and petals pale yellow, margins reflexed, the petals much narrower than sepals; lip with 6 erect ridges fringed with brown, the lateral lobes brown, streaked with white inside, the middle lobe nearly quadrate, reflexed, apiculate. Borneo. G.C. III. 15:695. A.F. 35:380.

11. **tomentòsa,** Lindl. Pseudobulbs elongated, ovoid, 2–3 in. long: lvs. up to a foot long, 3–5-nerved: racemes pendulous, tomentose; fls. 15–20, 2–2½ in. across; sepals

and petals pale orange-red, sepals lanceolate, petals linear-lanceolate; lip with lateral lobes oblong, rounded, streaked with red on inside, the middle lobe reniform or transverse-elliptic, sessile; keels 3, crenulate, lateral ones converging in the middle lobe and sometimes bearing 2 branches. Perak, Borneo, Sumatra.

12. **Massangeàna,** Reichb. f. Fig. 1022. Pseudobulbs pyriform, 3–5 in. long: lvs. elliptical, large, tapering toward the base, up to 20 in. long: racemes many-fld., pendulous, pubescent; fls. 2–3 in. across; sepals and petals pale yellow, the sepals oblong-lanceolate, the petals linear-oblong; lip with lateral lobes brownish within, lined or streaked with yellow, mid-lobe with a verrucose brown and yellow disk from which extend 3 denticulate keels. Assam. B.M. 6979. C.O. 4.

13. **panduràta,** Lindl. Pseudobulbs 3–4 in. long, oval-oblong, compressed: lvs. 15–20 in. long, cuneate-oblong: racemes many-fld., pendulous; fls. up to 4 in. across; sepals and petals green, linear-oblong, acute; lip fiddle-shaped, with black veins and stains on yellowish green ground, the mid-lobe crisped, black-warty; disk 2-keeled. Borneo. B.M. 5084. F.S. 20:2139. J.H. III. 30:377. A.F. 6:633. C.O. 6. Gt. 49:1480.

14. **Mayeriàna,** Reichb. f. Pseudobulbs ovate-oblong, about 2 in. long, compressed, 2-lvd.: lvs. 8–10 in. long, cuneate-obovate: raceme 8–10-fld., erect or nodding; fls. about 2½ in. across, green, veined black-brown; sepals oblong, acuminate, the petals shorter and narrower, the margins reflexed; lip nearly as long as sepals, the lateral lobes concealing only the base of the column, the middle lobe sessile, oblong-elliptic, crisped; keels 3, papillose. Singapore.

15. **asperàta,** Lindl. (*C. Lòwii,* Paxt.). Large species (18–24 in. high): pseudobulbs ovate-oblong, 5–6 in. long or more: lvs. up to 2½ ft. long, lanceolate, acute: raceme 7–10-fld., pendulous; fls. 3 in. across, cream-colored; sepals and petals lanceolate, lip with the lateral lobes white, streaked red-brown inside, the middle lobe nearly orbicular, the crisped margin pale yellow streaked red-brown; disk with 2 or 3 orange-red warty ridges. Borneo. P.M. 16:227. G.C. III. 46:34.

16. **Pàrishii,** Hook. f. Like No. 13, but racemes not drooping, pseudobulb 4-angled, 4–6 in. long: lvs. up to a foot long, lanceolate, acuminate: racemes 4–7-fld., erect; fls. about 2 in. across, pale yellow-green; sepals lanceolate, acuminate; petals linear-lanceolate; lip fiddle-shaped, black-spotted, the middle lobe apiculate, undulate; disk with 5 raised lines. Moulmein. B.M. 5323.

C. dìbo-lùtea, Rolfe. Fls. showy, very fragrant, pure white, with lobes yellow. Mts. of N. India.—*C. Brymeriàna,* Hort. A garden hybrid between C. Dayana and C. asperata.—*C. burfordiénsis,* Hort. (C. pandurata × C. asperata). Fls. pale green, the spiny crest black, the ridges green and yellow. G.C. III. 49:331.—*C. chrysotrópis,* Schltr. Scape much shorter than the lvs., few-fld. Sumatra.—*C. Còlmanii,* Hort. A garden hybrid between C. speciosa major and C. cristata alba.—*C. Cúmingii,* Lindl. Fls. white, the disk citron-yellow; sepals and petals lanceolate. Singapore. B.R. 27:29. B.M. 4645.—*C. fràgrans,* Hort. A trade name.—*C. fuliginòsa,* Lindl. Fls. appearing in succession, 2 in. across, light brownish white, the lip fringed. N. India. B.M. 4440. J.F. 1:7.—*C. Garderiàna,* Lindl.=Neogyne.—*C. Lawrencedna,* Rolfe. Fl. single; sepals and petals yellow, 2–2¾ in. long, the sepals lanceolate-oblong, the petals linear; lateral lobes of lip brown, the middle lobe white, the disk marbled with brown. Annam. B.M. 8164. G.C. III. 47:335.—*C. Mooreàna,* Sander. Racemes 4–8-fld.; fls. white; disk golden yellow, covered with clavate processes. Annam. B.M. 8297.—*C. ochràcea,* Lindl. Fls. about 2 in. across, fragrant, white, the lip blotched and streaked orange-yellow. N. India. B.R. 32:69. B.M. 4661. J.F. 4:342.—*C. perakénsis,* Rolfe. Racemes many-fld.; sepals light buff, lanceolate-oblong, about ½ in. long; petals light green, linear, a little shorter than sepals; lip light yellow, with a deep yellow blotch on disk. Perak. B.M. 8203.—*C. præcox,* Lindl., var *dìlba.* A nearly white form.—*C. Sánderæ,* Kränzl. Fls. white; sepals oblong-lanceolate; petals narrower, linear; lip yellow, marked with golden, the keels red-brown. Burma. G.C. III. 13:361.—*C. Veitchii,* Rolfe. Racemes many-fld., pendulous; fls. nearly globose, white, the sepals and petals much incurved; lip longer than sepals, the lateral lobes obtuse, the middle lobe ovate, revolute; disk obscurely 3-keeled. New Guinea. B.M. 7764.—*C. venùsta,* Rolfe. Racemes many-fld., pendulous; fls. pale yellow, the lip white, marked with yellow. S. W. China. B.M. 8262.—*C. virèscens,* Rolfe. Resembling C. Parishii. Fls. pale green with dark dots on the lip. Annam.

GEORGE V. NASH.

COFFÈA (from the Arabian name for the drink, itself conjecturally derived from Caffa, a district in southern Abyssinia). *Rubiàceæ.* Woody plants, producing the coffee of commerce; as a horticultural subject, sometimes cultivated for the ornamental appearance; and also in collections of economic plants.

Shrubs or small trees, natives of Trop. Asia and Afr.: lvs. mostly opposite, rarely in whorls of 3, elliptical, acute, usually coriaceous and glossy: fls. clustered in the axils, cream or cream-white and fragrant; calyx-limb 5-, rarely 4-, parted, the corolla salver-shaped, the corolla-tube cylindrical, the throat sometimes villous; stamens inserted in or below the throat of the corolla: fr. a berry; seeds 2, horny, which are the well-known coffee of commerce.—From 25–40 species, in Trop. Afr. and Asia, the species not yet clearly defined, nor well understood horticulturally.

Coffee-production is based mostly on *C. arabica* and *C. liberica,* both widely cultivated throughout the tropics, and in greenhouses northward. The coffee industry, one of the most important industries in the tropics, reaches the enormous figure of $200,000,000 or sometimes a little more than this. See the treatment in Vol. II Cyclo. Amer. Agri.

The coffee plant and its product. (T. B. McClelland.)

The main source of coffee is *Coffea arabica,* an evergreen shrub, growing 10 to 15 feet high. The younger plants have one main trunk or stem, but from this others frequently develop later, which are similar in form and habit to the first. The lateral branches are opposite, horizontal and in pairs, very rarely in whorls of three. The pairs of branches are in whorls on the main stem. The leaves, which are opposite and borne in pairs, are 4 to 7 centimeters (about 1½ to 3 inches) broad by 10 to 20 centimeters (4 to 8 inches) long, the length being usually slightly more than two and a half times the breadth. They are elliptical, acuminate at tip and attenuate at base. There are eight to eleven pairs of main lateral veins. In the axils where the veins join the midrib are small pores, open below and slightly swollen above. The tip of the leaf is frequently curled and is rather abruptly contracted. The margin is entire and wavy. The leaves, which are perennial, are a dark glossy green, and though thin are firm in texture.

There are usually two or three large blossomings and several small ones extending over a period of several months. The pure white and delicately fragrant star-like flowers are borne on very short pedicels in one to four axillary clusters of one to four flowers each. These flower-clusters are subtended by two to four common calyculi. The tube of the corolla is 8 to 10 millimeters (about ⅓ to ⅖ inch) long. Its segments are about 7 millimeters (nearly ⅓ inch) broad by 15 to 18 millimeters (⅗ to ¾ inch) long. The style is 17 to 22 millimeters (⅔ to nearly 1 inch) long. The stigma is two-branched, each branch being 5 millimeters (about ⅕ inch) long. The linear anthers, corresponding in number to the petals, are 9 millimeters long and are supported on filaments 5 to 7 millimeters long. The size varies somewhat with favorable or unfavorable conditions. The short annular calyx with its denticulate limb is so small as almost to escape notice.

Under *Coffea arabica* are included a number of varieties quite distinct in growth and product from the other varieties of the same species, such as Maragogipe, Mocha, Pointed Bourbon (sometimes classified as *C. laurina*) and others.

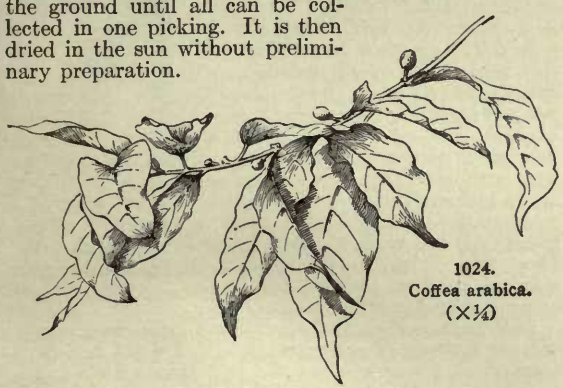
Maragogipe coffee, as its name indicates, is of Brazilian origin, having been discovered in 1870 near the town from which its name is derived. On account of the large size of the bean it has commanded a fancy price on the market, but this variety is considered to be a small yielder. The flowers, fruits, and leaves are all larger than the ordinary Arabian coffee and the

leaves curl noticeably. Its flavor is not considered superior to that of the ordinary Arabian coffee.

Mocha coffee, with its shorter internodes and smaller flowers, fruits, and leaves is a distinct variety. The "beans" are much less oval and are more rounded and hold a high reputation for quality.

Normally two coffee "beans" or seeds are produced in each red cherry-like drupe. Some drupes, however, contain three beans and others only one. When only one is formed it is called "peaberry," and is oval in shape instead of being flat on one side and convex on the other as is the bean when two are produced. The peaberries are sorted out by machinery and are sold at a fancy price on account of being a little different in appearance from the other coffee, but any claim to superiority of flavor is without foundation. There is one variety of coffee that produces a number of beans in each drupe, and the corolla-segments may range up to ten. As the number of beans increases, the size and the attractiveness of appearance decrease, so that this is a very undesirable variation.

The fruits require six and one-half to seven months to mature. The ripening of the coffee, in relation to the blossoming, extends over several months. Where the West Indian or wet process for curing the coffee is followed, the ripe cherries are picked every fortnight. While fresh they are passed through a machine which pulps and separates the coffee in its parchment from the pulp. The former is then fermented and washed to remove a slimy covering. After thorough drying in the sun or in heated driers, the parchment coffee may be stored or it may have the thin brittle parchment or horn-skin and the silver-skin removed by special machinery. If desired it may be further polished and artificially colored. After being sized and having the better grades cleaned of inferior beans, it is ready for roasting. In some places where the dry or old preparation is followed the coffee is allowed to ripen and much of it to fall from the trees and lie on the ground until all can be collected in one picking. It is then dried in the sun without preliminary preparation.



1024. Coffea arabica. (×¼)

Although coffee has been used as a beverage for hundreds of years by a few persons, as a world beverage it is comparatively modern. In 1825 the estimated production did not exceed 218,255,400 pounds. In 1906–1907 the production was estimated as 3,164,041,920 pounds, or an increase of 1,350 per cent in eighty-one years.

Brazil produces about three-fourths of the world's coffee crop. Then follow in order of importance Venezuela, Colombia, Guatemala, Mexico, Haiti, Salvador, Dutch East Indies, Porto Rico, British India, Costa Rica, Nicaragua, and other countries.

In Bulletin No. 79, Bureau of Statistics, United States Department of Agriculture, may be found a very extensive bibliography of coffee. In the Netherlands the per capita consumption is more than 15 pounds; in the United States under 11½ pounds; in Japan .003 pound.

A. *Corolla 5-parted, sometimes 4-parted.*

B. *Segms. of corolla narrow: lvs. oblong, 4–5 in. long, 1½ in. wide.*

arábica, Linn. Common or Arabian Coffee. Fig. 1024. Lvs. 3–6 in. long, rather thin, oblong, nearly 3 times as long as broad, more or less abruptly contracted near the apex to a point about ½in. long: segms. of corolla over twice as long as wide: fr. a 2-seeded, deep crimson berry, but the "berries" or beans of commerce are the seeds. The commercial varieties of coffee are based largely on the size, shape, color and flavor of the seeds, and hence the fr. is very variable, but the typical fr. may be considered to be oval and ½in. long. Indigenous in Abyssinia, Mozambique and Angola; supposed to have been intro. in early Mohammedan times from Abyssinia to Arabia, whence it became known to Europeans in the 16th century. This species furnished until recently the entire commercial product. B.M. 1303. Gng. 6:55.—A variegated form, var. **variegàta,** Hort., is more showy than the type. It is offered by dealers in tropical plants. As coffee grows wild in Afr. it is a small tree 10–15 ft. high, with the trunk 9–12 in. thick at the base. Often cult. under glass in the N. for its economic interest, and in S. Calif. it is a good outdoor ornamental shrub, esteemed for its shining lvs., fragrant white fls., and red berries.

BB. *Segms. of corolla wide: lvs. ovate.*

bengalénsis, Roxbg. Bengal Coffee. Lvs. ovate, barely twice as long as broad, acute, but not having a long, abrupt point: fls. in 2's or 3's; segms. of corolla barely twice as long as wide. E. Indies, Malaya. B.M. 4917.—This has much showier fls. than *C. arabica.* A small shrub with glabrous, dichotomous branches. Mts. of N. E. India, whence it was brought to Calcutta and much cult. for a time. It is now neglected, the berries being of inferior quality and the plants not productive enough.

AA. *Corolla 6-, 7-, or 8-parted.*

B. *Fls. in dense clusters or glomes: lvs. short-pointed.*

libèrica, Hiern. Liberian Coffee. Lvs. longer than in *C. arabica,* and wider above the middle, with a proportionately shorter and less abruptly contracted point: fls. 15 or more in a dense cluster; corolla-segms. usually 7. Trop. Afr. Trans. Linn. Soc. II. 1:171 (1876). G.C. II. 6:105. R.H. 1890, pp. 104–5.—Said to be more robust and productive than *C. arabica,* with berries larger and of finer flavor. It is a more tropical plant than the common coffee, and can be grown at lower levels.

Zanguebàriæ, Lour. (*C. zanzibarénsis,* Hort.). A glabrous, erect, closely branched shrub or small tree, to 6 ft., the branches ashy: lvs. ovate or obovate, obtuse or shortly pointed, 2–4 in. long, ¾–1½ in. wide, the lateral veins about 6 pairs: fls. white, axillary, in dense clusters; corolla-lobes 6–7: berry red, turning black.

BB. *Fls. solitary or in 3's: lvs. long-pointed, 2½–5 in. long.*

stenophýlla, Don. Lvs. 4–6 in. long, 1–1½ in. broad, narrower than in *C. arabica,* with a relatively longer and more tapering point: corolla-segms. usually 9. W. Afr. B.M. 7475.—This is said to yield berries of finer flavor than the Liberian coffee, and quite as freely, but the bush is longer in coming into bearing. This is a promising rival to the *C. arabica* of commerce. Seeds have been distributed by British botanical gardens, but are not known to be for sale at present in Amer.

C. madagascariénsis, Hort., and *C. robústa,* Hort., are names of uncertain status.

Wilhelm Miller.
N. Taylor.†

COFFEE: *Coffea.*

COFFEE BERRY. A name of *Glycine hispida,* which should be abandoned in favor of soybean. Various leguminous seeds are used as coffee substitutes and are so named; cf. *Cassia, Canavalia* and others.

COFFEE PEA. A western name for chick pea, *Cicer arietinum*, which is used as a substitute for coffee.

COFFEE-TREE: *Gymnocladus.*

COHOSH: *Actæa.* The blue cohosh is *Caulophyllum.*

COHUNE: *Attalea Cohune;* it is a source of oil.

COIR: Fiber of coconut, which see.

CÒIX (an old Greek name). *Gramineæ.* Tall, broad-leaved, branched grasses with bead-like inflorescence, one of them grown in gardens.

Plant loose-growing: at the end of each peduncle is an indurated, globular, or oval, hollow bead, developed from a lf.-sheath; from an orifice at the tip projects the staminate spike: pistillate fls. inclosed in the bead, the styles projecting.—Species about 3, E. Indies, the following widely distributed in all tropical countries.

Lácryma-Jòbi, Linn. JOB'S TEARS. Fig. 1025. Annual, 2–4 ft.: the beads or "tears," pearly white to lead-color, containing the seed, are about ½in. long. Dept. Agric., Div. Agrost., 20:14.—Cult. for ornament and as a curiosity. The hard bony frs. are used as beads and made into necklaces, to which are attributed marvelous properties. Var. **aûrea zebrîna,** has yellow-striped blades. A. S. HITCHCOCK.

CÒLA (native name). *Sterculiàceæ.* COLA. Also called Kola, Korra, Gorra. One species is much grown in the tropics for the stimulating cola nut.

The genus consists entirely of plants with unisexual or polygamous fls. in axillary or terminal clusters: calyx 4–5-cleft; petals none: fr. of 4–5 leathery or woody oblong carpels.—Probably about 40 species, of Trop. Afr. trees chiefly interesting for the cola nuts, which are said to sustain the natives in great feats of endurance. The tree grows on the east coast of Afr., but is very abundant on the west coast, and is now cult. in the W. Indies. Within the tropics the trade in this nut is said to be immense. It has become famous in the U. S. through many preparations for medicinal purposes and summer drinks. The seeds are about the size and appearance of a horse-chestnut, and have a bitter taste. Although repeatedly intro. to Kew, England, the plant never flowered there until 1868.

Colas require a rich, well-drained soil. Those introduced into the West Indies and other parts of America, especially *C. acuminata,* thrive best on a sandy loam. The trees are grown from seeds, which are large and fleshy, keeping well for some weeks after ripening. As the tree is difficult to transplant, the seeds may be planted singly in small pots, and the young trees kept growing thus until wanted for permanent planting. Propagation may also be effected by cuttings of ripe wood, which should be placed in bottom heat, and treated in the usual way. (E. N. Reasoner.)

acuminàta, Schott & Endl. About 40 ft. high in Afr., resembling an apple tree: lvs. alternate; petiole 1–3 in. long; blade 4–6 in. long, 1–2 in. broad, leathery, with prominent ribs below; older lvs. entire, obovate, acute; younger lvs. often once or twice cut near the base about half way to the midrib: fls. yellow, 15 or more in axillary and terminal panicles, about ½in. across, with a slender green tube and a showy yellow 6- or 5-cut limb, which is a part of the calyx: fr. 5–6 in. long. B.M. 5699. N. TAYLOR.†

CÒLAX (Greek, *parasite*). *Orchidàceæ.* Epiphytic orchids, much like Lycaste.

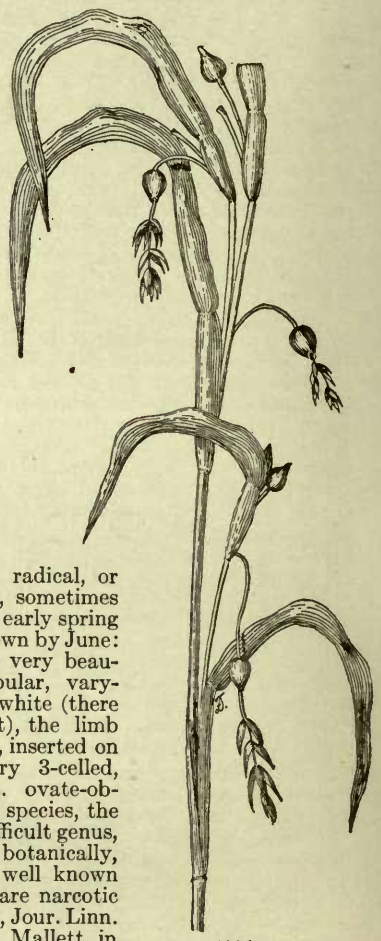
Pseudobulbous: fls. in an upright raceme, arising from the base of the new shoot; sepals and petals similar, the lateral sepal forming a distinct foot with the base of the column; lip 3-lobed, clawed, with a transverse hairy process; pollinia 4.—A Brazilian genus of 2 species.

jugòsus, Lindl. (*Maxillària jugòsa,* Lindl. *Lycáste jugòsa,* Benth.). Pseudobulbs ovoid, 2–3 in. long, 2-lvd.: lvs. 5–9 in. long, lanceolate: raceme 2–3-fld.; fls. 2–3 in. across; sepals white, obtuse, oval-oblong; petals white, obovate-oblong, spotted and barred with violet-purple; lip white, shorter than petals, the side lobes streaked violet-purple, the middle lobe semi-circular, with numerous pubescent keels, streaked and blotched violet-purple. B.M. 5661. I.H. 19:96.

C. trípterus, Rolfe. Ovary 3-winged; disk of lip bearing a broad fleshy callus. Brazil.

GEORGE V. NASH.

CÓLCHICUM (from Colchis, a country in Asia Minor, where the genus is most plentiful). *Liliàceæ.* MEADOW SAFFRON. AUTUMN CROCUS. Autumn flowering, rarely spring-flowering, bulbous plants with crocus-like blossoms.



1025. Coix Lacryma-Jobi. (×½)

Leaves either all radical, or radical and cauline, sometimes ciliate, appearing in early spring and usually dying down by June: fls. various colored, very beautiful; perianth tubular, varying from purple to white (there is 1 yellow-fld. sort), the limb 6-parted; stamens 6, inserted on the perianth; ovary 3-celled, many-ovuled: caps. ovate-oblong in most of the species, the seeds globose.—A difficult genus, very much confused botanically, but horticulturally well known and popular. They are narcotic poisons. J. G. Baker, Jour. Linn. Soc. 17. 1880. G. B. Mallett, in Flora and Sylva, 1:108, 1903, has an excellent horticultural account of the genus.

Colchicums are most charming and interesting plants of easy culture. The bloom comes in August and September, at a season when the herbaceous beds begin to lose their freshness, and, although individual flowers are fugacious, others follow in quick succession, thus prolonging the time of flowering. Opening, as they do, without foliage, some help is required from the greenery of other plants; for this purpose any low-growing, not too dense kind, may be used, such as the dwarf artemisias, sedums, or *Phlox subulata.* Colchicums are most effective in masses, which can be established by thick planting, or as the result of many years' growth. They can be grown in rockwork, in beds, or in grass which is not too thick nor too often mown; they will thrive in partial shade, but succeed best in an open sunny border. They should be planted in August or early September, in deep well-enriched soil, a light sandy loam, with the tip of the long bulbs 2 to 3 inches below the surface; some protection should be given in winter. They remain in good condition for many years, and should not be disturbed unless they show signs of deterioration, fewer flowers and poor foliage. Then

they should be lifted and separated, just after the leaves die, end of June or early July. This is the usual method of propagation, but they can also be increased from seeds, sown just after ripening, June to July; the seedlings may not appear until the following spring. Seedlings bloom when three to five years old. The bulbs are obtainable from the Dutch growers at moderate prices, and they must be imported early; otherwise they are apt to bloom in the cases. *C. autumnale*, with rosy purple flowers, is a well-known and the most commonly cultivated species. There are numerous varieties, of which the best are the white, the double white and the double purple. Belonging to this same group and not differing much except in size and shading of the flower, are *C. byzantinum*, *C. montanum*, and *C. umbrosum*. *C. speciosum*, a native of the Caucasus, is the finest in every way of the genus. The flowers are much larger and of better shape, and the color, a rosy pink, is much more delicate; the habit of growth is robust, and the plant is most easily handled. *C. Parkinsonii* is distinct from the above varieties inasmuch as the flowers are tessellated, purple and white, giving a curious checker-board appearance which is unique; the leaves are much smaller and are wavy. *C. agrippinum*, *C. Bivonæ*, *C. cilicicum* and *C. Sibthorpii*, are other species having checkered flowers more or less similar to *C. Parkinsonii*. *C. Bulbocodium*=*Bulbocodium vernum*. Monograph by J. G. Baker in Jour. Linn. Soc., vol. 17 (1880). (B. M. Watson.)

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A. *Blooming in spring: lvs. appearing with the fls.*

B. *Color rosy lilac: size of anthers small.*

C. *Anthers oblong, purple.*

1. **montânum,** Linn. (*C. Bertolònii*, Stev.). An important and variable species, with many synonyms and variations. Baker makes 7 forms. Corm ovoid, ½–1 in. thick, the tunics brown, membrananceous, the inner ones produced to a point 2–4 in. above the neck: lvs. 2–3, rarely 4–6, linear or lanceolate, about 2–3 in. long at the time of flowering, finally 6–9 in. long: fls. 1–4, in spring and autumn. Oct.–June. Medit. region, from Spain to Persia. B.M. 6443.—It appears in early spring with the snowdrops and crocuses.

2. **crociflòrum,** Regel, not Sims nor Schott & Kotschy. Corm ovate-oblong: lvs. all radical, sheathing at the base, a few sometimes on the st., flat and linear, margins minutely and usually distantly toothed: corolla white, with violet-purple stripes, especially within, the tube about 2 in. long, the limb scarcely 1–1⅓ in. long; style exceeding the stamens. Feb., March. Cent. Asia.

CC. *Anthers linear, yellow.*

3. **Stèvenii,** Kunth. Corm narrower than in No. 1, about ½–¾ in. thick: lvs. at length 4–5 in. long: fls. Oct.–Jan. Syria, Arabia, Persia.—Less popular than No. 1.

BB. *Color yellow: size of anthers large.*

4. **lùteum,** Baker. This is the only yellow-fld. form in the genus, all the others ranging from purple to white. Although it belongs to the Medit. group, with lvs. and fls. produced at the same time and in spring, it is a native of W. India at an elevation of 7,000–8,000 ft. Corm tunics dark brown, sometimes almost black: lvs. 3 or 4, wider and less tapering than in No. 1, at the time of flowering 3–4 in. long, finally 6–7 in. long. B.M. 6153.—Very desirable.

AA. *Blooming in autumn: lvs. appearing after the fls.*

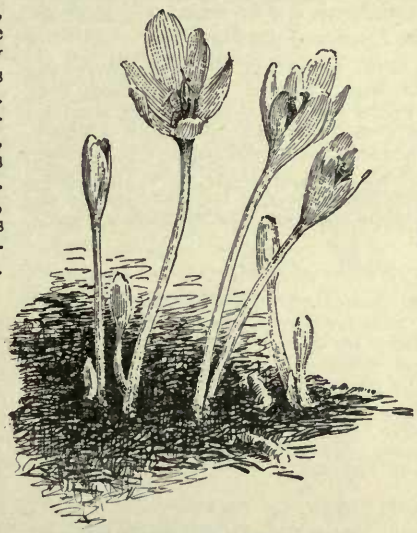
B. *Perianth tessellated or checkered.*

C. *Tessellation distinct.*

D. *Lvs. spreading or prostrate.*

5. **variegàtum,** Linn. Lvs. 2–3, lanceolate, about 6 in. long, 12–15 lines wide, lying flat on the ground; margins wavy: fls. 2–3 from each spathe, 4 in. across, rose-color with a white tube. Isls. of the Levant and Asia Minor. B.M. 1028. Variable. The plant known as *C. chionense* is apparently a form of it. Corm size of walnut.

6. **Pârkinsonii,** Hook. f. (B.M. 6090) (*C. tessellàtum*, Authors), is the best of all the tessellated forms, the tessellation being more sharply defined and more delicate than the type. It is a smaller plant, and has shorter and more strongly undulated lvs., which lie closer to the ground. Of this plant Parkinson said in his "Paradisus Terrestris," 1629: "This most beautifull saffron flower riseth up with his flowers in the Autumne, as the others before specified doe, although not of so large a size, yet farre more pleasant and delightfull in the thicke, deep blew, or purple coloured beautifull spots therein, which make it excell all others whatsoever: the leaves rise up in the Spring, being smaller then the former, for the most part 3 in number, and of a paler or fresher green color, lying close upon the ground, broad at the bottome, a little pointed at the end, and twining or folding themselves in and out at the edges, as if they were indented. I have not seen any seede it hath borne: the root is like unto the others of this kinde, but small and long, and not so great: it flowereth later for the most part then any of the other, even not untill November, and is very hard to be preserved with us, in that for the most part the roote waxeth lesse and lesse every yeare, our cold Country being so contrary unto his naturall, that it will scarce shew his flower; yet when it flowereth any thing early, that it may have any comfort of a warm Sunne, it is the glory of all these kindes."



1026. Colchicum autumnale. (×⅓)

DD. *Lvs. ascending.*

E. *Margin of lvs. wavy.*

7. **agrippìnum,** Baker (*C. tessellàtum*, Hort.). Corms a trifle thicker than in No. 5: lvs. 3–4, 6–9 in. long, 12–15 lines wide, margin wavy: fls. 2–4 from each spathe. F.S. 11:1153.—This is a marked form of *C. variegatum*, of garden origin, which has similar fls., but a more robust habit and more nearly erect lvs.

EE. *Margin of lvs. flat, not wavy.*

8. **Bivònæ,** Guss. Lvs. 6–9, nearly 1 ft. long, 9–15 lines wide, rather hooded at the apex, margin flat, not wavy: fls. 1–6 from each spathe, rose-purple faintly checkered with a darker color, 4–6 in. long. Medit. region. Var. **supérbum,** Hort., an excellent form, is advertised in English catalogues. F.S.R. 1:108.

CC. *Tessellation less distinct.*

9. **Sibthorpii,** Baker. Easily distinguished from Nos. 5, 7, and 8 by the much broader segms. of the perianth, and by the lvs., which are nearly erect, obtuse, and not at all wavy: lvs. 5–6, dull green, finally 1 ft. or more long, 1½–2½ in. wide, narrowed gradually to the base: spathe striped with green, and tinged with lilac at the tip: fls. 1–5 from each spathe; perianth-tube often 6 in. long. Mts. of Greece. B.M. 7181. F.S.R. 1:108. —A large, cup-shaped fl., showing no open spaces between the broad, overlapping segms. Very handsome.

BB. *Perianth not tessellated.*

C. *Size of fls. large, 3 in. or more across.*

D. *Lvs. broad, 3–4 in. wide.*

E. *Number of fls. 1–4.*

10. **speciòsum,** Stev. Corm 2 in. thick, the largest of the genus: st. 1 ft. high: lvs. 4–5, 12–15 in. long, 3–4 in. wide, narowed from the middle to the base, shining green: fls. 1–4 from each spathe, violet, with a white eye, but varying almost to pure pink, often 6 in. across. Caucasus. B.M. 6078. F.S. 23:2385. F.M. 1876:235. Gn. 11:80.—Commonly considered the finest species of the genus; blooms Sept. and Oct. Var. **máximum,** Hort. Plant 7½ in. high.

EE. *Number of fls. 12–20.*

11. **byzantînum,** Ker-Gawl. Closely allied to the above, but with wider lvs., smaller and paler fls., and broad, short anthers: st. 6 in. high: lvs. 5–6, oblong, dark green, striate, 9–12 in. long, 3–4 in. wide: fls. smaller than in No. 10, usually 3–4 in. across, lilac-purple, and often 12–20 from each spathe. Transylvania and Constantinople. B.M. 1122.—Corn large, depressed. *C. cilicicum,* Hort., has rosy fls., somewhat tessellated. G.C. III. 23:35.

DD. *Lvs. narrow, 1–2 in. wide.*

12. **Bornmùelleri,** Freyn. Lvs. elliptic-lanceolate, 3–4 in. long, 1–2 in. broad: fls. 8 in. long and 5 in. across, the limb pale rose or lilac-rose at first, subsequently deeper purple, the corolla-tube white. Asia Minor. Early spring.—One of the rarest and finest of the group, suitable for the rock-garden.

13. **autumnàle,** Linn. Fig. 1026; 442, p. 433. St. 3–4 in. high: lvs. 3–4, rarely 5–6, 9–12 in. long, 1½–2 in. wide: fls. 1–4, rarely 5–6, from each spathe, purple, with a white variety, about 4 in. across; perianth veined. Eu. and N. Afr. B.M. 2673 (as *C. crociflorum*). —Possibly the commonest in the American trade. It has beautiful double forms in purple and pure white. F.S. 19:1936.

14. **Decàisnei,** Boiss. Corm ovate, membranaceous: lower lvs. broadly lanceolate, the upper ones narrower and acutish, entire, 1–1½ in. broad: fls. pale-rose, or flesh-colored, the tube elongate-elliptic, the stamens a little shorter than the perianth; anthers yellow, linear; style only slightly exceeding the stamens. N. Afr. and the eastern Medit. region. Nov.–Jan.—Planted in masses with *C. crociflorum* for rock-gardens, it is very effective.

CC. *Size of fls. small, about 2 in. across.*

D. *Number of fls. from each spathe more than 1 or 2.*

E. *Perianth-segms. acute.*

15. **Troòdii,** Kotschy. Corm medium-sized: lvs. 3–4, 6–12 in. long, 9–12 lines wide, dark green above: fls. 4–5 or even 12, lilac-purple, about 2 in. across; perianth segms. lanceolate-acute. Cyprus. B.M. 6901 shows a pure white variety.

16. **fasciculàre,** Boiss. Corm oblong: lvs. 5–7, broadly lanceolate, channeled, the apex acutish, frequently ciliate, about 1 in. wide: fls. many, in clusters, the corolla 2½ in. long, white, 6–10-nerved; stamens equaling the corolla, but slightly exceeded by the style branches. Feb. Syria.

EE. *Perianth-segms. obtuse.*

17. **umbròsum,** Stev. Corm small: lvs. 4–5, 6–9 in. long, 9–12 lines wide: fls. 1–5 from each spathe, lilac, about 2 in. across; perianth-segms. oblanceolate, obtuse, with 8–12 veins. Caucasus.

DD. *Number of fls. from each spathe 1 or 2.*

18. **alpìnum,** DC. (*C. montànum,* All. not Linn.). Lvs. 2, rarely 3, nearly erect or spreading, 4–8 in. long, 3–6 lines wide, obtuse, channeled, shining green, narrowed from the middle to the base: fls. 1 or 2 from each spathe, about 2 in. across, lilac; segms. oblanceolate, obtuse, 3–4 lines wide, with 10–15 veins. Mts. of France and Switzerland.

C. gigantèum, Hort. A plant with magnificent pink fls.—Is not certainly referable to any species. The name appears in several catalogues, but is unknown in botanical literature. See F.S.R. 1:108.—*C. hydrophilum,* Hort. An early spring-flowering species; bulb size of a walnut: lvs. and fls. appearing together, the fls. bright clear rose and taller than the lvs., the latter growing after the fls. are gone and attaining a length of 6 in.; fls. in clusters of 3–15; stamens half as long as the segms. Taurus Mts. G.C. III. 29:102.—*C. sieheànum,* Hort. A late autumn-flowering species with rich reddish purple fls. Asia Minor.—*C. veratrifòlium,* Hort. Similar to some of the forms of C. speciosum, but earlier in flowering.

WILHELM MILLER.
N. TAYLOR.†

COLDFRAME. An unheated covered frame (see *Frame*) used (1) for the starting of plants in spring in advance of settled weather but not so early as in a hotbed; (2) for receiving plants from a hotbed or greenhouse, holding them as an intermediate station until they may go in the field; (3) carrying hardy plants over winter, as spinach, lettuce; (4) providing a general store-place for hardy or semi-hardy stuff from greenhouse and garden; (5) affording a propagating-bed in spring and summer for seeds or cuttings. Usually the coldframe is topped with glass, as is the hotbed, but prepared paper or cloth is sometimes used. Coldframes are usually of temporary construction. L. H. B.

COLD-STORAGE, REFRIGERATION, RETARDING. Dealers in bulbs, cut-flowers, nursery stock, fruits and vegetables employ cold-storage to retard the growth of bulbs and plants, or to preserve cut-flowers and produce, by using specially constructed sheds, refrigerators, ice-boxes, or the public cold-storage warehouses. The nursery stock thus stored can be packed and shipped from the cold to warmer parts of the country in good season for planting, when it would be impossible to dig and ship such stock without the storage system. Sheds for the storage of nursery stock have earthen floors, are ventilated and lighted from the ridge-and-furrow roof and heated to exclude frost, the maximum temperature being 35° to 40.° Large trees are stood upright, the smaller stock usually laid lengthwise in compartments. The roots are covered with sphagnum, or a mixture of sphagnum and excelsior or cedar shingletow; the shingletow or excelsior alone will not make good covering for this purpose. See *Nursery.*

The roots and bulbs commonly placed in cold-storage are those used by florists for forcing, such as lily bulbs, lily-of-the-valley pips, and the like. By placing these in cold-storage, growers can secure a continuous succession of bloom throughout the year. Lily bulbs are stored in the original cases packed in soil, the cases being cleated to provide circulation of air, and held at 34°. The *multiflorum* and *formosum* varieties of *Lilium longiflorum* can be held in storage three to four months, and the *giganteum* type of this lily ten to eleven months, *L. auratum* four months, *L. speciosum* and varieties eight months. The sizes (circumference) of storage lily bulbs and number of bulbs to the case are as follows:

L. longiflorum and its varieties *multiflorum*, *formosum* and *giganteum*, 6- to 8-inch, 400; 7- to 9-inch, 300; 9- to 11-inch, 200; in *L. longiflorum giganteum* there is an 8- to 10-inch size which runs 225 to the case; *L. auratum* 8- to 9-inch, 160; 9- to 11-inch, 100; 11- to 13-inch, 75; *L. speciosum*, 8- to 9-inch, 200; 9- to 11-inch, 100; 11- to 13-inch, 75. Lily-of-the-valley pips are packed in a mixture of sphagnum and sand, one-fourth of the latter being used to three-fourths of the moss and held at 28.° These are packed 500, 1,000 and 2,000 to the case and can be kept in storage eleven months. Canna roots, dahlias and gladioli should be held at 35° to 40.°



1027. Coleus cutting.

Cut-flowers, such as roses, carnations, orchids, violets, and lilies, used by florists, are preserved for varying periods in ice-boxes or refrigerators, the usual temperature being 35° to 40.° Peonies cut when the buds show color, leaves removed from the lower part of the stem, wrapped in paper, and the lower bare portions of the stems placed in water, will keep several weeks at a temperature of 32° to 33.° *Lilium candidum* in bud can be treated the same way.

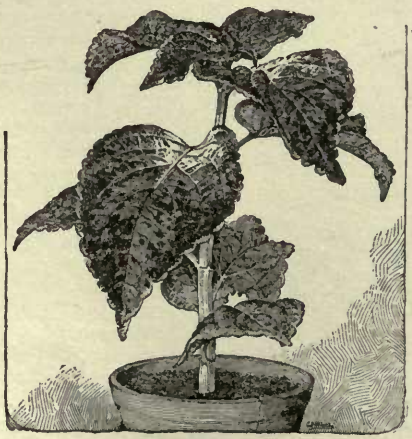
Fruits and vegetables are stored at 33° to 35.° Warehousemen say that cold-storage merchandise keeps best and is easiest to handle in packages containing about a bushel. See *Storage*. MICHAEL BARKER.

COLE. A generic name, little known in North America, for plants of the cabbage tribe; cole-oil is secured from species of Brassica.

CÒLEA (Sir G. Lowry Cole, Governor of Mauritius). *Bignoniàceæ*. Glabrous evergreen trees or shrubs of Madagascar, Mauritius and the Seychelles, members of which may occur in collections of warmhouse (or stove) plants. Lvs. opposite or verticillate, pinnate, with many entire lfts.: fls. medium-sized, yellow, white or rose-color in lax or dense cymes or fascicles; corolla funnelform, somewhat bilabiate, with 5 rounded spreading lobes; perfect stamens 4, didynamous.—Probably 15 species, but little known in cult. They thrive in a fibrous earth and prop. by means of mature shoots in sand over bottom-heat.

CÒLEUS (Greek for *sheath*, referring to the monadelphous stamens). *Labiàtæ*. Common window-garden and greenhouse showy-leaved herbs, and a few less known species grown for the handsome flowers.

Herbs or small shrubs, annual or perennial, upright: lvs. opposite, dentate or serrate, petioled or sessile: st. 4-angled: fls. mostly blue or lilac, in terminal spike-like racemes, small and middle-sized and usually bluish, the 5-toothed calyx deflexed in fr.; corolla bilabiate, the lower lobes longer and concave, and inclosing the essential organs; stamens 4, didynamous and declinate, the filaments united into a tube, the anther-cells confluent; ovary 4-parted, subtended by a gland-like disk, the style 2-lobed.—Probably 150 species, in the tropics of the eastern hemisphere, being especially abundant in Afr., E. India and adjacent isls. Some species produce tubers that are eaten in the same way as potatoes.



1029. A good young coleus plant.

The common coleuses are of the most easy culture. They root readily from short cuttings, cut either to a joint or in the middle of an internode (Fig. 1027). Few conservatory plants are more ready to root than this. They may be rooted at any time of the year when new wood is to be secured. Formerly coleuses were much used for bedding, but the introduction of better plants for this purpose has lessened their popularity. They require a long season; they are likely to burn in the hot summers of the interior country; they have a weedy habit. However, they withstand shearing and therefore are useful for carpet-bedding. The leading variety for this purpose is still the old Golden Bedder, whose golden yellow foliage is used as filling for fancy designs.—Coleus plants make excellent specimens for the window-garden and conservatory. Best results are secured when new plants are started from cuttings each spring. They also grow readily from seeds, many interesting leaf-forms and colors arising. The old plants become leggy, lose their leaves, and lack brightness of color. They are very subject to mealy-bug. They are also liable to root-gall (the work of a nematode worm), as shown in Fig. 1028. When plants are thus affected, take cuttings and burn the old plants, and either bake or freeze the earth in which they grew.



A. *Common garden coleus, with red, purple, yellow, green and variegated foliage.*

1028. A coleus attacked by root-galls.

Blùmei, Benth. (*C. Verschaffèltii*, Lem. *C. scutellarioìdes* var. *Blùmei*, Miq.). This species, founded on cult. plants in Java, is probably to be regarded, as now understood, as an assemblage or combination of species. The horticultural forms are perhaps derived in part (as suggested by Briquet and by Koorders) from *C. laciniatus*, *C. bicolor*, and others; and perhaps they are to be considered also in connection with *C. atropurpureus*, Benth., of Malaysia, and its relatives. The entire garden material needs to be worked over in comparison with authentic native oriental specimens. Portraits of *C. Blumei* of botanical interest are: B.M. 4754. I.H. 27:3–7; 35: 46; 39:164. F.S. 22:228778. A soft perennial herb or sub-shrub, growing 2–3 ft. high, little branched: lvs. ovate, narrowed or broad at base and long-acuminate, sharply and nearly regularly toothed, variously colored with yellow, dull red and purplish. An extreme form of this is var. **Verschaffèltii**, Lem., Fig. 1030, which is more robust and branchy, the lvs. more brilliantly colored, acute but not acuminate, truncate or even cordate at base, and irregularly cut-dentate, with rounded teeth, giving the margin a crispy effect (I. H. 8:293). In some forms, the lvs. are laciniate.

AA. *Other species of Coleus, now and then in cult. (Still other species may be expected to appear in the trade.)*

thyrsoídeus, Baker. Tender shrub, 2–3 ft. high: sts. pubescent: lvs. cordate-acuminate, coarsely crenate, lower ones 7 in. long: fls. bright blue, in racemes which contain as many as 18 forking cymes with about 10 fls. in each. Cent. Afr. B.M. 7672.—Considered to have much merit for cult., either under glass, or in the open far S. Winter.

shirénsis, Baker. Perennial herb, densely pubescent, 3 ft., much like the above in habit: sts. angular, pale green turning to brown: lvs. glandular, pungently aromatic, broadly ovate, acuminate, membranous, 2–3 in. long, deeply crenate, pubescent beneath but scantily so above: fls. dark blue (also described as light blue), in large erect terminal panicles. Cent. Afr. B.M. 8024.—Winter.

Mahónii, Baker. Shrub, to 2 ft., pubescent, the branchlets slender: lvs. petioled, ovate, acute, 2–3 in. long, crenate, membranous, pale and finely pubescent beneath and green and nearly glabrous above: fls. small, purple with golden anthers, in a large graceful panicle. Cent. Afr.—Winter.

Pénzigii, Damm. Soft perennial herb, white-hairy: lvs. ovate, membranous, narrowed abruptly at base, crenate; petiole winged: fls. bright lilac (also described as ashy blue) in a long and lax racemose panicle, the whorls being about 8-fld. Nile Land. L. H. B.

COLIC-ROOT: *Aletris farinosa.*

COLLÀBIUM (*neck* and *lip*, referring to a peculiarity of the fl.). *Orchidàceæ.* Two terrestrial orchids, of Java and Borneo, rarely cult., requiring the treatment given Catasetum. Lf. single, plicate: fls. or clusters racemose, on a tall scape; lateral petals attached to the foot or base of the incurved column; lip at its base encircling the column (whence the generic name); pollinia 2. *C. nebulòsum,* Blume. Sts. fleshy, about 2 in. long: lf. broadly ovate, acuminate, the petiole rounded: scape about 2 ft., erect; fls. numerous in scattered clusters or whorls, spurred, about ½in. long, the lip 3-lobed, white and a little fringed, the sepals and



1030. Coleus Blumei var. Verschaffeltii.

petals greenish with reddish margins. Java. *C. símplex,* Reichb. Lf. oblong, acute, wavy, green with darker blotches: fls. racemose at the apex of the scape; lip white; sepals and petals greenish yellow with purple and brown blotches. Borneo.

COLLARDS. A kind of kale. Probably several somewhat different plants pass as collards, the characteristic being that they produce tufts or rosettes of leaves that are removed and used as greens. Usually referred to *Brassica oleracea* var. *acephala.* See *Brassica.*

In the South, a form of the plant known as Georgia collards is much grown for domestic use and the southern market. The plant grows 2 to 4 feet high and forms no head, but the central leaves often form a kind of loose rosette. These tender leaves are eaten as a potherb, as all other kales are. Fig. 1031, shows a Georgia collard, with a heavy crown. The seeds of collard may be started in a frame under glass, or in a seed-bed in the open. As far south as the orange-belt, they are usually started in February and March, in order that the plants may mature before the dry, hot weather. Farther north they are started in July or August and the plants are ready for use before cold weather. Transplant to rows 3½ to 4 feet apart, and 3 feet apart in the row. Till as for cabbage.



1031. Collards.

Young cabbage plants are sometimes eaten as "greens" under the name of collards; and cabbage seeds are sown for this specific purpose. In the North, where heading cabbages can be raised, collards of whatever kind are not greatly prized. L. H. B.

COLLÈTIA (Philibert Collet, 1643–1718, French botanist). *Rhamnàceæ.* Odd spiny shrubs grown under glass, and in the open in California and other warm regions.

Leaves small and simple (or wanting), opposite: branches short, often flattened, arranged in opposite pairs, thickened, spiny (sometimes called lvs.): fls. small, perfect, yellowish or white, nodding on 1-fld. pedicels, single or fascicled in the axils or beneath the flattened divaricate spines; calyx bell-shaped or tubular, 4–5-parted; petals 4–6 or 0, inserted on the calyx; stamens 4–6; disk joined to calyx-tube, inconspicuous or the margin rolled-in; ovary 3-lobed and 3-celled, standing in the disk, the stigma 3-lobed: fr. a coriaceous dry drupe-like caps.—About a dozen species in S. Amer., mostly in the tropical parts. The colletias are said to start readily from cuttings of half-ripened wood, as well as from seeds. They are to be grown as single or detached specimens, because of their oddity.

cruciàta, Gill. & Hook. (*C. hórrida,* Hort.). Very curious shrub, 3–4 ft., with elliptic flattened very broad-spiny decurrent branches: lvs. few, elliptic, entire: fls. small, white, a few together at the base of the spines, borne profusely in spring. S. Brazil, Uruguay. B.M. 5033.

spinòsa, Lam. Shrub, to 10 ft., with strong awl-shaped very sharp spines: lvs. elliptic, small, sessile, serrate, mostly vanishing at blooming time: fls. larger, urn-shaped, borne singly or nearly so beneath the spines. S. Brazil, Uruguay.

ulícina, Gill. & Hook. Smaller, 3–4 ft.: spines as in *C. spinosa,* but more numerous, thicker, and hairy: fls. cylindrical, in clusters near tops of the branches. Andes of Chile.

Ephédra, Vent. Small stiff bush: branches erect, spiny: lvs. wanting: fls. (in very early spring) sessile at

the nodes, spicate-glomerate; calyx top-shaped, the lobes spreading. Peru, Chile. L.B.C. 19:1830.—Reported as cult. in Calif. L. H. B.

COLLIGUÀYA (Chilean name). *Euphorbiàceæ.* Small trees of the Chilean region, scarcely in cult., although the fragrant wood of some species is used. Seeds of this and related genera which have springing movements, due to contained insect larvæ, are sometimes known as "jumping beans." Juice milky: fls. monœcious, apetalous; calyx imbricate or none in staminate fls.; stamens 1–5; ovary 2–4-celled, cells 1-ovuled. The following may be expected in botanical collections, although probably not in the trade: *C. odorífera,* Molina. Lvs. serrate, ovate to oblong. *C. brasiliénsis,* Klotzsch. Lvs. serrulate, linear-lanceolate. *C. integérrima,* Gill. & Hook. Lvs. linear, entire.

J. B. S. Norton.

COLLÍNSIA (after Zaccheus Collins, American philanthropist and promoter of science, Philadelphia, 1764–1831). *Scrophulariàceæ.* Hardy flower-garden annuals mostly from California and western North America.

Leaves simple, verticillate in 3's, or opposite: fls. in the axils, solitary or in whorls, racemose in some species; calyx bell-shaped; corolla deeply bi-labiate; stamens 4, the fifth rudimentary and glandular.—About 25 species. They are not far removed botanically from Pentstemon and Chelone. From the former, the genus differs in having the fifth sterile stamen reduced to a mere gland.

The collinsias are free-flowering and of the easiest culture. They may be sown outdoors in the fall in well-drained soil, and will bloom earlier than if sown in spring. Their flowers borne in midsummer range in color from white through lilac and rose to violet, with clear, bright blue also, at least on one lip of the flower. There is no yellow.



1032. Collinsia bicolor.

A. *Fl.-stalks very short, giving the clusters a dense appearance.*

B. *Corolla strongly declined; throat as wide as long.*

bícolor, Benth. Fig. 1032. Height 1–2 ft.: hairy, glabrous, or sticky: sts. weak and bending: lvs. more or less toothed, and oblong or lanceolate, sessile, finely toothed, opposite or in 3's: fls. typically purple and white, with 5 or 6 well-marked color varieties. Var. **álba,** Hort. (Fig. 1033), has pure white fls., or the lower lip greenish or yellowish. Var. **multícolor,** Voss (*C. multicolor,* Lindl. & Paxt.), has variegated fls., the same fl. being white, lilac, rose or violet on either lip or both. Var. **multícolor marmoràta,** has the lower lip white, suffused lilac, and upper lip light lilac, spotted and striped carmine. Calif., below 2,000 ft. B.M. 3488. P.M. 3:195. B.R. 1734.—This is the most widely distributed and variable species, and the one on which the genus was founded. Calif., mostly in moist ground.

BB. *Corolla less strongly declined; throat much longer than broad.*

bartsiæfòlia, Benth. Height 1½ ft., the st. usually stiff and simple: sticky and somewhat glandular, rarely hairy: lvs. from ovate-oblong to linear: fl.-whorls 2–5, purplish or whitish: seeds not wrinkled. Calif.

AA. *Fl.-stalks ½in. long or more, giving the clusters a looser look.*

vérna, Nutt. Height about 6 in.: lvs. ovate or oblong, or the lowest rounded and slender-stalked, and the upper ovate-lanceolate and partly clasping: whorls about 6-fld.; fl.-stalks longer than the fls.; throat of the corolla as long as the calyx-lobes; lower lip bright blue; upper lip white or purplish: seeds thick, not flattened, oblong, arched. Moist woods, W. N. Y. and Pa. to Wis. and Ky. B.M. 4927.



1033. Collinsia bicolor var. alba. (×½)

grandiflòra, Douglas. Height 4–12 in.: lvs. thickish, the lowest roundish and stalked: whorls 3–9-fld.; fl.-stalks about as long as the fls.; lower lip deep blue or violet; upper lip white or purple; throat of the corolla sac-like, as broad as long, or as long as the upper lip: seeds roundish, smooth. Shady hills of Calif. B.R. 1107.

Wilhelm Miller.
N. Taylor.†

COLLINSÒNIA (after Peter Collinson, English botanist, correspondent of Linnæus and John Bartram). *Labiàtæ.* Horse-Balm. Horse-Weed. Stone-Root. Native perennial herbs.

Plants of small importance horticulturally, with large, odorous, ovate, serrate, mostly long-stalked lvs., thick roots, and simple or panicled, naked, terminal racemes of yellow or whitish fls.—Three species in E. N. Amer., one of which is sometimes offered by dealers in native plants, but is not especially ornamental. They are of simple cult.

canadénsis, Linn. Citronella. Height 2–4 ft.: lvs. 4–9 in. long, broadly ovate to oblong: racemes panicled; calyx in fl. 1 line, in fr. 4 or 5 lines long; corolla light yellow, lemon-scented, ½in. long. Rich woods, Canada to Wis., Kans., and south to Fla. L. H. B.

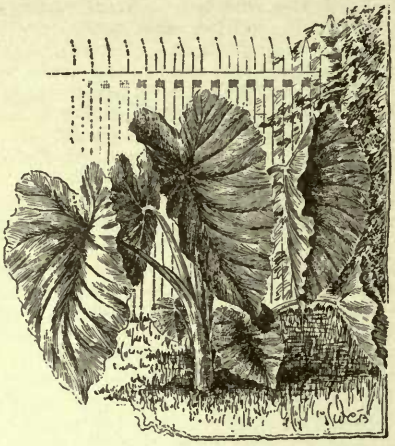
COLLÒMIA (Greek for *glue,* alluding to the mucilaginous character of the wetted seeds). *Polemoniàceæ.* In Asa Gray's late treatment, Collomia is included with Gilia, although at first kept distinct by him (Proc. Amer. Acad. Arts. & Sci. XVII, 223), and this disposition is followed here, particularly since none of the species seems to be known in the trade as Collomia. Engler & Prantl keep the genus distinct, however, ascribing to it eighteen species from western North America and Chile. Such as are cultivated will be found in this Cyclopedia under *Gilia.* The Collomias are annual, biennial and perennial.

COLOCÀSIA (old Greek substantive name). *Aràceæ.* Perennial herbs with cordate-peltate leaves, which are often handsomely colored in cultivation; grown under glass, and one of the forms much used for planting out when large-leaved tropical effects are desired; also grown for the edible tubers.

Plants tuberous or with an erect caudex: lf.-blades peltate, ovate or sagittate-cordate, basal lobes rounded: blade of spathe 2–5 times longer than tube; spadix shorter than spathe, terminating in a club-shaped or subulate appendage destitute of stamens. Differs from Alocasia and Caladium in floral characters—Species 5. Tropics.

Colocasia includes the plants known as *Caladium esculentum,* which are much grown for subtropical bedding. *C. odorata* (which is an Alocasia) has very large,

thick stems, which may be wintered over safely without leaves, or at most with one or two, the stems, to save space, being placed close together in boxes. *C. esculenta* rests during the winter and is kept under a greenhouse bench or anywhere out of the reach of frost or damp. All of the tall-growing colocasias are of the easiest culture. As they are very rank-growing plants they are not much grown in greenhouses, but are chiefly planted out-of-doors for summer display. They do best in damp rich soil. The dwarf species and forms are suited for pot growth, but little is seen of them except in public gardens. Consult *Caladium* for further treatment. (G. W Oliver.)



1034. Colocasia antiquorum var. esculenta. (Caladium esculentum).

Colocasias furnish the much-cultivated taro of the Pacific tropics, this edible product being the large starchy roots. From it is made the poi of Hawaii. In Japan and other countries the tubers of colocasias are much cultivated, and are handled and eaten much as we use potatoes (see Georgeson, A. G. 13:81). The young leaves of some kinds are boiled and eaten. The dasheen is of the same group. It has been recently introduced from tropical America, and is receiving considerable attention for cultivation in the South. The tubers may also be forced for the tender shoots. Cf. Bull. 164 Bur. Plant Ind. U. S. Dept. Agric. (1910), and subsequent publications of Off. Foreign Seed and Pl. Intro.

antiquòrum, Schott. Lvs. peltate-ovate; basal lobes half as long as the apical one, connate two-thirds to three-fourths their length, separated by a broad, triangular, obtusish sinus. India. B.M. 7364.

Var. **euchlòra,** Schott (*C. euchlòra,* C. Koch). Petioles violet; blade black-green, with violet margins.

Var. **Fontanèsii,** Schott (*Alocàsia violàcea,* Hort. *Calàdium violàceum,* Hort. *C. álbo-violàceum,* Hort.?). Petioles violet; blade dull green, with violet margins. B.M. 7732.—Multiplies rapidly by whip-like runners and grows well in shallow water.

Var. **illústris,** Engler (*C. illústris,* Hort.). Black Caladium. Petioles violet; blade more oblong-ovate, with black-green spots between the primary veins. F.M., 1874:107.—Very beautiful in masses, but fls. have offensive odor.

Var. **esculénta,** Schott (*Calàdium esculéntum,* Vent. *Colocàsia esculénta,* Schott). Elephant's Ear. Fig. 1034. Spadix with an appendage half as long as the staminate infl.: lvs. bright green, often 3 ft. or more long, nearly as wide. Hawaii and Fiji. G. 2:62, 571; 7:44.

affìnis, Schott. Blade thin, membranaceous, rounded-ovate or ovate, the apical lobe scarcely a fourth or a third longer than wide; basal lobes connate nearly their entire length, bright green above, glaucous beneath; blade only 4–6 in. long. Himalaya.—Not hardy in Cent. Fla.

Var. **Jénningsii,** Engler (*Alocàsia Jénningsii,* Veitch). Petiole purplish, with transverse purple lines; blade cordate, emarginate, with large, oblong or triangular black-green or black-violet spots between the primary lateral veins. I.H. 16:585. F.S. 17:1818–19. —Not hardy in Cent. Fla.

nèo-guineénsis, André. Remarkable for its tufted habit, the shortness of the lf.-stalks, its short-stalked infl., and the beautiful green tone of its smooth and shiny lvs., spotted with creamy white. New Guinea. I.H. 27:380.

Mârchallii, Engler (*Alocàsia Márchallii,* Hort. *A. hýbrida,* Bull). Hybrid, probably of *C. affinis* and *C. antiquorum.* Larger in all parts than *C. affinis,* the petioles pale green, very slightly emarginate, with large, confluent spots.

C. bataviénsis=Alocasia bataviensis(?).—*C. Caracasàna,* Engler =Xanthosoma.—*C. javánica,* Hort.=(?).—*C. Mafáffa,* Hort.= Xanthosoma.—*C. marginàta,* Hort.=Caladium bicolor.—*C. monorrhìza,* Hort.=(?).—*C. odòra.* Brongn.=Alocasia odora, Koch. Tree-like, the st. or caudex 3–6 ft. and 6 in. diam.: lvs. green, cordate, stalked, bearing peduncles in pairs in their axils. E. Asia. B.M. 3935.—*C. odoràta,* Hort.=Alocasia macrorrhiza.

George V. Nash.†

COLOCYNTH: *Citrullus.*

COLOR IN FLOWERS. The range of simple color among flowers is not very extensive. There are singular and almost unaccountable intervals in that range where color is conspicuously absent in every genus. Indeed, there is no such thing as a pure green flower, nor a pure blue one, neither is there any flower to match the remarkable blue-green or green-blue so familiar in the plumage of certain birds; this has no existence at all in the vegetable world. The range of color, therefore, among flowers is strictly circumscribed. A simple color is a hue not complicated with any other tint or shade or hue. Roughly described, the hues comprise: yellow, gold-yellow, orange, scarlet, red, crimson, magenta, purple, violet, and ultramarine; these together with blue, peacock-blue, green, and yellow-green (hues which do not appear in the floral world) compose a circle of color from which all tints and shades are derived. Fig. 1035. In other words, the admixture of white with a hue produces a tint, and the admixture of black, a shade. Fig. 1036. A reduction of the range of hues given above to its simplest terms would comprise only yellow, orange, red, purple, blue, and green, six primary colors. Fig. 1037. Although pioneer investigators of the nature of color



1035. The intermediate hues.

resolved these six hues into three—yellow, red, and blue,—the restriction was made at the cost of absolute purity in the other three hues which they chose to name secondary colors. There is no possible way of producing absolutely pure orange, violet, or green, by a combination of pigments.

The generic character of flower-colors is comprehended in the hues just named, although such names are of little consequence so long as identification is without question. Unfortunately scientists and artists have not yet established a standard nomenclature of color, and as a consequence the name of a particular hue is largely determined by a consensus of public opinion, which, very naturally, is not always correct.

WITH BLACK	WITH WHITE	CLEAR COLOR
OLD GOLD	SULPHUR	YELLOW
OCHRE	STRAW Y.	COLD Y.
BURNT ORANGE	SALMON	ORANGE
TERRA COTTA	SHRIMP P.	SCARLET
CARDINAL	PINK	RED
MAROON	C. PINK	CRIMSON
PLUM	P. LILAC	MAGENTA
DARK B. PLUM	LILAC	PURPLE
LOGWOOD VIOLET	B. LILAC	VIOLET
INDIGO	V. BLUE	ULTRAME

1036. Color phases in flowers.

Classification of colors.

It is essential, therefore, to accept both popular and scientific estimates of color if the subject is to be considered in its relation to flowers. The scientific determination of simple colors is expressed by certain arbitrary numbered lines in the spectrum. Thus, yellow is at line 580, gold-yellow at 605, orange at 630, scarlet at 655, red at 680, green at 530, peacock-blue at 505, violet at 430, ultramarine at 455, and blue at 480. These numbers indicate the wave-lengths of the respective hues, with the micron (one-millionth part of an inch) as the unit. This identification of color, however satisfactory from a scientific point of view, is both intangible and impracticable in every other respect. The flower-petal or the artist's pigment matched with the spectrum is the only proper medium through which to convey an adequate knowledge of a given hue to the layman, and it must be remembered that everyone is hypothetically the layman who is not directly associated with the particular science or art under consideration. The colors of certain flower-petals as matched with the spectrum lines are as follows:

Yellow (580).—*Œnothera biennis, Brassica nigra, Ranunculus acris, Helianthus decapetalus,* a single dandelion ray.

Gold-yellow (590).—*Rudbeckia hirta,* golden calendula.

Gold-yellow (585).—*Kerria japonica.*

Gold-orange (600).—Golden eschscholtzia.

Gold-orange (615).—*Crocus susianus.*

Orange (635).—*Tropæolum majus* (deepest orange hue), the common type.

Scarlet (645).—Mme. Crozy canna, scarlet geranium and tropæolum, berry of *Cornus canadensis.*

Red (680).—Red azalea, red carnation, tube of *Rhododendron nudiflorum.*

Red (690).—Red gladiolus.

Crimson.—Crimson peony, American Beauty rose (dilute).

Magenta.—Magenta cineraria, *Polygala sanguinea.*

Purple.—Purple cineraria, *Mimulus ringens.*

Violet (425).—*Viola cuculata* and *Campanula rotundifolia* (light).

Violet (430).—*Verbena erinoides.*

Ultramarine violet (440).—*Centaurea Cyanus,* the bluest phase (light).

Ultramarine blue (455).—*Scilla sibirica* (light).

Ultramarine blue (435).—*Gentiana Andrewsii,* (bluest tip of petal).

Blue (475).—*Myosotis palustris,* bluest phase (pale).

Such a list is manifestly imperfect; to state the case accurately, few flowers are "on the line;" three of the colors have no numbered lines, and many of the plant species or varieties are not and can not be explicitly cited. For example, the red carnation must be a red and not a scarlet-red variety, and its coloring should match that of the *Rhododendron nudiflorum* tube; the same rule applies to the red gladiolus. It is equally the case that many flowers show only a modification or a dilution of the hue they are chosen to represent; the blue of the forget-me-not at best is extremely dilute.

A list of artists' pigments is more to the point. It has the great advantage of nomenclatorial fixity and it does not include hues subject to change. The representative colors are:

Lemon, zinc, ultramarine, pale cadmium, and light malori yellows.

Medium cadmium and malori gold-yellows.

Cadmium orange and deep malori orange-yellow.

Orange mineral.

Scarlet-vermilion.

Carmine or alizarin lake (no single pigment is exactly normal red), these incline to scarlet.

Crimson lake.

Magenta: a mixture of crimson and mauve lakes in nearly equal parts.

Mauve lake: a true purple.

Violet ultramarine.

Guimet's French ultramarine.

Cobalt blue.

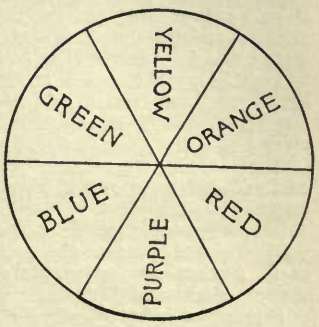
Emerald-green.

The color harmonies.

If the simple colors, yellow, orange, red, purple, blue, and green, are arranged in a circle (Fig. 1037), those lying opposite each other harmonize by reason of absolute contrast. Blue and orange, for example, are complementary colors and theoretically they balance each other. It by no means follows, however, that a mass of orange nasturtiums and blue forget-me-nots must therefore look well together; the very massing of such hues would make that impossible in spite of the fact that the misty grayish character of a clump of blue forget-me-nots is the reverse of aggressive. But the orange of the nasturtium is obtrusive to the last degree, and its environment should be as colorless as possible—even to the point of dull gray or white.

If these six simple colors in the circle are again separated by intermediate hues (Fig. 1035), so about three of the latter lie between the six original colors, the result will be a circle of twenty-four divisions, having the effect of a rainbow. This will perfectly illustrate the principle of color harmony and color discord. Besides the opposing colors which harmonize by contrast, there are neighboring colors which harmonize by analogy.

For example, any four or five colors lying side by side in the circle are bound together harmoniously by reason of their near relationship. Therefore, all these four or five colors may be combined—and nature does combine them—with esthetic results. But skip over four of the colors and attempt a combination of the first and sixth, and the result will prove to be a discord, the bond of relationship is broken, and the eye is disturbed by the aggressiveness of two colors between which there is evidently no bond of sympathy. It

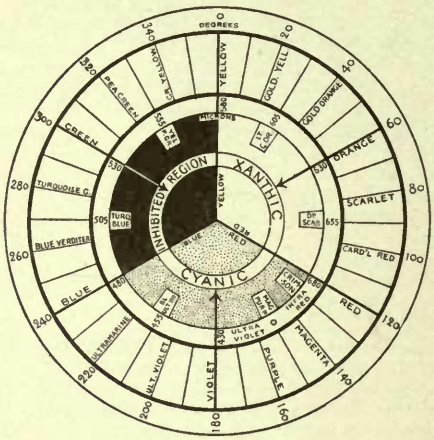


1037. Harmony by contrast.

would be safe to say, therefore, that the circle demonstrates the fact that its colors situated at right angles with each other are discordant, and those lying nearly parallel with each other are harmonious.

This is the theoretical side of color harmony. The practical side is scarcely different; it simply modifies the theory. Brilliant blue and orange, which are theoretically harmonious, are scarcely as agreeable in each other's company as the rule would imply. The trouble, however, lies with the brilliancy. The golden calendula and the deep purple aster in association are violent and aggressive. Remove the one and the other and substitute pale-tinted flowers of these hues and the result will be harmonious.

Flower families are very likely to sustain harmonies of analogy. Hyacinths, sweet peas, and nasturtiums



1038. The circle of 360° in colors.

represent groups with very nearly related hues or tints. There is a predominating influence of crimson-pink among sweet peas, of lilac among hyacinths, and of orange among nasturtiums, yet the influence at times (in a particular variety) is wholly wanting and is replaced by an analogous tint or hue. It would be a rather nice bit of color adjustment which would result in a harmony superior to that of a careless grouping together of flowers gathered at random from any one of these three genera.

But the theory that analogous colors harmonize is correct only when not carried to excess. Attempts to force deep-hued flowers into harmony often lead to contrary results. A range of color from crimson to ultramarine depends for its harmony upon the careful grading of intermediate hues. Such colors, in full force, might do violence to each other. It is tempting the hardness of a diamond to pound it with a hammer. It is taxing crimson too heavily to expect it to show its beauty in the presence of strong violet! The effort should rather be to merge the individualities of the crimson and the purple flowers into a group and effect a play of color between the two.

The theory that colors at right angles on the wheel are discordant is also subject to some modification. Relatively the right-angled colors must be crude and strong to affect the eye objectionably. Yellow and red in the rose is an agreeable color-combination. Yellow and red dahlias crowded together are certainly harsh and unneighborly.

A country bouquet of asters, marigolds, fuchsias and dahlias is bad, because the country garden is not a part of it. Atmosphere, space, and a stretch of green foliage make a world of difference.

It is wisest to try the effect of one color upon another before allowing two or three strong hues to wage war with each other. It will be found quickly that white is a peacemaker, and green is an invaluable mediator. With these colors at command, the chances of discord are reduced to a minimum. Everything also depends upon simplicity in color-combinations. It is questionable whether a combination of more than two colors can be ever esthetically a success. The adjustment of many colors needs the hand of an expert.

The restriction of color in flowers.

The very strict limitation of range in flower-colors demands careful study if it would be thoroughly understood. Augustin Pyramus de Candolle divided flower-colors into two classes, which he named xanthic (red, scarlet, orange, gold-orange, yellow, and green-yellow), and cyanic (green-blue, blue, ultramarine-violet, violet, purple, and red). Further, he explained, flowers of the yellow (xanthic) series could pass into red or white but never into blue, and those of the blue (cyanic) series could pass into red or white but never into yellow. The theory is correct but it requires both modification and revision. Gold-orange must evidently displace yellow, and ultramarine-violet displace blue as series names; furthermore, the passage into red should not exceed scarlet-red in the xanthic series, or crimson-red in the cyanic series. Pure red logically should be the zero point between the two divisions, and not be included in either unless connected by analogous hues.

Gold-orange and ultramarine-violet are respectively the type-colors of the two series because each occupies a median position with equal influence on either hand. Red, occupying the median position between the two series, should and does exercise an equal influence on both; a casual glance at the chromatic scale demonstrates the fact. Neither the xanthic nor the cyanic series can exclusively claim the respective yellow and blue in absolute purity, for the cogent reason that among flowers yellow is associated with both these divisions, and a true blue scarcely appears at all. Further, if pure red is the zero point between the two series, then the consistent red of the xanthic order is scarlet-red, and that of the cyanic order is crimson-red; a pure red or pure yellow flower, therefore, consistently belongs to either order according to its xanthic or cyanic congeners.

The best proofs of the above statements are to be found among the flowers themselves. Asters belong to the cyanic group, but there is no blue aster. Tropæolums belong to the xanthic group, but there is no pure yellow nasturtium; there are, however, ultramarine-violet asters and gold-yellow nasturtiums. There is a pure yellow, a golden orange, but no white marigold (Tagetes); the species is xanthic. The family Cruciferæ is cyanic; it includes pure yellow, deeper yellow, and magenta flowers. The genus Hyacinthus is cyanic; it includes no blue flower, but many which are purple, violet, cyanic red, and modified yellow. *Viola tricolor* is cyanic; it includes a strong yellow along with intense purple and violet-ultramarine flowers. The genus Zinnia is xanthic, it includes no true yellow flower but many which range through all reds into cyanic crimson. The genus Rosa is cyanic; its flowers range from pure red to magenta-crimson, develop a strong, modified yellow, fuse yellow with crimson, but never approach the xanthic gold-orange. The genus Chrysanthemum is xanthic; its flowers include all yellows, skip pure orange and scarlet, and range from scarlet-red to cyanic red-crimson.

Species belonging to the cyanic group invariably produce white flowers which have an albino origin. Species of the xanthic order produce white flowers which are not albinos but which invariably displace flowers of some strong, pure xanthic hue. For example, geraniums are white, red, scarlet, and pink, but never gold-orange or golden yellow. Carnations are white, red, and cardinal-red, but never scarlet, or orange. Chrysanthe-



XXIX. Cranberry-picking in a New Jersey bog.

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mums are yellow, white, and pink, but never orange or scarlet. Dahlias are scarlet, red, crimson-red, and even pure yellow, but never pure gold-orange, or orange.

It is perfectly evident from the foregoing examples that the range in a given genus, or species, is limited to what may be termed the swing of a pendulum upon the chromatic scale (Fig. 1038). The swing may extend over a quarter of the dial, rarely it does more. If it happens that two colors are developed, like violet and yellow, it will still be found that there is but one pendulum-swing and not two. Violet will be associated with contiguous hues, but yellow will be developed quite alone.

This, it is reasonable to believe, is direct evidence of a dual or treble origin of color in a flower group. Yellow cannot be evolved from violet, or vice versa. Necessarily, if white appears in a xanthic group, it must have evolved alone and independent of any color-range in that group. Undoubtedly the range of contiguous colors itself has evolved from a median hue which has spread out, fanlike, in graded variations within strict limits. Naturally, such statements conflict with the old theory that all flowers were originally yellow, but they are not inimical to the idea that the earlier ones might have been yellow, and later ones magenta, violent ultramarine, scarlet, and gold-orange. It is important to keep in mind the fact that a steamboat is not evolved from a locomotive.

It is further evident that yellow belongs quite as little to the xanthic as it does to the cyanic series, or, to put it more strongly, it belongs to neither. Its origin, independent of any "range," was undoubtedly the elimination of blue from chlorophyll. Hence, it is not surprising to find it in some modified form associated with both series, and in the cyanic series isolated. The flora of the northeastern United States is essentially cyanic. Twenty-one per cent is yellow, 21 per cent magenta and 22 per cent white; the remainder is 8 per cent xanthic and 28 per cent cyanic—the last mostly pink and light violet. The record is significant and points directly either to an arrested color development, or to a depauperate color condition in an inclement region; the former seems the more likely. An aggregation of cyanic-flowered plants are found in the north temperate zone, and of xanthic-flowered plants in the torrid zone.

Color activity.

Color results from a play of light upon a surface which rejects or absorbs certain rays. It is a significant fact that the red end of the spectrum comprehends those hues which are produced by the caloric rays of the sun, and the violet end those hues which are produced by the actinic rays. It is not surprising therefore that the coloring of vegetation is intense, and that xanthic flowers predominate under the equator. A separation of cyanic and xanthic flowers follows almost identically the thermal lines which band the great continents of the northern hemisphere, cyanic color prevailing north, and xanthic color south of the line marking 80° F. In a word, xanthic flowers belong to a very warm, and cyanic flowers to a temperate or cold climate. That they should become mixed in a narrow zone between the extremes is only natural; the rule, therefore, is in no way compromised thereby. That yellow, too, should appear in both cyanic and xanthic groups is not at all surprising. In the spectrum it holds a median position between the red and the violet ends; it is neither a hot nor a cold color, and has consequently evolved from its primitive condition as a constituent of the green in chlorophyll under any and all temperatures. That is the only way to account for its isolation when connected with cyanic groups.

It would appear, then, that magenta, violet, and ultramarines, together with gold-orange, orange, and red, are primitive colors quite as well as yellow and white. In what order they appeared upon the earth in the petals of flowers, it would be difficult to determine, but it is reasonable to think they appeared as original colors, in weak, perhaps, but absolute purity. Otherwise, the remarkable limitation of color-range must be accounted for by a less logical theory. Upset this limitation, and attempts to produce a blue rose, yellow aster, white nasturtium, or green carnation, should prove successful. Recognize the limitation, and the futility of such attempts becomes at once apparent, and the possibility of improving existing "strains" of color is illimitable. At some time or other in the distant past the law of limitations fixed the range of flower-colors; no new law of elasticity has since developed to remove the boundaries and thus aid the floriculturist in his ambition to produce what would prove to be a mere novelty. See *Standards of Color.*

F. Schuyler Mathews.

COLTSFOOT: *Tussilago Farfara.* Sweet coltsfoot is Petasites, formerly called Nardosma.

COLUMBINE: *Aquilegia.*

COLQUHOÙNIA (after Sir Robert Colquhoun). *Labiàtæ.* Tender plants with dense whorls of gaping fls. an inch long or more, colored scarlet and yellow.

Erect or twining shrubs, woolly in all parts when young: lvs. large, crenate: whorls few-fld., axillary or crowded into a terminal spike or raceme; corolla-tube incurved, the throat inflated.—Two Asian species. Prop. by cuttings of growing tips, in sandy soil, under glass in summer.

coccínea, Wall. Tall climber, with very long branches, 8–10 ft.: lvs. stalked, ovate-acuminate, 3–5 in. long, crenate, dark green above, roughish, typically with scarcely any woolliness except when young: corolla twice as long as the calyx. B.M. 4514.—*C. tomentòsa,* Houll., is probably identical. The dense woolliness is perhaps temporary. R.H. 1873:130 shows a handsome terminal spike in addition to axillary clusters, containing about 20 fls.—Apparently not advertised, but probably as worthy as the next.

vestìta, Wall. Very smilar to *C. coccinea,* except that it is a low-growing, erect plant, and more densely and permanently woolly on the st., calyx and under side of lvs., which are elliptic or elliptic-ovate and cordate.—Cult. outdoors at Santa Barbara, Calif., where it may be used for the wild garden as it is perfectly hardy. Not of much horticultural value.

N. Taylor.†



1039. Columnea gloriosa. (×⅙)

COLÚMNEA (after Columna or Colonna, Italian writer on plants, sixteenth century). *Gesneràceæ.* Tropical American shrubs and climbers, sometimes grown under glass in choice collections.

Flowers widely gaping, showy, often 2 in. long: lvs. opposite, nearly equal or widely unlike: fls. solitary or numerous, axillary, stalked or not, without bracts or with bracts in an involucre; corollas scarlet, carmine or yellowish.—A group of 100

species of which half a dozen mostly red- or orange-fld., are cult. abroad and may be known to a few fanciers at home, but are not advertised by the dealers. They are warmhouse evergreens requiring the treatment of Trichosporum (Æschynanthus).

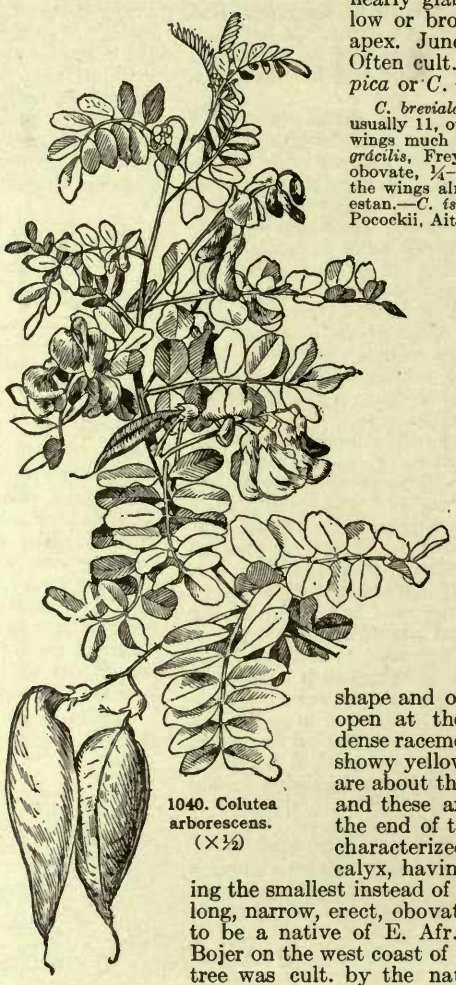
Schiedeàna, Schlecht. The best known species. It has handsome scarlet fls. 2 in. long, sometimes variegated with yellow. It is an herbaceous climber from Mex. B.M. 4045. P.M. 9:31.

gloriòsa, Sprague. Fig. 1039. An epiphytic perennial herb: lvs. ovate or ovate-oblong: fls. axillary, solitary, scarlet and yellow. Costa Rica. B. M. 8378.

C. glàbra, Oerst, var. *màjor.* Fls. scarlet; stamens white. Costa Rica.—*C. magnífica,* Klotzsch & Hanst. Corolla bright scarlet; tube inflated about the middle. Costa Rica. G.C. III. 43:66.—*C. Oerstediàna,* Klotzsch. Epiphytic undershrub or herb: fls. scarlet. Costa Rica. B.M. 8344. N. TAYLOR.†

COLÙTEA (*Koloutea,* ancient Greek name). *Leguminòsæ.* BLADDER SENNA. Shrubs grown chiefly for their attractive yellow or brownish red flowers and the ornamental bladder-like pods.

Deciduous, with alternate, odd-pinnate lvs.: lfts. many, rather small; stipules small: fls. papilionaceous, in axillary, few-fld., long-peduncled racemes, yellow to brownish red; calyx campanulate, 5-toothed; standard suborbicular with 2 swellings above the claw; 9 stamens connate, 1 free: pod inflated, bladder-like, many-seeded.—About 15 species in the Medit. region to Abyssinia and Himalayas. Ornamental free-flowering plants of rapid growth, with pale green or glaucous foliage and yellow or brownish red fls. during summer, followed by large, usually reddish-colored and decorative pods. They grow in almost any soil, but prefer a tolerably dry and sunny position; not quite hardy N., the hardiest being *C. arborescens.*—Prop. by seeds sown in spring or by cuttings of mature wood inserted in fall in sandy soil; rarer species and varieties are sometimes grafted on *C. arborescens* in spring under glass.



1040. Colutea arborescens. (×½)

A. *Fls. yellow: pod closed at the apex.*

arboréscens, Linn. Fig. 1040. Shrub, to 15 ft.: lfts. 9–13, elliptic, dull green, mucronulate, usually slightly pubescent beneath, ½–1 in. long: fls. 3–8, about ¾in. long; wings nearly as long as the keel, flat. June–Sept. S. Eu., N. Afr., N. B.M. 81.—Lvs. have cathartic properties. Var. **crìspa,** Kirchn. Dwarf, with crisped lvs. Var. **bullàta,** Rehd. (*C. bullàta,* Hort.). Dwarf and compact: lfts. 5–7, obovate or nearly orbicular and somewhat bullate.

cilícica, Boiss. (*C. longialàta,* Koehne. *C. melanocàlyx,* Hort., not Boiss.). Shrub: lfts. bluish green, usually 11, oval or broadly ovate, rounded or truncate and mucronulate at the apex, ½–¾in. long: fls. bright yellow, 3–6, about ¾in. long; wings longer than the keel. June–Aug. Asia Minor. G.C. III. 16:155.

AA. *Fls. orange-yellow or brownish red; wings shorter than the keel.*

mèdia, Willd. Shrub, to 10 ft.: lfts. 7–13, obovate, grayish green or glaucous, ⅓–⅔in. long, nearly glabrous: fls. 3–6, orange or reddish yellow, the standard with brownish markings: pod closed at the apex. June–Sept.—Probably hybrid of garden origin between *C. arborescens* and the following, often cult. under the names of the following species.

orientàlis, Mill. (*C. cruénta,* Ait.). Shrub, to 6 ft.: lfts. 7–11, obovate, glaucous, thickish, ⅓–½in. long, nearly glabrous: fls. 3–5, reddish yellow or brownish red: pod open at the apex. June–Sept. S. E. Eu., Orient.—Often cult. under the name of *C. halepica* or *C. istria.*

C. brevialàta, Lange. Shrub, to 4 ft.: lfts. usually 11, oval, ½–¾in. long: fls. 2–6, yellow; wings much shorter than keel. S. France.—*C. grácilis,* Freyn & Sintenis. Lfts. usually 11, obovate, ¼–½in. long: fls. 2–5, yellow, with the wings almost as long as the keel. Turkestan.—*C. ístria,* Mill. (C. halepica, Lam. C. Pocockii, Ait.). To 4 ft.: lfts. glaucous, small and numerous: fls. yellow, nearly 1 in. long; wing longer than the keel.—*C. nepalénsis,* Hook. Similar to C. arborescens: racemes drooping. B.M. 2622. B.R. 1727. Tender.

ALFRED REHDER.

COLVÍLLEA (after Sir Charles Colville, governor of Mauritius). *Leguminòsæ.* Showy-flowered tropical tree, a worthy rival of the royal poinciana, which is closely allied, but easily distinguished, especially by its round and full, not flat, legume.

Colvillea has drooping racemes, 1½ ft. long, densely crowded with perhaps 200 fls. of curious shape and of a splendid scarlet; the fls. open at the st. end of the pendent dense raceme, and display masses of long showy yellow stamens; the unopened fls. are about the size and shape of a filbert, and these are gradually smaller towards the end of the raceme.—Only 1 species, characterized by its large, oblique, colored calyx, having 4 segms., the standard being the smallest instead of the largest part; wings very long, narrow, erect, obovate: pod 2-valved.—Supposed to be a native of E. Afr., but discovered in 1824 by Bojer on the west coast of Madagascar, where a single tree was cult. by the natives. It flowered there in April or May. Its cult. is similar to that of cesalpinia. Prop. in the S. only by seeds. Not common in cult. outside of botanic gardens and fanciers' collections.

racemòsa, Bojer. Tree, 40–50 ft. high, with the general aspect of *Poinciana regia* but with a thicker trunk and ampler foliage: branches very long and spreading: lvs. about 3 ft. long, alternate, remote, twice pinnate, with 20–30 pairs of pinnæ which are opposite, 4 in. long, and have 20–28 pairs of lfts., each ½in. long: keel very small, almost covered by the wings; free stamens 10, 3 inserted below the standard, 2 under the wings, 1 under the keel, and 4 under the ovary. B.M. 3325–6. WILHELM MILLER.

COMÁNDRA (name alludes to the hairs in the fl.). *Santaláceæ.* Perhaps a half-dozen leafy herbs or subshrubs, one in Eu., and the others in N. Amer., more or less parasitically attached to the roots of other plants, one or two of which may be of interest to horticulturists. Lvs. alternate, almost sessile: fls. whitish or greenish, small, perfect, in terminal cymes or umbellate panicles; calyx 4–5-cleft, lined or constricted

above the ovary, and the tube sometimes conspicuously continued to a neck or top on the fr.; petals wanting; stamens of same number as calyx-lobes, the anthers connected by hairs to the calyx-lobes: fr. nut-like or drupe-like. **C. umbellàta,** Nutt. (Fig. 1041), 6–18 in. high, in dry mostly open ground in the eastern states, is an attractive plant when allowed to spread naturally in patches in waste places: rootstock not showing above ground (*C. Richardsiàna,* Fern., has a superficial rootstock): lvs. thin, oblong, pale beneath: fls. whitish.

L. H. B.



1041. Comandra umbellata. (×½)

COMARÉLLA: *Potentilla.*

COMAROSTÀPHYLIS: *Arctostaphylos.*

COMÀRUM (an old Greek name). *Rosàceæ.* One species allied to Potentilla, and often referred to that genus but differing in the lateral style unknown in Potentilla. **C. palústre,** Linn. (*Potentilla palústris,* Scop.), the marsh cinquefoil, is a decumbent herb growing in swales in the northern states (also in the Old World), with pinnate, 5–7-foliolate lvs. (lfts. dentate), and solitary or cymose purple fls. ½in. across: petals shorter than the calyx-lobes, acute; stamens numerous. An odd and interesting but not showy plant, sometimes planted in bogs. Mn. 3:97.—The fr. somewhat resembles a strawberry, but is spongy instead of juicy. In some parts of Scotland, it is said to be called cowberry and is rubbed on the inside of milk-pails to thicken the milk. **C. Salesòvii,** Bunge (*Potentilla Salesoviàna,* Steph.), of the Himalayan rigion and Thibet, 11,000–14,000 ft. altitude, is a suffruticose silky-hairy plant worthy of cult., but little known in gardens: lvs. pinnate; lfts. 7–9, oblong, obtuse, crenate-serrate: fls. white, in an ample paniculate cyme. Probably better placed in Potentilla. B.M. 7258.

N. Taylor.†

COMBRÈTUM (old Latin name). *Combretàceæ.* Tropical shrubs and trees, many of which are climbers by means of the persistent leaf-stalks.

Leaves mostly opposite, in some species verticillate in 3's or 4's, entire: fls. in spikes or racemes, polygamous; calyx bell-shaped; petals usually 4; stamens usually 8: fr. winged and indehiscent, 1-seeded. —A genus of 250 species from Asia, Afr. and Amer., particularly S. Afr. The combretums are warmhouse plants, little known in this country. Prop. by cuttings of firm wood. One climbing species is in the American trade: **C. coccíneum,** Lam. (*C. purpùreum,* Vahl. *Poivrea coccínea,* DC.), from Madagascar. Lvs. oblong-lanceolate, acuminate, evergreen: fls. small, brilliant red, the long-exserted stamens forming the chief feature of beauty; the handsome loose spikes often in panicles; parts of the fl. in 10's. B.M. 2102. L.B.C. 6:563.—Handsome. *C. butryosum* yields a butter-like substance, used by the Kafirs as food. *C. sundaicum* in recent years has attained some prominence as a reputed anti-opium remedy.

N. Taylor.†

COMFREY: *Symphytum.*

COMMELÌNA (bears the name of early Dutch botanists). Also written Commelyna. *Commelinàceæ.* Day-Flower. Perennial or annual herbs, of which a very few are cultivated in the open or under glass for their interesting flowers.

Upright, spreading or procumbent, usually more or less succulent, often rooting at the joints: lvs. alternate, sessile or short-petioled, clasping the st., a lf. subtending the sessile fl.-cluster and forming a clasping folded spathe: fls. opening for a day, mostly blue (varying to white and rose), irregular; outer perianth parts (calyx) 3, colored, 2 of them somewhat united; inner parts (petals) 3, one of them small and 2 broad and with long claws; stamens usually 6, but only 3 of them fertile; filaments not hairy: fr. a 2–3-celled caps. on a recurved pedicel.—Nearly or quite 100 species, in warm regions around the globe, a few of them reaching cool-temperate climates. The cult. species are perennials. The hothouse species appear not to be offered in this country or to be much cult. Allied to Tradescantia and Zebrina.

Commelinas are mostly of easy culture, thriving well in any light rich soil. The evergreen stove and greenhouse species are readily propagated in March or April by cuttings inserted in an ordinary propagating-bed and kept close for a few days, while the tuberous-rooted half-hardy herbaceous species may be propagated either by division of the tubers or by seeds sown in a frame early in April and afterwards transplanting the seedlings in the herbaceous border. In the fall, they should be lifted and the tubers stored away in the same manner as dahlias. Of the tuberous-rooted species, *C. cœlestis* is perhaps the best, its bright blue flowers being very effective, especially when planted in masses. (Edward J. Canning.)



1042. Commelina cœlestis. (×½)

A. *Plant hardy in the open.*

nudiflòra, Linn. (*C. Séllowii,* Walp. *C. Sellowiàna,* Schlecht.). Creeping, rooting at the joints, glabrous or practically so: lvs. lanceolate to ovate-lanceolate, acute or acuminate, the lf.-sheaths often ciliate: spathe-lf. acute or acuminate, broad at base, petioled: fls. few in each cluster, ½in. or less across, blue: caps. 3-celled and 5-seeded. N. J. southward and widely dispersed in other parts of the world.—Sometimes offered as an outdoor plant. A rose-colored form is reported.

communis, Linn. Much like the last and often confused with it: more erect and less rooting at joints: fls. larger: caps. 2-celled and 4-seeded. N. Y. southward, and widely distributed; perhaps an intro. from Asia.

AA. *Plant tender or only half-hardy.*

tuberòsa, Linn. Diffuse and branching, from a tuberous root: lvs. narrow-lanceolate, 2–3 in. long: spathe-lf. cordate-ovate to lanceolate, conduplicate, more or less hairy; sheaths pubescent: fls. rich blue. Mts. of Mex.—The plant sold under this name is recommended as a free-flowering border plant in England, the tubers to be lifted in autumn and stored in dry sand for the winter.

cœléstis, Willd. Fig. 1042. Erect, root more or less tuberous, 10–18 in. high, branching, with clasping, long, broad-lanceolate pointed lvs. and blue fls. (2–10 together) on elongating axillary pubescent peduncles: spathe-lf. ovate, folded; sheaths ciliate. Mts. of Mex.—Runs into several forms. Var. **álba,** Hort., has white fls. Var. **variegàta,** Hort., has fls. blue and white. *C. cœlestis* is a half-hardy plant, in the N. requiring protection of a greenhouse, although it may be planted out. Prop. by seed, cuttings and tubers.

L. H. B.

COMPARÉTTIA (Andreas Comparetti, 1746–1811, Italian botanist). *Orchidàceæ.* A small group of graceful epiphytes.

Pseudobulbs, 1–3-lvd.: racemes simple or branched; fls. small, lateral sepals united in a single piece, lengthened at the base into a conspicuous horn; lateral petals converging; labellum large, produced into a double spur, which is hidden in the horn made by the sepals; column free, semi-terete, erect; pollinia 2.—Four species, Mex. to Brazil. Grown on blocks or in baskets in a light intermediate or warmhouse.

coccínea, Lindl. Pseudobulbs small, bearing lanceolate, coriaceous lvs., purple beneath: racemes several-fld.; fls. 1 in. across; petals and sepals light yellow, margined orange-red, labellum large, broader than long, crimson. Brazil. B.R. 24:68. I.H. 13:472.

falcàta, Poep. et Endl. (*C. ròsea,* Lindl.). Similar in habit to *C. coccinea:* fls. 1 in. across, deep crimson; labellum broad; racemes pendent. Peru. B.M. 4980. A.F. 6:609. Lind. 4:163. F.S. 2:109.

macropléctron, Reichb. f. Fls. 10 or more, 2 in. across, dorsal sepal whitish, often spotted with purple; midlobe of labellum cleft, suborbicular, magenta-rose, dotted at the angled base; spurs conspicuous. Colombia. B.M. 6679. Var. **punctatíssima,** Hort., has the fls. copiously rose-spotted. C.O. 1. GEORGE V. NASH.†

COMPASS PLANT: *Silphium.*

COMPOST. Mixed and rotted vegetable matter, particularly manure and litter, used as a fertilizer and amendment.

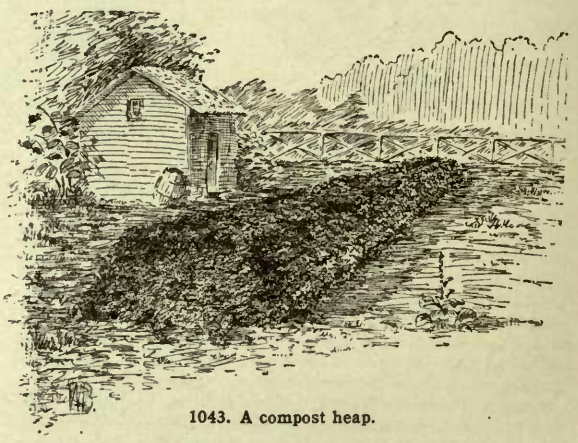
The mixture of bulky fertilizing materials known as compost, while of little importance to the general farmer, plays an important part in garden practices. Many of the garden crops must be made in a very short time, or are of delicate feeding habits. Their food, therefore, must be easily assimilable. It is good practice to pile all coarse manures, sods, weeds, or any rubbish available for the purpose, in big flat heaps (Fig. 1043), to ferment and rot before being applied to the garden soil. If desired, chemical manures, especially superphosphate (dissolved bone or South Carolina rock) and potash (muriate or kainit), may be added to make the compost the richer. By spading or forking the heaps over a few times at reasonable intervals, a homogeneous mass is easily obtained, which can be applied in greatest liberality without fear, or more sparingly, in accordance with the needs of the particular crop. Of equal, if not still greater importance, is the compost heap which gives soil for greenhouse benches, flats, hotbeds and coldframes. This compost is principally made of sods shaved off a rich pasture or meadow and piled in alternate layers with stable manure, more of the latter being used for forcing succulent crops, and less in growing plants which should be short and stocky, like cabbage or tomato plants. Garden litter may be added to the pile, as leaves and trimmings. All compost heaps, during dry weather, need frequent and thorough moistening with water, or, better, with liquid manure. Turn several times during the year, to ensure thorough rotting of the materials. T. GREINER.

COMPTÈRIS. The only published reference to this generic name and species is in G.C. III. 29: May 21, 1901, suppl. 2, where its introduction to cultivation by L. Linden is noted. The name Compteris may be a corruption, or the plant may have been a young form of some known form. The description below is quoted from The Gardeners' Chronicle.

C. Brazzaiàna, Hort. Intro. in Eu. about 1900, as a remarkably distinct large fern with long bipinnate fronds narrow at base and broad across the middle and tapering to a narrow point; barren pinnæ oval or oblong and simple; fertile pinnæ distinctly lobed.

R. C. BENEDICT.

COMPTÒNIA (Henry Compton, Bishop of London, patron of horticulture, died 1713). *Myricàceæ.* A small native shrub, useful for covering banks and to grow on sterile sandy and stony soil.



1043. A compost heap.

The genus is allied to Myrica, and by some not regarded as sufficiently different in botanical characters to justify separate generic rank: branching brown-twigged bush, diœcious or monœcious, with globular fertile catkins, the 1-celled ovary surrounded by 8 linear persistent scales or bractlets: lvs. long-oblong, pinnatifid: fr. a bur-like axillary head of few small nuts. The only species is **C. asplenifòlia,** Gærtn. (*C. peregrìna,* Coulter. *Myrìca asplenifòlia,* Linn.) SWEET FERN. In dry, sterile soil in the E. and N. U. S.; also in the trade. It is an attractive undershrub (1–3 ft.) with fern-like, scented foliage and brownish heads of imperfect fls.: roots long and cord-like: staminate catkins 1 in. or less long, slender, in clusters at the ends of the branchlets. L. H. B.

CONÁNDRON (*cone-shaped anther*). *Gesneriàceæ.* Almost stemless herb with radical glabrous rugose lvs. Differs from Streptocarpus, its nearest horticultural relative, in having a straight, not twisted pod. For cult. see *Streptocarpus.* It should be grown in shade and is hardy only south of N. C.

C. ramondioìdes, Sieb. & Zucc., of Japanese mountains, is the only species. It is an interesting little tuberous-rooted herb, with oblong, rugose, irregularly toothed root-lvs. and scapes bearing 6–12 white or purple, dodecatheon-like fls.: cymes nodding or drooping pubescent; corolla 1 in. diam.: seeds very minute.

B.M. 6484.—This is one of several groups of rare and widely scattered herbs, of which Ramondia, Haberlea, Wulfenia, Didymocarpus, Shortia and Schizocodon are examples. Conandron is adapted to growing in shady rockeries. Scapes less than 1 ft. high. Little known in cult., but is in the trade. N. Taylor.†

CONE-FLOWER: *Rudbeckia.* **Purple Cone-Flower:** *Echinacea.*

CONGÈA (from an East Indian vernacular name). *Verbenàceæ.* A few species of climbing shrubs in Burma and the Malayan peninsula: lvs. opposite and entire: fls. in peduncled capitate cymes which are combined in large terminal panicles, the bracts at the base of the cyme-peduncles large and often showy; calyx funnel-form, 5-toothed; corolla-tube slender, seldom much exceeding the calyx, usually hairy in the throat, 2-lipped, the upper lip of 2 narrow upright lobes and the lower of 3 shorter broader lobes; stamens 4, exserted; ovary incompletely 2-celled: fr. a small roundish nearly dry drupe. **C. tomentòsa,** Roxbg., is grown in India and is said to be suitable for growing in a stove or warm conservatory in Britain: a strong climber, conspicuous for the pink and changing tints of the large elliptic persistent bracts in the loose woody terminal panicles: lvs. 3 in. long, ovate-acute, soft-hairy beneath: corolla white; calyx hairy. Burma. G.C. III. 54:399.—Evergreen: infl. retained for several weeks. Allied to *Petræa volubilis.*

CONIFERS: *Arboriculture.*

CONIOGRÁMME (Greek, *dust-line*). Formerly *Dictyogramma. Polypodiàceæ.* A few Japanese and Pacific island ferns, with naked sori, which follow the course of the free or reticulated veins. The species are sometimes referred to Gymnogramma. Strong-growing indoor-ferns, useful for specimen plants.

japónica, Diels. Lvs. simply pinnate or bipinnate at the base, 1½–2 ft. high, the pinnæ 6–12 in. long and an inch wide; sori extending from the midrib to the edge. Japan and Formosa.—Also known as *Gymnogramma japonica.* An interesting fern of rather strong growth, and very distinct in appearance. Grows best in a moderate temperature—for example, 55–60°—and requires an open and well-drained soil of peaty character. R. C. Benedict.†

CONÌUM (Greek name). *Umbelliferæ.* Two weedy biennial plants, widely distributed. *C. maculàtum,* Linn., is the poison hemlock, "by which," as Gray writes, "criminals and philosophers were put to death at Athens." It is a rank, much-branched European herb which has run wild in E. N. Amer., and which has been offered in the trade as a border plant. It is biennial, rank-smelling, and poisonous, and is scarcely worth cult. although the finely cut dark foliage is highly ornamental. It grows from 2–4 ft. high, and has large umbels of small white fls. See *Poisonous Plants.*

In North America the word hemlock is used for the hemlock spruce, *Tsuga.*

CONOCÉPHALUS (Greek, *cone head*). One of the liverworts (Marchantiaceæ), with broad flat forking evergreen thallus, growing on moist banks, like a moss. *C. cónicus,* Dumort., is sometimes offered by collectors as a cover for rockeries, but can scarcely be said to be a cultivated plant.

CONOCLÍNIUM: *Eupatorium.*

CONOPHÁLLUS (name refers to the cone-shaped inflorescence). *Aràceæ.* A name proposed by Schott for certain aroids, but now made a section of Amorphophallus. **C. Kónjac,** Koch., is *Amorphophallus Rivieri* var. *Konjac,* Engler. The great tuber is much grown in Japan for the making of flour (see Georgeson, A.G.13:79). *Amorphophallus Rivieri* is figured on p. 276, Vol. I.; also in R.H. 1871, p. 573; and in B.M. 6195 (as *Proteinophallus Revieri*). Konjak is offered by importers of Japanese plants.

CONSERVATORY. Primarily a glasshouse in which plants that have been brought to perfection—usually in other greenhouses—are to be placed for display or to be kept in condition.

The conservatory should be as near the residence as possible; if not an architectural unit of the house, it may be connected by a corridor or pergola. The size of a conservatory depends of course upon the requirements or taste of the family; some are as small as 6 by 10 feet, while others are as large as 35 by 75. The aspect or side of the dwelling best suited to a conservatory is on the east, and preferably against a gable, so that sliding snow from the roof of the dwelling will not give trouble. If this is not convenient, the glass roof of the conservatory must be protected with snow-guards. A lean-to house is subject to great fluctuations if placed against the south side.

Since much attention has been given to the building of conservatories within the past few years, they can now be made attractive in architectural design, and at the same time supply the best possible conditions for the well-being of the plants. A curvilinear roof is usually more attractive and is better for the plants than a flat roof, but abundant ventilation must be provided. The roof glass should be ground or, frosted, as plants remain in flower much longer under a subdued light than when exposed to direct sunlight. Even ground glass is not sufficient in summer, some shading being required; roller shades are hard to adjust and not altogether practicable; whitewash applied to the glass outside is unsightly and damages the painted wooden strips in which the glass is laid. The following has been found to be an excellent shading mixture: Sixteen ounces white lead, thirty-eight ounces turpentine, two ounces linseed oil; apply to the glass outside with an ordinary paint-brush. The advantages of this mixture are that it is not unsightly, is easily applied, and wears off as winter comes on.

The heating of a conservatory is an important matter, since even night temperatures must be maintained as in other greenhouses. This can easily be arranged if the dwelling is heated by hot water, which is the best for any conservatory; but with steam or hot air it is more difficult; if possible when these methods of heating the dwelling are used, a separate small hot-water system should be installed for the conservatory. The temperature at which conservatories are to be kept depends upon the plants grown in them. Palms, ferns, orchids and ornamental-leaved plants generally require a night temperature of about 60°. Flowering plants, such as chrysanthemums, azaleas, primulas and bulbs, do better in a temperature of 45° to 50° at night with a rise of 15° to 20° for both classes of plants by day before opening the ventilators, and these, in winter especially, must be opened with caution, admitting the outside air very sparingly.

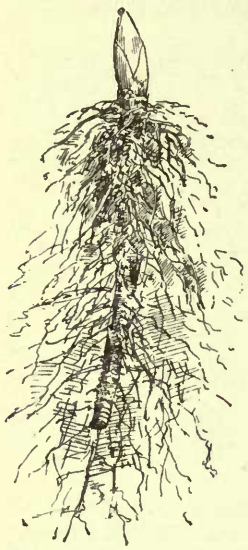
The floor of a conservatory may be of tiles and the interior may be arranged with rugs and easy chairs in the center with the plants arranged on tables around the outside or over the heating-pipes. The catalogues of the principal greenhouse builders show some very artistic arrangements, both inside and outside.

A conservatory is often a part of a commercial greenhouse establishment, being in effect the display house or room into which interesting and perfected plants are brought for inspection; and in large cities conservatories are often attached to florists' stores, not only as a display house but because plants will keep in much better health and condition for a much longer time than in the ordinary conditions of the florist's store; but commonly the word is used as above to designate an adjunct to a home. Edward J. Canning.

CONVALLÀRIA (old name *Lilium convallium*, derived from *convallis*, a valley). *Liliàceæ.* LILY-OF-THE-VALLEY. A dainty herb, much prized for its erect racemes of white delicately-scented flowers; perennial.

Leaves radical, from a horizontal rootstock, producing upright parts or pips (Fig. 1044): fls. white (sometimes pink-tinged), small and short-bell-shaped, with short blunt recurved lobes, nodding, in a short, radical, raceme (Fig. 1045), the stamens 6 included, style 1 (Fig. 1046): fr. a globular small few-seeded red berry. —Commonly considered to be only one species, native in Asia, Eu., and in the higher mts., Va. to S. C.; of several similar races or types.

Lily-of-the-valley is much prized for its delicate, sweet-scented flowers. The rhizome and roots are sold in drug-stores: they are poisonous in large doses; in small doses used as a heart tonic. The plant is popularly supposed to be the one referred to in the Sermon on the Mount, but this is not to be determined. It is essentially a shade-loving plant. The species is **C. majàlis**, Linn. Lvs. oblong or oval, thick and persisting till autumn, forming a dense sod, plane, with more or less bloom: racemes 5–10 in. high: berry ¼in. diam. R.H. 1886: 84. Gn. 47, p. 179; 52:182 and p. 319 (the latter in fruit). A.F. 13:402. Gng. 5:56–7. F.R. 2:4. G.C. III. 23:149 (var. *grandiflora*). Lowe, 42 (var *variegata*).



1044. Lily-of-the-valley pip.

The plant is hardy, and is easily grown in partially shaded places and moderately rich ground. Old beds are liable to run out. The roots and runners become crowded, and few good flower-stems are produced. It is best to replant the beds every few years with vigorous fresh clumps, which have been grown for the purpose in some out-of-the-way place. Five or six strong pips, with their side growths, planted close together, will form a good clump in two years if not allowed to spread too much. The mats of clean foliage make attractive carpets under trees and in other shady places. If the bed is made rich and top-dressed every fall, it may give good results for four or five years; and plants in such beds thrive in full sunshine. One form has prettily striped foliage, very ornamental in the early part of the season. Lilies-of-the-valley bloom early in spring. They run wild in many old yards, in cemeteries, and along shady road-sides. There are double-flowered forms; also one (var. *prolificans*) with racemes 2 feet long. (J. B. Keller.)

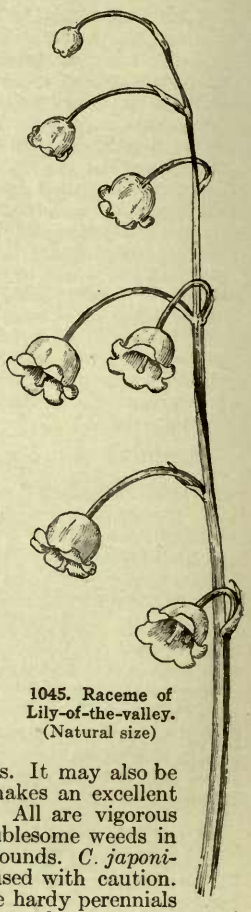
For culture as a florist's flower, see *Lily-of-the-valley.*

Recent studies of this genus by E. L. Greene, have distinguished 3 other species: *C. japónica*, Greene, representing the Japanese form of the plant: rootstock very short and stout: lvs. 2 only, subequal, elliptic, cuspidately acute, bright green with no trace of bloom on either surface: peduncle short, about equaling the bases of the lvs.; raceme few-fld., the bracts small, ovate-lanceolate; perianth widely opening, broadly bell-shaped or almost saucer-shaped; stamens large, very short, the very obtuse anthers longer than the filaments.—*C. globòsa*, Greene. Herbage light green, without trace of bloom: lvs. with a more fibrous and less fleshy anatomy than those of C. majalis, and of shorter duration, disappearing by the end of summer: perianth urn-shaped (not bell-shaped); stamens inserted about the middle of the perianth, extending horizontally (rather than vertically, as in C. majalis). Probably N. C., but described from plants growing in a wild garden in Washington, D. C.; later-blooming than C. majalis.—*C. majúscula*, Greene. Differs from C. majalis in its very large light green lvs., which have no trace of bloom and an excessively fibrous anatomy which makes the growing lf. to look plicate; more than twice larger than C. majalis, later-blooming: perianth broadly bell-shaped; filaments very short, nearly hypogynous, erect; anthers large, oblong, obtuse, cordate at base. S.E. Pa., and southward.

L. H. B.

CONVÓLVULUS (Latin, *convolvo*, to entwine). *Convolvulàceæ.* Includes *Calystègia.* BINDWEED. Annual and perennial herbs, grown mostly in the open; some are twiners.

Sometimes suffrutescent, twining, trailing, erect or ascending, with filiform, creeping rootstocks: lvs. petiolate, entire, toothed or lobed, generally cordate or sagittate: fls. axillary, solitary or loosely cymose, mostly opening only in early morning; corolla campanulate or funnelform, the limb plaited, 5-angled, 5-lobed or entire.—A genus of about 175 species, widely distributed in temperate and tropical regions. Convolvulus and Calystegia are no longer kept separate. As *Convolvulus Sepium* is the type of both genera, they are therefore synonymous. When the fls. of *C. occidentalis* are borne singly, the calyx bracts are broad and Calystegia-like; when borne in clusters the bracts are greatly reduced.



1045. Raceme of Lily-of-the-valley. (Natural size)

The species thrive in a variety of soils without especial care. The greenhouse species do best in a soil with considerable fiber. The hardy perennials are usually propagated by dividing the roots, otherwise by cuttings or seeds, the tender species preferably by cuttings. *C. tricolor* is the most important of the hardy annuals. It may also be started in the greenhouse, and makes an excellent plant for the hanging-basket. All are vigorous growers, and may become troublesome weeds in some places if not kept within bounds. *C. japonicus* and *C. Sepium* should be used with caution. This is the chief reason why the hardy perennials are not often found in well-kept gardens, except along wire fences or lattice screens, where the turf is laid up close so as to allow only a narrow border for the roots. The double-flowered form of *C. japonicus* is seen to best advantage in half-wild places, or on rocky banks, where shrubs make but a stunted growth. Here it will grow luxuriantly, forming graceful festoons from branch to branch, and covering the ground with a pretty mantle of green. (J. B. Keller.)

C. purpureus, the common morning-glory, and many related species are to be found under Ipomœa.



1046. Section of flower of lily-of-the-valley, laid open to show the parts. (×2)

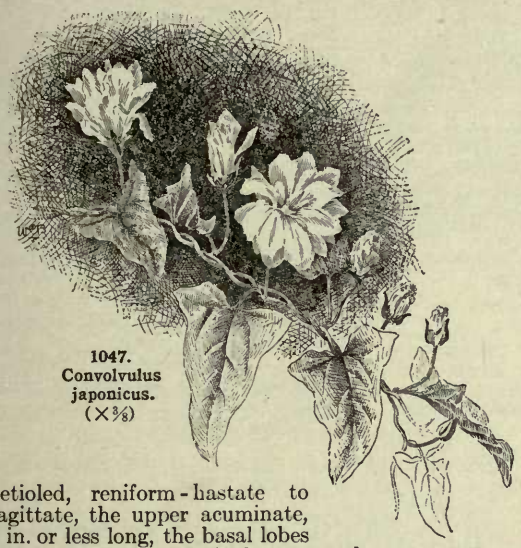
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A. *Calyx with 2 membranaceous bracts at the base: peduncles usually 1-fld. (Calystegia.)*

B. *St. prostrate, 8 in. to 2 ft. high: peduncle usually shorter than the lvs.*

1. **califórnicus,** Choisy (*C. villòsus,* Gray. *Calystègia villòsa,* Kellogg). Plant densely white-villose throughout: st. prostrate, scarcely twining: lvs. slender-petioled, reniform-hastate to sagittate, the upper acuminate, 1 in. or less long, the basal lobes often coarsely toothed: bracts oval or ovate, completely inclosing the calyx: fls. cream-yellow, 1 in. long. Calif.—Perennial.



1047. Convolvulus japonicus. (×⅜)

2. **malacophýllus,** Greene. Similar to the preceding but foliage velvety or plushy pubescent. Calif.—Perennial. Other closely related Californian species are *C. saxícola,* Eastw., *C. deltoìdeus,* Greene, *C. Bérryi,* Eastw. and *C. atriplicifòlius,* House.

BB. *St. twining or trailing, 3–10 ft. high: peduncle exceeding the lvs.*

3. **japónicus,** Thunb. (*Calystègia pubéscens,* Lindl.). California Rose. Fig. 1047. Hardy perennial herbaceous twiner: growth very vigorous, often 20 ft.: whole plant more or less densely and minutely pubescent: lvs. hastate, lanceolate, obtuse or broadly acute, with angular or rounded lobes at the base, variable, occasionally without lobes, rarely sharp lanceolate: fls. bright pink, 1–2 in. broad, produced freely during the summer months and remaining expanded for several days. Japan and E. Asia. The double form is now naturalized from S. E. N. Y. to D. C. and Mo. P.M. 13:243. F.S. 2:172. B.R. 32:42.—The double form is completely sterile, with narrow wavy petals, irregularly arranged, the outer somewhat lacerate. A valuable decorative plant for covering stumps and walls. In rich soil the roots spread rapidly, and will smother out all other plants unless confined in tubs. The *Calystegia pubescens* of Lindley has been wrongly referred to *Ipomœa hederacea,* but the two plants are very different, the former being perennial and the latter annual. See Journ. Hort. Soc. 1:70 (1846). The plant is commonly confounded with *C. Sepium.*

4. **occidentàlis,** Gray. Hardy perennial, herbaceous or with suffrutescent base: st. twining, several feet high, glabrous or minutely pubescent: lvs. from angulate-cordate, with a deep and narrow sinus, to lanceolate-hastate, the posterior lobes often 1–2-toothed: peduncle 1-fld. or proliferously 2–3-fld., bracts ovate or lanceolate, usually completely inclosing the calyx, variable; corolla white or pinkish, 1–2 in. long; stigmas linear. Dry hills, Calif.—Listed as early as 1881. An admirable plant for rockeries. Several related species are native also to Calif.: *C. cyclostègius,* House, *C. Binghamiæ,* Greene, *C. polymórphus,* Greene, *C. Greènei,* House, *C. áridus,* Greene, *C. purpuràtus,* Greene, *C. illecebròsus,* House, *C. graciléntus,* Greene, and *C. lóngipes,* Wats.

5. **Sèpium,** Linn. (*Calystègia Sèpium,* R. Br.). Rutland Beauty. Fig. 1048. Perennial trailer, 3–10 ft. long, glabrous or minutely pubescent: lvs. round-cordate to deltoid-hastate, the basal lobes divaricate, entire or angulate: fls. white, rose or pink, with white stripes. F.S. 8:826. B.M. 732. A.G. 12:638. Gn. 50:514.—A very variable species. Cosmopolitan in temperate regions. An insidious weed in moist soil. The native forms have been called *C. intèriar,* House, Rocky Mt. region; and *C. americànus,* Greene, in the eastern states, but are difficult to distinguish. Var. **rèpens,** Gray (*C. rèpens,* Linn.). Pubescent: sts. trailing or sprawling: the basal lobes of the lvs. obtuse or rounded. Coastal region from Que. to Fla.

AA. *Calyx without bracts: peduncle 1–6-fld. (Eucon-volvulus.)*

B. *St. prostrate, trailing, glabrous or minutely pubescent.*

6. **mauritánicus,** Boiss. Strong perennial roots: st. herbaceous, slender, prostrate, rarely branched, minutely villose: lvs. alternate, round-ovate, obtuse, short-petioled: fls. blue to violet-purple, with a lighter throat, 1–2 in. across, very handsome. Afr. B.M. 5243. F.S. 21:2183. Gn. 39:52.—A free bloomer through the summer. On dry banks each plant forms a dense tuft which throws up many graceful shoots. Not hardy north of Philadelphia.

7. **Scammònia,** Linn. Hardy perennial trailer, deciduous: st. angular, glabrous: lvs. cordate-sagittate, gray-green, the lobes entire or dentate: sepals glabrous, ovate, obtuse; corolla white, creamy or light pink. Asia Minor.—The large tap-roots supply the resinous cathartic drug scammony.

BB. *St. erect or ascending, silky.*

8. **Cneòrum,** Linn. St. shrubby, half-hardy, 1–4 ft. high: lvs. persistent, lanceolate or spatulate, silky gray: infl. a loose panicle, 1–6-fld.; fls. white or tinged with pink, borne freely during the summer. S. Eu.—Valuable as a pot-plant for greenhouse or window decoration, or trained to a warm wall. Confused with *C. oleæfolius.*

9. **oleæfòlius,** Desr. Tender perennial: lvs. linear-lanceolate, acute, slightly villose: fls. bright pink, borne freely in loose, umbellate panicles in the summer. Greece. B.M. 289 (as *C. linearis*).—Many plants now passing as *C. oleæfolius* are *C. Cneorum.* The latter may be distinguished by its broader, blunter, silvery-villose lvs., lighter-colored blossoms and taller growth.



1048. Convolvulus Sepium. (×¼)

10. **trícolor,** Linn. (*C. mìnor,* Hort.). Fig. 1049. Hardy annual: st. trailing, ascending 6–12 in., angulate, densely covered with long brown-

ish hairs: lvs. linear-oblong or subspatulate, obtuse or rounded at the apex, usually pubescent but sometimes glabrous, the margin ciliate towards the base: peduncle 3-fld., exceeding the lvs.; sepals ovate, lanccolate, villose, acute; limb of the corolla azure-blue, throat yellow, margined with white. S. Eu. B.M. 27.—One of the best annuals for the home border. Each plant covers a ground space of 2 ft., and blooms continuously throughout the summer. Fls. remain open all day during pleasant weather. There are many variously striped and spotted forms of this popular annual, none of which surpasses the type in beauty. A variety with pure white fls. is attractive. Other well-marked horticultural forms are: Var. **vittàtus**, prettily striped with blue and white. F.S. 3:298. R.H. 1848:121. Var. **compáctus**, dwarf, and valuable for pot culture. Gt. 47, p. 635. A 5-petaled form is also recorded. F.S. 8, p. 116, desc.



1049. Convolvulus tricolor. (×⅓)

11. **aùreus supérbus**, Hort. A tender perennial, but may be treated as an annual, since it flowers the first season from seed: st. trailing or twining, 4–5 ft. long: fls. golden. —Valuable as a greenhouse climber and for hanging-baskets. Not sufficiently described for identification.

C. althæòides, Linn. (C. italicus, Roem. & Schult.). St. prostrate, twining or climbing, if it finds support: upper lvs. pedatifid.; lower ovate-cordate, crenate, silvery: fls. pink. May–Aug. Medit. region. B.M. 359. F.S. 10:1021 (as var. argyreus). R.H. 1864:111.—*C. ambìgens*, House, native from Mont. to New Mex. and S. Calif., is a close relative to C. arvensis.—*C. arvénsis*, Linn. Slender perennial trailer, 1–3 ft. long, glabrous or nearly so: lvs. ovate-sagittate or hastate, variable: fls. white or pink. Eu. and E. Asia. Naturalized in old fields through the Atlantic states and Calif. A troublesome weed in cult. grounds.—*C. canariénsis*, Linn. Greenhouse evergreen: lvs. oblong-cordate, acute, villose: fls. violet-purple; peduncle 1–6-fld. Canary Isls. B.M. 1228.—*C. dahùricus*, Herb. (Calystegia dahuricus, Fisch.). Hardy deciduous twiner, 3–6 ft.: lvs. oblong-cordate, shortly acute: fls. pink or rose-violet. June, July. N. Eu. B.M. 2609. F.S. 10:1075.—*C. erubéscens*, Sims (C. acaulis, Choisy). Tender biennial: lvs. oblong, hastate, the basal lobes toothed: fls. small, 5-lobed, rose-pink. Austral. B.M. 1067. —*C. macrostègius*, Greene. The plants in the trade under this name may be referred to C. occidentalis.—*C. màjor*, Hort., not Gilib.= Ipomœa purpurea.—*C. ocellàtus*, Hook. Stove evergreen: limb of corolla white, 5-angled; throat reddish purple: lvs. sessile, linear, acute, 1-veined, villose. S. Afr. B.M. 4065.—*C. scopàrius*, Linn.—*C. Soldanélla*, Linn. Sts. prostrate: lvs. reniform: fls. pink or rose-colored. Sandy shores, Wash. to Calif.; also in Eu. and Asia.

S. W. FLETCHER.
H. D. HOUSE.†

COÒKIA: *Claucena.*

COONTIE: *Zamia integrifolia.*

COOPÈRIA (after Joseph Cooper, English gardener). *Amaryllidàceæ.* Tender bulbous plants with the habit of Zephyranthes but night-blooming.

Flowers fragrant, solitary, 2 in. or more across, waxy-white, tinged red outside, and more or less green within; the perianth subtended by a bract-like spathe, somewhat as in Iris; anthers erect in distinction to versatile in Zephyranthes: lvs. appearing with the fls. in summer, long, narrow, flat and twisted.—Only 2 or 3 species from Texas to New Mex. and Mex., usually growing in dry places. The bulbs should be taken up in autumn and stored during the winter in dry soil. Cult. easy and like zephyranthes.

A. *Neck of bulb short: perianth-tube 3½ in. long or more.*

Drúmmondii, Herb. EVENING STAR. Bulb roundish, 1 in. thick, with a short neck: lvs. narrowly linear, erect, 1 ft. long: peduncle slender, fragile, hollow, ½–1 ft. long; spathe 1½–2 in. long, 2-valved at the tip; perianth tube 3–5 in. long; limb ¾–1 in. long, white, tinged with red outside; segms. oblong, cuspidate. Prairies, of wide range. Var. **chlorosòlen**, Baker, has a perianth-tube stouter and tinged with green: limb longer and less wheel-shaped: lvs. a little broader. B.M. 3482.

AA. *Neck of bulb long: perianth-tube less than 2½ in. long.*

pedunculàta, Herb. GIANT PRAIRIE LILY. More robust than *C. Drummondii:* bulb with a longer neck, 2–3 in. long: lvs. about 6, 1 ft. long, ¼in. broad: peduncle about 1 ft. long; spathe 1–2-valved at the tip; perianth-tube shorter, 1½ in. long; limb nearly as long as the tube, tinged red outside. B.M. 3727. R.H. 1853:401.—The best species. Fls. larger, of purer color, and remaining open a day or two longer.

N. TAYLOR.†

COPAÍFERA (from *copaiba*, Brazilian name of the balsam derived from some of these trees). Syn. *Copaiba. Leguminòsæ.* Sixteen or more spineless trees of Trop. Amer., and Afr., with abruptly pinnate lvs., small mostly white, not papilionaceous fls. in panicles, interesting because several of them produce an oleo-resin known as copaiba. They are not in cult., except now and then in collections of economic plants.

COPERNÍCIA (from *Copernicus*). *Palmàceæ*, tribe *Corỳpheæ.* Tall fan-palms with their trunks frequently thickened above the base.

Leaves flabellate, the petiole often with small spines; the small young lvs. usually undivided, the older much cut palmately: spadix very much branched, the fls. single upon it or in small clusters; calyx tubular, more or less deeply 3-toothed: fr. globose or ovoid, 1-seeded. —Species about 8, all confined to Trop. Amer. *C. cerifera* is a valuable economic plant, the wood being among the hardest known, and the lvs. being the source of a valuable wax. For cult., see *Corypha.* G.C. II. 24:362. Beccari, Le Palme Americane, tribe Corypheæ, 1907.

cerífera, Mart. CARNAUBA PALM. St. 30–35 ft., with a small swelling near the base: lvs. 3–4 ft. wide, nearly round; rachis none; petiole convex below, concave above, the margins with rather thick spines: spadix erect or spreading, 5–6 ft. long and thrice branched; fls. in clusters on the spathe. Trop. S. Amer.—Not well known in the trade; see *Livistona.*

C. austràlis, Becc., a recently described species, said to be more hardy than C. cerifera, has been cult. at Riverside, Calif. Taller, 60–80 ft.; infl. densely woolly tomentose.

N. TAYLOR.

COPRA: material from the coconut, which see (p. 811).

COPRÓSMA (Greek name referring to the fetid odor of the plants). *Rubiàceæ.* Shrubs or small trees, often trailing, of New Zealand, Australia and Polynesia, sometimes planted for the pretty fruit or variegated leaves.

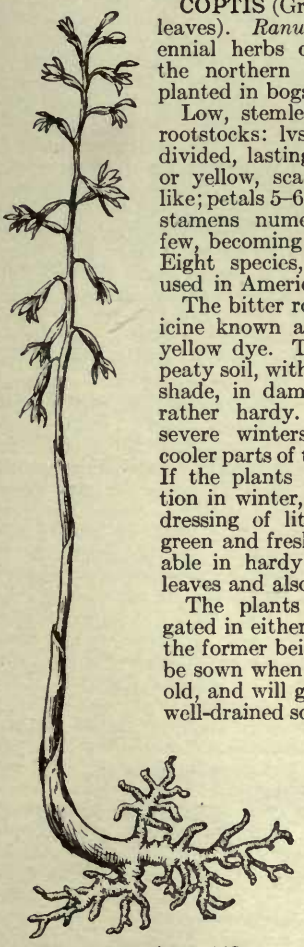
Leaves opposite, mostly small, stalked or almost sessile: fls. small, solitary or fascicled, white or greenish, dicœcious; corolla-limb 4–5-lobed, the lobes revolute; stamens 4–5: fr. an ovoid or globose usually 2-celled drupe.—About 60 species mostly in New Zeal., extending to Borneo, Hawaii and Juan Fernandez.

Coprosmas are greenhouse plants in the North, but they are rarely cultivated. Propagated by hardened cuttings. The soil which is found among kalmia roots, mixed with good loam and sand, if necessary, will suit these plants. Cuttings should be rooted in moderate heat in spring, before growth begins. If placed under a handlight or propagating-frame, care must be taken to prevent damping, to which the cuttings are liable. (G. W. Oliver.)

Baùeri, Endl. (*C. Baueriàna,* Hook. f.) Shrub or small tree, in exposed and rocky places in its native habitat sometimes not more than 1–3 ft. high and with branches nearly prostrate, in better conditions often a round-topped tree 20–25 ft. high: lvs. thick, shining green, 1–3 in. long, wide-ovate or oblong, obtuse or notched at the apex, the margins usually revolute: male fls. in dense heads on short axillary peduncles; females 3–6, the heads with shorter peduncles; calyx very small; corolla of female fls. tubular, 4-lobed. New Zeal.—In cult. there are two forms, both with variegated lvs.; one has lvs. broadly blotched creamy yellow, at times the green disappearing altogether (var. *variegàta* or *picturàta*); the other (*C. Stóckii,* Hort.) has lvs. blotched yellow-green on a deeper ground. *C. Baueri* is a favorite in S. Calif., and probably the only one grown there; thrives near the sea.

acerôsa, A. Cunn. Low and spreading, much branched, with minute lvs., small white fls., and pretty sky-blue drupes or berries. New Zeal.—Once catalogued in Calif.

Pètriei, Cheesem. Prostrate and creeping, forming mats, the branches to 1½ ft. long: lvs. ¼in. or less long, linear-oblong or -obovate, rigid and thickish: fls. solitary, on the ends of short erect branchlets, the males 4-toothed and without calyx, the females smaller, irregularly toothed and calyculate: drupe ⅓–½in. diam., mostly purplish. N. Zeal.—Mentioned abroad for cultivation. L. H. B.



1050. Corallorhiza multiflora. (×⅓)

CÓPTIS (Greek, *to cut,* from the cut leaves). *Ranunculàceæ.* Hardy perennial herbs of the cooler parts of the northern hemisphere, sometimes planted in bogs and moist places.

Low, stemless plants, with slender rootstocks: lvs. radical, compound or divided, lasting over winter: fls. white or yellow, scapose; sepals 5–7, petal-like; petals 5–6, small, linear, hood-like; stamens numerous: carpels stalked, few, becoming an umbel of follicles.—Eight species, only one of which is used in American gardens.

The bitter roots yield the tonic medicine known as "gold thread;" also a yellow dye. The plants should have peaty soil, with a little sand, and prefer shade, in damp situations. They are rather hardy. The roots withstand severe winters, being native of the cooler parts of the northern hemisphere. If the plants are given some protection in winter, as in a cold pit or by a dressing of litter, the leaves remain green and fresh. The plants are valuable in hardy borders because of the leaves and also the flowers.

The plants are very easily propagated in either early spring or late fall, the former being preferred. Seeds may be sown when ripe, before they become old, and will grow readily in moist but well-drained soil. They should be only slightly covered with soil but the surface should be kept moist by a close covering with leaves or paper, and partial shade is preferred. The seedlings may be transplanted at any time after the leaves are large, by keeping plenty of soil about the roots.

trifòlia, Salisb. No st.: rootstock yellow: lvs. compound, long-petioled; lfts. broadly obovate, cuneate, obtuse, the teeth mucronate: fl.-st. slender; sepals white, with yellow base; petals small, club-shaped: follicles 3–7, spreading, equaled by their stalk; seeds black. May–July. Adirondacks and westward. L.B.C. 2:173.—Neat and pretty, with shining lvs.

K. C. Davis.

CORAL BERRY: *Symphoricarpus vulgaris.*

CORAL DROPS: *Bessera elegans.*

CORALLORHÌZA (Greek for *coral-root*). *Orchidàceæ.* Coral-Root. Low orchids, growing in woods and parasitic on roots, destitute of green foliage, the plant usually brownish or yellowish and inconspicuous.

Flowers small, somewhat 2-lipped, usually obscurely spurred at the base; sepals and petals nearly alike; lip small, slightly adherent to the base of the column; pollinia 4.—Species few, in N. Amer., Eu. and Asia. The coral-roots have little merit as garden plants, although very interesting to the student. They may be grown in rich, shady borders. Two species have been offered by dealers in native plants. **C. multiflòra,** Nutt. (Fig. 1050), is purplish, 1½ ft. or less high, 10–30-fld., lip deeply 3-lobed: grows in dry woods in northern states; **C. Mertensiàna,** Bong., scape many-fld., 8–15 in. high, the lip entire and broadly oblong: occurs in Brit. Col. and north to Alaska. **C. odontorhìza,** Nutt., provides what is known as crawley-root, said to be used for its diaphoretic and febrifuge properties: it is a slender plant, in woods S., but extending north as far as Canada, light brown or purplish, 6–7 in. tall: lip nearly or quite entire, white spotted with crimson.

L. H. B.

CORAL-PLANT: *Jatropha.*

CORAL-ROOT: *Corallorhiza.*

CORAL-TREE: *Erythrina.*

CÓRCHORUS (name refers to some reputed virtue, as an eye remedy, of one of the species). *Tiliàceæ.* Shrubs or herbs of the tropics, two of which supply jute.

The jute plants are *C. capsularis* Linn. and *C. olitorius,* Linn. The latter differs from the *C. capsularis* in having an elongated, not semi-globose, pod. B.M. 2810. They are annual plants, natives of Asia but cult. throughout the tropics, growing 10–12 ft. high, with a straight st. as thick as the little finger and branched only at the top. Fls. small, yellow, with 4–5 glandless petals and a slender caps., or sometimes the caps. is globose. The young shoots of both are used as pot herbs. *C. olitorius* is much grown for this purpose in Egypt, and is known as Jews' mallow. Jute is made from the fibrous bark of these and other species of Corchorus. It is released from the sts. by retting in stagnant pools. See Cyclo. Amer. Agric., Vol. II, pp. 282, 507.

C. Baldáccii, Fedde, has very recently been mentioned in foreign horticultural literature. It is described as a perennial, woody at the base: lvs. linear-elliptic, pilose above and white-tomentose beneath: fls. solitary, axillary and minute. Italian Somaliland.

The corchorus of trade lists is likely to be Kerria.

CÓRDIA (an early German botanist, Valerius Cordus, born 1515). *Boraginàceæ.* Warm-climate trees, shrubs or almost herbaceous, sometimes planted.

Leaves mostly alternate, petioled, entire or dentate: fls. in dense heads or clusters or scirpioid cymes, perfect or polygamous, the corolla usually white or orange; calyx tubular or campanulate, toothed or lobed; corolla tubular, funnelform or salverform, lobed, the parts and the stamens 4 or more; style 4-lobed: fr. a drupe which is 4-loculed and usually 4-seeded.—Species about 230 in tropical and subtropical regions, mostly

in the western hemisphere. Some of them are vines; some are herbaceous above the base. Species confused.

The cordias are greenhouse plants with showy flowers of easy culture. Grown in the open in the extreme South. Propagated by cuttings of firm wood and by seeds.



1051. Cordia Greggii var. Palmeri. (×⅓)

Sebestèna, Linn. (*C. speciòsa*, Willd.). GEIGER TREE. Tall evergreen shrub or small tree, hairy, with rough, ovate, entire or undulate stalked lvs.: fls. 1–2 in. long, orange or scarlet, stalked, in large open terminal clusters, the crumpled corolla-lobes and stamens 5–12: drupe inclosed in the hazel-like husk formed by the persistent calyx. Keys of Fla. and south. B.M. 794.

Gréggii, Torr. Much-branched shrub, to 8 ft.: lvs. less than 1 in. long, pale, obovate, obtuse, dentate, rugose, long-cuneate at the base: fls. more than 1 in. across, white, in few-fld. contracted capitate clusters but becoming looser as flowering proceeds; corolla-lobes obtuse; stamens 5 or 6, scarcely half the length of the corolla. Mex. Var. **Pálmeri,** Wats. (Fig. 1051, adapted from G.F. 2:233) has more broadly funnel-form corolla, the limb 1¼ in. broad: lvs. somewhat larger, ovate-oblong and abruptly cuneate at the base, acute or obtuse at the apex. Mex.—Deserving of planting in the southwest country, if hardy.

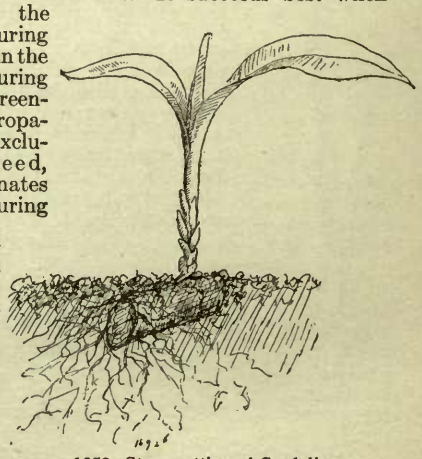
Other cordias are likely to come into cult. in the southern country. Some of them yield drugs, many of them produce useful timber, and some have edible frs. There are numbers of species in Porto Rico and others of the W. Indies.—*C. Fráncisci*, Tenore. Tall: lvs. dark green: fls. white. S. Amer.—*C. Mýxa*, Linn., from Trop. Asia and Austral., is one of the best woods for kindling fire by friction, and is useful in many other ways.

L. H. B.

CORDYLÎNE (*club-like*, referring to the fleshy roots). *Liliàceæ*. DRACENA. DRACENA PALM. Greenhouse plants closely related to Dracæna; planted in the open in California and similar climates.

Stems tall, often woody and palm-like, bearing large crowded lvs., to the striking variegation of which the group owes its value: fls. panicled; stamens 6; pedicels articulated; perianth 6-parted; ovary 3-celled: fr. a berry.—Cult. for the ornamental foliage. The horticultural forms and names have become very numerous. The various species are in the trade under Dracæna, which see for a key to the species of both genera combined. From Dracæna, Cordyline differs in the ovary containing several ovules in each cell, and the solitary pedicels being provided with a 3-bracted involucre. In the following paragraphs, the initial D. indicates that the plant in question is known in the trade as a Dracæna, and C. that it is known as a Cordyline (see *Dracæna*). For a monograph, see Baker, Journ. Linn. Soc. 14:538 (1875).

Of cordylines or dracænas, propagation is usually effected by cutting the ripened stems or trunks, from which all leaves have been removed, into pieces from 2 to 4 inches long. These are laid either in very light soil or in sand in the propagating-bed, where they receive a bottom heat of about 80°, being barely covered with sand or moss (Fig. 1052). The eyes soon start into growth, and, as soon as they have developed about six leaves, these shoots are cut off with a small heel and again placed in the propagating-bed until rooted, after which they are potted off into small pots in light soil, kept close until they become established. They are then shifted on into larger pots as soon as well rooted. They delight in a mixture of three parts good turfy loam and one part well-decayed cow-manure, with a liberal sprinkling of sharp sand. A warm, moist atmosphere suits them best while growing, but towards fall the finished plants must be gradually exposed to full sunshine and a dry atmosphere, which develops their high colors. The kinds enumerated below are such as are mainly grown in large quantities for decorative purposes, and are sold principally during the winter months, especially during the holiday season, when plants with bright-colored foliage are always in strong demand: *C. amabilis.*—A strong-growing form with broad green foliage, which is prettily variegated with white and deep rose. One of the hardiest varieties, either for decorations in winter or for outdoor work, vases, and the like in summer. *D. fragrans.*—An African species with broad, massive, deep green foliage which makes noble decorative plants, being frequently grown into specimens from 6 to 8 feet high. Its foliage is of heavy texture, making it a useful plant for the dry atmosphere of a living-room. Two handsomely variegated forms of the above are *D. Lindenii* and *D. Massangeana*, both very desirable varieties. *C. terminalis.*—This is the most popular species, and is grown in immense quantities. The foliage on well-matured plants is of an intense rich crimson marked with lighter shadings. *C. australis* (commonly called *C. indivisa*).—Used principally as an outdoor decorative plant in summer, being extensively used for furnishing vases, window-boxes, and the like. It succeeds best when planted out in the open border during summer, potted in the fall and stored during winter in a cool greenhouse. It is propagated almost exclusively from seed, which germinates freely if sown during the early spring months in sandy soil, in a temperature of 60° to 65°, growing them on during the first season in small pots. These, if planted in the open border the second season, make



1052. Stem-cutting of Cordyline.

fine plants for 6- or 7-inch pots. There are a number of varieties of *C. australis*, among them several handsomely variegated bronze-colored forms, which, however, are but little distributed yet. Among the principal varieties and species besides the above which are grown in a commercial way are: Baptistii, Shepherdii, stricta grandis, Youngii, Goldieana, Lord Wolseley, De-Smetiana, Sanderiana, Godseffiana, and Mandæana. (J. D. Eisele.)

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A. *Foliage of sessile, thick, sword-shaped lvs.*

B. *Lvs. glaucous beneath, broad.*

1. **indivìsa,** Kunth. Arborescent, 10–20 ft. high: lvs. dark green, densely crowded, 2–6 ft. long, 4–6 in. broad at the middle, 1½–2 in. at the base, rigid, very coriaceous; midrib stout, colored red and white, veins on each side of it 40–50: panicle nodding; bracteoles lanceolate, 3–4 lines long, membranous; perianth 3–4 lines long, white; tube very short, campanulate; segms. equal, sharply recurved: berries ¼in. diam., blue; ovules 5–6 in each cell. New Zeal. Gn. 49, p. 86. Lowe, 52.—Coolhouse; valuable for vases. Rare in cult. See *C. australis*, No. 4.

BB. *Lvs. green on both sides, narrower.*

2. **strícta,** Endl. (*D. congésta*, Hort.). Slender, 6–12 ft. high: lvs. less crowded than in the next, acuminate, 1–2 ft. long, 9–15 lines wide, base 3–6 lines wide, scarcely costate; veins scarcely oblique, margins obscurely dentate: panicle terminal and lateral, erect or cernuous; pedicels ½–1 line long; lower bracteoles lanceolate; perianth lilac, 3–4 lines long, campanulate, interior segms. longer than the outer; ovules 6–10 in each cell. Austral. B.M. 2575. G.C. III. 17:207.—Coolhouse, vases, and the like. Var. **grândis,** Hort. Large, highly colored. Var. **díscolor,** Hort. Like var. *grandis*, but with foliage dark bronzy purple.

3. **austràlis,** Hook. (*D. indivìsa*, Hort. *D. calocòma*, Wend.) Fig. 1053; 359, Vol. I. Arborescent, 15–40 ft. high: lvs. densely rosulate, 1½–3 ft. long, 1½–2½ in. wide; base 6–12 lines wide, acuminate, green; midrib firm, indistinct, nerves on each side of it 12–20, scarcely oblique: panicle drooping or erect, terminal, ample; pedicels very short; bracteoles deltoid, ½ line long; perianth white, 3–4 lines long; tube short, campanulate, segms. nearly equal, recurved: berry white or bluish-white; mature seeds often solitary. New Zeal. B.M. 5636. G.C. III. 23:153. Gn. 47, p. 312; 48, p. 197. I.H. 35:40 (as var. *Doucetiana*); 37:114 (as var. *Dalleriana*); 40:190 (as *C. lineata* var. *purpurascens*). S.H. 1, p. 487.—Coolhouse, vases. Var. **aùrea-striàta,** Hort. Variegated with a number of longitudinal yellow stripes. Var. **atropurpùrea,** Hort. Base of lf. and under side of midrib purple. Var. **lineàta,** Hort. Lvs. broader, the sheathing base stained with purple. Var. **Veìtchii,** Hort. (*D. Veìtchii*, Hort.). Base of lf. and under side of midrib bright crimson. *C. Hoòkeri*, Hort., was a garden form of this species.—Much of the *C. indivisa* of the American trade has been, in the past, *C. australis*. Known as "cabbage tree" to residents of New Zealand.

AA. *Foliage of petioled lvs.*

B. *Lvs. oblanceolate; petioles broad.*

4. **rùbra,** Hugel. Slender, 10–15 ft. high: lvs. contiguous, ascending, 12–15 in. long, 18–21 lines wide above the middle, thick, dull green both sides, distinctly costate; veins oblique; petiole broad, deeply grooved, 4–6 in. long: panicle lateral, nodding; pedicels very short; bracteoles small, deltoid; perianth lilac, 4½–5 lines long, inner segms. longer than the outer; ovules 6–8. Country unknown.—Cool-house, vases. *D. Bruántii*, Hort., was a garden form of this species. R.H. 1897, pp. 514, 515. G.C. III. 22:285. G.W. 12, p. 230.

BB. *Lvs. lanceolate; petioles narrow, nearly terete.*

5. **Haageàna,** Koch (*C. Múrchisoniæ*, F. Muell.). Slender and small: lvs. contiguous, ascending, oblong-falcate, 4–8 in. long, 2–2½ in. wide at the middle, acute, base rounded or deltoid, thick, dull green throughout, distinctly costate; veins slender, oblique; petiole 3–4 in. long, deeply channelled: panicle lateral; pedicels 1½–2 lines long; perianth 4–4½ lines long, tinged with lilac; ovules 6–8 in each cell. Austral.



1053. Cordyline australis—C. indivisa of the trade.

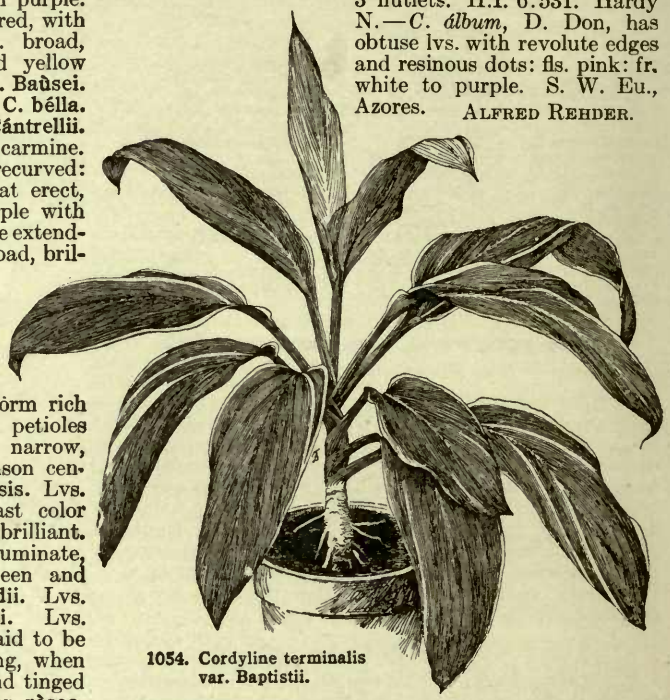
6. **terminàlis,** Kunth. Low and slender, 3–8 ft. high: lvs. contiguous, ascending, green or rarely colored, 12–30 in. long, 2–5 in. wide, elliptical or elliptic-lanceolate, acute, thickish, distinctly costate; veins frequently unequal, strongly oblique; petiole 4–6 in. long, deeply channelled: pedicels very short or none; bracteoles deltoid, membranous; perianth 5–6 lines long, white, lilac, or reddish, segms. short; ovules 6–10 in each cell: berry large, red. E. Indies. A.G. 16:361. B.R. 1749. Var. **cannæfòlia,** Baker (*D.* and *C. cannæfòlia*, Hort.). Lvs. oblanceolate, 12–15 in. by 2–2½ in.: perianth 2 lines long; segms. twice the length of tube. Var. **férrea,** Baker (*D.* and *C. férrea*, Hort.). Lvs. narrow, oblanceolate, 2–2½ in. broad, dull purple or variegated; petiole short: fls. much as in the typical form, but redder and often smaller. B.M. 2053.—*C. Guilfòylei* is a form with lvs. tapering both ways, recurved, striped with red, pink or white; white on lower part of lf. and margin of petiole. I.H. 19, p. 249. Var. **Tì,** Baker (*D. braziliénsis*, Schult. *C. Eschscholziàna*, Mart.). Robust: lvs. large, mostly oblong, 4–6 in. wide: panicle large, lower branches compound; perianth 6 lines long, lilac; segms. as long as the tube.—*D. imperiàlis*, Hort., is a form with lvs. arching or erect, thick, deep metallic green, rayed all over with bright crimson or pink, handsome. *D. regìnæ*, Hort.,

belongs here. The varieties of this species in cult. are almost innumerable. Names that have been used for those in the American trade, usually considered as horticultural species, though many of these names are now no longer used, are as follows: **C. amábilis.** Lvs. broad, shining deep green, in age becoming spotted and suffused with rose and white. **C. amboyénsis.** Lvs. oblong-lanceolate, recurved, deep bronze-green, edged with rose-carmine below; petioles tinged with purple. **C. anerliénsis.** Lvs. very broad, deep bronze-red, with some white. **C. Baptístii.** Fig. 1054. Lvs. broad, recurved, deep green, with some pink and yellow stripes: sts. also variegated. I.H. 26:334. **C. Baûsei.** Lvs. broad, dark green, with some white. **C. bélla.** Lvs. small, purplish, marked with red. **C. Cántrellii.** Lvs. dark metallic crimson, young ones bright carmine. **C. Coòperi.** Lvs. deep wine-red, gracefully recurved: common in cult. **C. Frâseri.** Lvs. somewhat erect, broad, oblong, abruptly acute, blackish purple with bloom, margin below with a deep rosy lake stripe extending down the petiole. **C. Glâdstonei.** Lvs. broad, brilliant crimson. **C. hýbrida.** Lvs. broad, variegated, deep green margined with rose, in age deep rose, creamy white in young lvs. **C. jardiniére** (*C. terminalis alba* × *C. Guilfoylei*). Lvs. very small and compact, narrow, green broadly margined with white. **C. metállica.** Lvs. erect-arching, oblong, when young uniform rich coppery purple, in age dark purple-bronze; petioles same. F.M. 1872:24. **C. nìgro-rûbra.** Lvs. narrow, linear-lanceolate, dark brown with rosy crimson centers, young often entirely rose. **C. norwoodiénsis.** Lvs. striped with yellow, green and crimson, last color principally confined to the margin; petioles brilliant. **C. Robinsoniàna.** Lvs. long lanceolate-acuminate, arched, light green, striped with bronze-green and brownish crimson. I.H. 26:342. **C. Schúldii.** Lvs. broad, variegated. F.E. 7:961. **C. Scóttii.** Lvs. broad, arching, deep green, crimson edged; said to be a hybrid. **C. Yoúngii.** Lvs. broad, spreading, when young bright green streaked with deep red and tinged with rose, in age bright bronze. **C. Yoúngii** var. **ròsea,** Hort. Green, tinged with pink, white or carmine. **C. Yoúngii** var. **álba,** Hort. Variegated with white instead of red. Crosses with *C. Scottii* are known as *C. stricta, C. albo-lineata,* Mrs. George Pullman, Mrs. Terry; with *C. norwoodiensis,* as Little Gem.

C. angústa, Hort. (C. terminalis var.). Lvs. narrow, arching, dull dark green above, purplish beneath. A slender form.—*C. angustifòlia,* Kunth=C. stricta.—*C. aurantiaca,* Hort.=(?).—*C. Balmoreàna,* Hort. Lvs. bronzy with white and pinkish stripes.—*C. Bánksii,* Hook. Lvs. very long, linear-lanceolate, 3–5 ft. long, 2–3 in. wide, petioled, green, glaucous beneath; veins conspicuous. G.C. III. 18:613.—*C. Berhéleyi,* Hort.=(?).—*C. Cassanòvæ,* Hort. =(?).—*C. Chélsonii,* Hort. (form of C. terminalis). Lvs. large, glossy dark green, almost black, becoming suffused and edged with crimson. I.H. 19, p. 90.—*C. compácta,* Hort. (C. terminalis form). Lvs. recurved, broad, dull green, with bronze and rose stripes in age.—*C. Dénnisonii,* Hort. (C. terminalis form). Dwarf: lvs. broad, bronzy purple.—*C. Elizabethiæ,* Hort.=(?).—*C. excélsa,* Hort. (C. terminalis form). Lvs. broad, arching, bronzy, margined with crimson.—*C. Frederica.*=(?).—*C. frutéscens*=(?).—*C. gloriòsa* Hort. (C. terminalis form). Lvs. very large and broad, green, with a peculiar bronze-orange hue.—*C. helychioìdes,* F. Muell.=C. terminalis.—*C. heliconiæfòlia,* Otto & Diet.=C. terminalis.—*C. Héndersonii,* Hort.=(?).—C. *magnífica,* Hort. (C. terminalis form). Lvs. large and broad, bronzy pink, becoming darker.—*C. Mánners-Súttoniæ,* F. Muell.=C. terminalis.—*C. Màyi,* Hort. Lvs. green, margined with red; young lvs. wholly red.—*C. porphyrophýlla,* Hort. (C. terminalis form). Lvs. deep bronzy purple, glaucous beneath.—*C. Réx,* Hort. (C. terminalis form). Lvs. medium width, bronzy green, flushed purple and streaked with carmine.—*C. rosàcea,* Hort. (C. terminalis form). Lvs. recurved, broad, dark bronzy green margined with pink.—*C. Rúmphii*=D. Hookeriana. —*C. Salmònea*=(?).—*C. sepìaria,* Seem.=C. terminalis.—*C. Sièberi,* Kunth=C. terminalis.—*C. spléndens,* Hort. (C. terminalis form). Lvs. dense, short, ovate-acute, bronzy green, shaded with rose-carmine.—*C. zeelándica,* Hort.=C. rubra.

K. M. WIEGAND.

CORÈMA (Greek, *a broom,* in allusion to its bushy habit). *Empetràceæ.* BROOM CROWBERRY. Two species of low heath-like shrubs from E. N. Amer. and S. W. Eu. and the Atlantic Isls., of which the American species is rarely cult. in botanical collections. Closely allied to Empetrum and differing chiefly in the apetalous fls. arranged in terminal heads, and in their upright bushy habit. Cult. and prop. like Empetrum. **C. Cónradii,** Torr., is a much-branched shrub, to 2 ft. high, with crowded linear lvs. about ⅓in. long: fls. inconspicuous, in terminal heads, the staminate with long exserted purple stamens: fr. a small berry-like drupe, usually with 3 nutlets. H.I. 6:531. Hardy N.—*C. álbum,* D. Don, has obtuse lvs. with revolute edges and resinous dots: fls. pink: fr. white to purple. S. W. Eu., Azores. ALFRED REHDER.



1054. Cordyline terminalis var. Baptistii.

COREÓPSIS (Greek, signifying *bug-like,* from the fruit). Including *Calliópsis. Compósitæ.* TICKSEED. Annual or perennial herbs, flowering in summer or autumn, nearly all natives of eastern North America, some of them popular as flower-garden subjects.

Leaves opposite or rarely alternate: heads pedunculate and radiate; the broad involucre with bracts of 2 distinct series, the outer narrower or shorter and more herbaceous, the inner broad triangular-ovate or oblong, thin, yellowish green or purplish, and striate; receptacle chaffy; rays very showy, yellow, particolored or rarely rose, neutral; disk-fls. yellow, dark or brown; pappus of 2 weak bristles or scales, or a low crown or none: achenes often winged.—The genus differs from Bidens only in the reduced or obsolete, not stiff-awned pappus, and lf.-segms. not serrate. Many of the species are in the trade under the name Calliopsis. Other genera with this peculiar involucre are Hidalgoa, Dahlia, Thelesperma, Cosmos, and Leptosyne. All the kinds are of easiest cult. The perennials are hardy border plants. The annuals are raised in any garden soil, and bloom freely with little care. They are all showy plants, of 50–70 species.

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A. *Rays cuneate, tobed.*

B. *Disk yellow; rays rose-purple.*

1. rósea, Nutt. Perennial: diffusely branched from slender, creeping rootstocks, 1–2 ft. high, smooth: lvs. all narrowly linear, entire or with a few linear teeth or lobes: heads small, about 1 in. broad or less, short-peduncled; rays narrowly wedge-shaped, lobed at the apex: achene narrowly oblong, wingless; pappus an obscure border. Mass. to Ga.

BB. *Disk and involucre dark purple; rays yellow or particolored, wedge-shaped and lobed.*

C. *Outer involucral bracts very short, lanceolate or triangular.*

D. *Lvs. entire: achenes with lacerate wings and setiform pappus.*

2. angustifòlia, Ait. (*C. dichótoma,* Michx. *C. linifòlia,* Nutt.). Perennial: strict and tall, 1–3 ft. high, glabrous, sparsely branched at the summit: lvs. entire, thickish; basal oblanceolate to narrowly spatulate, long-petioled; lower cauline elliptical on long petioles; upper narrowly spatulate or linear, sessile or reduced to bracts: heads 1–1½ in. broad; rays entirely yellow. S. U. S.

DD. *Lvs. divided: achenes and pappus not as above.*

3. cardaminefòlia, Torr. & Gray. Annual: low and diffusely much branched from the base, 6–24 in. high, glabrous: numerous basal and lower cauline lvs. petioled, pinnatifid, divisions several pairs, short, oval, elliptical, rarely linear, often again divided; upper cauline nearly sessile with narrower and fewer divisions: heads as in No. 5, but smaller, and often entirely dark: achenes broader, winged; pappus minute or none. S. U. S. Gn. 29, p. 498; 37, p. 203.

4. Atkinsoniàna, Douglas. Perennial or annual: st. tall, 2–4 ft. high: lvs. pinnatifid, the divisions linear: heads as in the next: achenes with narrow wing or scarious margin; pappus composed of 2 short, subulate teeth. Autumn-flowering. S. W. U. S. B.R. 1376.



1055. Coreopsis tinctoria—Calliopsis elegans of gardens. (×½)

5. tinctòria, Nutt. (*C. bicolor,* Reichb. *C. élegans,* Hort. *Calliópsis marmoràta,* Hort.). Fig. 1055. Annual: st. tall, strict, 1–3 ft. high, branched, glabrous: basal lvs. few or wanting; cauline petioled, the upper sessile, pinnatifid, divisions from narrowly elliptical to often again divided and narrowly linear: heads ¾–1½, rarely 2, in. broad; rays with dark purple base: achenes oblong, wingless; pappus none. Cent. U. S. B.M. 2512 B.R. 846. Mn. 1, p. 85.—A common garden annual; showy and good. Var **nàna,** Hort. Dwarf, low and compact. Gn. 29, p. 499. Tom Thumb varieties. Var. **atropurpùrea,** Hook. (*C. nìgra,* Hort.). Rays almost entirely dark. B.M. 3511.



1056. Coreopsis lanceolata. (×½)

CC. *Outer involucral bracts narrowly linear, about equaling the inner.*

6. Drúmmondii, Torr. & Gray (*C. diversifòlia,* Hook. *C. pícta,* Hort.). Golden Wave. Annual: st. branched above, 10–24 in. high: lvs. petioled below, sessile above, pinnatifid, divisions few, short, broadly elliptical, those of the upper lvs. linear: heads 1–2 in. broad, large; rays usually dark at the base: achene oval, wingless, margin cartilaginous incurved; pappus none. Texas. B.M. 3474. S.B.F.G. II. 4:315. Gn. 26, p. 461; 29, p. 498; 37, p. 203; 43, p. 397. G.M. 54:13. G. 16:58.

BBB. *Disk yellow or brown; rays entirely yellow (except No. 7); peduncles long.*

C. *Style-branches acute or obtusish, not acuminate: dark lines at base of rays.*

7. coronàta, Hook. Annual: low and often weak, 12–24 in. high, much branched from the base, sparsely hirsute: lvs. thick; the basal usually numerous, petioled, pinnatifid or entire, divisions elliptic, rather obtuse, lateral divisions smaller; the cauline lvs. few, spatulate, often entire: heads 1½–2 in. broad; rays with a few dark lines above the orange base; outer involucre a third to a half shorter than the inner: achene orbicular, broadly winged, often echinate, with a thickened callus at base and apex on inner face; pappus very minute. Texas. B.M. 3460. S.H. 1:270. Gn. 26, p. 461; 29, p. 499.

CC. *Style-branches cuspidate-acuminate: rays entirely yellow.*

8. pubéscens, Ell. (*C. auriculàta,* Schkuhr & Hort., not Linn.). Perennial: tall, 1–4 ft. high, branched above, pubescent or nearly glabrous, leafy throughout: lvs. thickish, oval to lanceolate, very acute, petioled or nearly sessile, entire or with small, acute, lateral lobes; basal few: heads 1½–2½ in. broad; outer involucre nearly as long as the inner: achenes and pappus similar to those of the next species. S. U. S. Gn. 37, p. 202.

9. lanceolàta, Linn. Fig. 1056. Perennial: low, 1–2 ft. high, sparingly branched, glabrous or nearly so, leafy toward base: lvs. few, large, oblong-spatulate to linear, petioled, barely acute, upper entire, lower usually pinnatifid, divisions very distant: heads 1½–

2½ in. broad; peduncles very long; outer involucre equaling the inner or one-half shorter: achenes orbicular, papillose, broadly winged; pappus of minute scales or obsolete. E. U. S. Gn. 25, p. 165; 33, p, 7; 37, p. 203. G.W. 10, p. 22. V. 18:102.—Used extensively for cut-fls.

Var. **glabélla,** Michx. (var. *angustifòlia,* Torr. & Gray). Low: sts. scapiform: lvs. narrow and crowded at base of st., 2–4 lines wide.

Var. **villòsa,** Michx. (*C. oblongifòlia,* Nutt.). Lvs. spatulate-obovate to oblong, villous, as is also the st., with jointed hairs.



1057. Coriaria japonica. (×⅓)

10. **grandiflòra,** Nutt. (*C. lóngipes,* Hook. *C. Boykiniàna,* Nutt.). Perennial; simple or branched, glabrous, 1–2 ft. high, leafy throughout: basal lvs. few, lower lvs. spatulate or lanceolate, entire, upper divided into several linear entire divisions: heads 1–2½ in. broad: achene orbicular, papillose, broadly winged; pappus of 2 small scales. S. U. S. B.M. 3586. Gn. 47:7; 62, p. 338. Mn. 5:201. G. 29:461. J.H. III. 57: 479. Gn. W. 23:349; 26:113.

AA. *Rays elliptical, entire or toothed at apex.*

B. *Color of rays pale yellow: lvs. petioled.*

11. **trípteris,** Linn. Perennial; very large and stout, 4–8 ft. high, branched above, glabrous: lvs. petioled, 8 in. or less long, trifoliate, or rarely irregularly 5–7-foliate, divisions lanceolate: heads medium, rays pale, disk-fls. yellow or dark purple: achene oblong, narrowly winged; pappus a fimbriate border. Cent. U. S.

BB. *Color of rays deep yellow: lvs. sessile.*

C. *Lvs. 3-cleft to below middle; base entire, 3-ribbed.*

12. **palmàta,** Nutt. (*C. prǽcox,* Fresen.). Perennial; tall and stout, 1½–3 ft. high, sparingly branched at the summit: lvs. thick, cuneate, 2½ in. long, divisions broadly linear, often irregularly again divided: heads 1½–2½ in. broad: achenes oblong, narrowly winged; pappus minute or obsolete. Cent. U. S. R.H. 1845:265.

CC. *Lvs. divided to the base.*

D. *The lvs. 3-divided, divisions entire, ½–1 in. broad.*

13. **màjor,** Walt. (*C. senifòlia,* Michx.). Perennial; tall and stout, 2–3 ft. high, pubescent, much branched above: basal lvs. wanting, lower cauline small, upper 2–3 in. long, palmately 3-divided, divisions equal, lanceolate, acute: heads 1¼–2 in. broad; rays deep yellow; disk-fls. yellow: achenes obovate-elliptical, winged, summit 2-toothed. S. E. U. S.

Var. **Òemleri,** Brit. Smooth: lf.-divisions more attenuate at the base. B.M. 3484 (as *C. senifolia*).

Var. **lineàris,** Small. Smooth: lf.-divisions narrow, 2–4 lines wide.

DD. *The lvs. dissected, divisions ⅓–3 lines wide.*

14. **delphinifòlia,** Lam. Perennial; glabrous, branched above, 1–3 ft. high: lvs. sessile, 2–3 in. long, basal wanting, ternately divided, divisions dissected into linear-filiform segms., which are 1–3 lines wide: head 1–2½ in. broad; disk dark: achene oblong-obovate, narrowly winged; pappus-teeth short. S. E. U. S.

15. **verticillàta,** Linn. (*C. tenuifòlia,* Ehrh.). Perennial; sparingly branched, 1–3 ft. high: basal lvs. wanting; cauline, sessile, similar to the last but segms. only ⅓–⅔ lines wide: heads 1–2 in. broad; disk yellow: achenes oblong-obovate, narrowly winged; pappus nearly obsolete. E. U. S.

C. aristòsa, Michx., *C. aùrea,* Ait., and *C. trichospérma,* Michx., are now placed under Bidens (which see).—*C. atropurpùrea,* Hort. =Thelesperma sp.—*C. auriculàta,* Linn. (C. diversifolia, DC.). Perennial: low, stoloniferous, hirsute: lvs. petioled, short, oval, mostly entire: heads large, very long-peduncled: probably not in the trade. S. U. S.—*C. bélla,* Hutchins. Undershrub about 3 ft. high. British E. Afr.—A very handsome species.—*C. Grántii,* Oliv. A compact bushy plant about 2 ft. high. Fls. in the winter. Trop. Afr. B.M. 8110. G.C. III. 39:162. Gn. 69, p. 161.—*C. Léavenworthii,* Torr. & Gray. Annual: lf.-divisions linear-spatulate: rays cuneate, lobed, yellow; awns 2, slender: achene winged. Fla.—*C. nudàta,* Nutt. Perennial, rush-like: lvs. mostly basal, long, filiform: rays rose-colored: wing of achene pectinate. S. U. S. —*C. radiàta,* Hort. Plant very dwarf: fl.-heads with ray-florets rolled up. Of garden origin.

K. M. Wiegand.

CORIANDER is the seed-like fruit of *Coriandrum sativum,* Linn., an umbelliferous annual of southern Europe. The plant grows 1 to 3 feet high, glabrous, strong-smelling, with leaves divided into almost thread-like divisions, and small white flowers. The plant is easily grown in garden soil. It occasionally becomes spontaneous about old yards. The seeds (fruits) are used as seasoning and flavoring in pastries, confections and liquors, although they are less known in this country than caraway. The plant is sometimes grown in American gardens with sweet herbs and other things.

CORIÁNDRUM: *Coriander.*

CORIÀRIA (*corium,* skin, leather; a shrub used for tanning leather was described as *frutex coriarius,* by Pliny). *Coriariàceæ.* Shrubs or perennial herbs grown chiefly for their ornamental fruits.

Leaves deciduous, entire, 3–9-nerved, opposite and distichous: fls. polygamous-monœcious in slender racemes, small; petals and sepals 5; stamens 10: fr. berry-like, consisting of 5 1-seeded nutlets inclosed by the enlarged and colored petals.—About 8 species in Himalayas and E. Asia, Medit. region, N. Zeal. and S. Amer. Ornamental shrubs or herbs, with slender arching branches imitating pinnate lvs., and with very showy yellow, red or black fr. The lvs. of some species are used for tanning leather; the frs. are poisonous in some species, edible in others. *C. japonica* has proved hardy with slight protection in Mass., and *C. terminalis* seems to be of the same hardiness; the other species are more tender. They grow in almost any good garden soil, and prefer sunny position. Prop. readily by seeds and greenwood cuttings in summer under glass; also by suckers and layers.

japónica, Gray. Fig. 1057. Shrub, 2–3, sometimes to 10 ft.: branches quadrangular: lvs. nearly sessile, ovate or ovate-lanceolate, 3-nerved, smooth, 2–4 in. long: fls. in axillary racemes from the branches of last year: fr. becoming bright red in summer, changing to violet-

black when ripe. Japan. B.M. 7509. G.F. 10:343 (adapted in Fig. 1057). S.I.F. 2:58. R.H. 1913, p. 79.

terminàlis, Hemsl. Herbaceous or suffruticose, 2–3 ft.: branches quadrangular: lvs. nearly sessile, broad-ovate to ovate-lanceolate, 5–9-nerved, scabrous on the veins beneath, 1–3 in.: fls. in terminal racemes on shoots of the current year: fr. black. Sikkim, W. China. Var. **xanthocárpa,** Rehd. & Wilson. Fr. yellow. Sikkim. B.M. 8525. R.H. 1907:160. G.C. III. 34:282. J.H. III. 49:443. F.S.R. 3:106. M.D. 1897:1.—A very ornamental plant, keeping its yellow fr. from July until late in fall; being herbaceous, it is easier to protect from frost than the former. Originally intro. into cult. as *C. nepalensis.*

C. himalayénsis, Hort. Said to have persistent lvs. and edible frs. Possibly not different from C. nepalensis.—*C. myrtifólia,* Linn. Shrub, 4–10 ft.: lvs. 3-nerved, glabrous: fls. greenish, from the old wood: fr. black, poisonous. Medit. region. Yields a black dye.—*C. nepalénsis,* Wall. Shrub, 8–10 ft.: lvs. 3–5-nerved, glabrous: fls. brownish: fr. black. Himalayas.—*C. sarmentòsa,* Forst. Suffruticose, procumbent: racemes axillary, on young branches. B.M. 2470.—The wineberry shrub of the natives. The berries yield a pleasant drink, but the seeds are poisonous. Source of the New Zeal. toot-poison, which is very destructive to human and animal life. —*C. sínica,* Maxim. Allied to C. japonica. Shrub to 18 ft.: lvs. oval or broadly elliptic, abruptly short-pointed, 1½–3 in. long: fr. black. Cent. China.

ALFRED REHDER.

CÒRIS (ancient name, transferred). *Primulàceæ.* Two low thyme-like herbs of S. Eu., sometimes planted in rock-gardens, but apparently not in the trade. Lvs. small, alternate, linear, spreading or recurved, the margin revolute: fls. lilac or rose-purple, in terminal densely-fld. racemes. *C. monspeliénsis,* Linn., of the Medit. region, is 6 in. high, much branching and spreading, the sts. thickly covered with the little narrow lvs.

CORK-TREE: *Quercus.*

CÓRMUS: *Sorbus.*

CORN, MAIZE (SWEET and POP). A tender annual cultivated for its grain, which is used both for human and live-stock food, and for the herbage which is used as forage. As a horticultural crop, it is grown primarily for the unripe grain or for pop-corn.

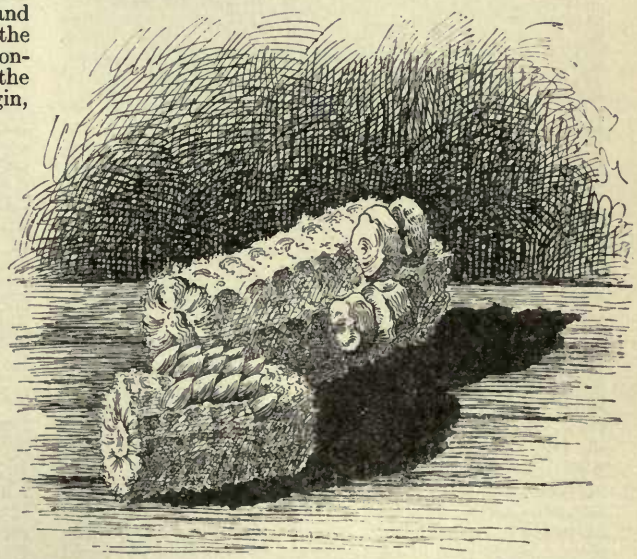
The word maize, Spanish *maiz,* is derived from the name Mahiz, which Columbus adopted for this cereal from the Haytians. Maize has not yet been found truly wild. Its close relationship to a native Mexican grass called teosinte, *Euchlæna mexicana,* is indicated by the known fertile hybrids between this species and maize as pointed out by Harshberger. Teosinte and the only other species which show close botanical relationship to maize are indigenous to Mexico. In fact the evidence all shows that maize is of American origin, although its original form has not yet been discovered, nor has its evolution from other types been completely traced. DeCandolle concludes that maize is not a native of the Old World but is of American origin, and that it was introduced into the Old World shortly after the discovery of the New, and then was rapidly disseminated.

Very early in the exploration and settlement of the New World, the whites learned from the natives the use of maize as food. Several of the Indian names for preparations of food from this cereal were adopted or adapted by the settlers and passed into the English language,—as for example hominy, samp, and succotash. In the English-speaking colonies, maize was grown as a field crop under the name Indian corn, but later the tendency was to drop the word Indian so that this cereal is now known in American agriculture and commerce by the simple word corn. The word corn has thus come to have a specific meaning on this continent which does not attach to it in the British Isles.

Corn now holds first rank among the agricultural products of the United States, both in the area devoted to its cultivation and in the value of the annual crop. The types known in garden culture in this country are the sweet corns and the pop-corns; the other types, which are more strictly agricultural, may be designated as field corns. Sweet corn and pop-corn are also grown as field crops in comparatively limited areas, the sweet corn either as a truck crop or for canning, and the pop-corn to supply the demand for this product in our domestic markets. Only the types of sweet corn and pop-corn will receive attention in this article.

Botanical classification.

Zea almost uniformly has been considered by botanists as a monotypic genus, its one species being *Zea Mays.* But *Z. Mays* is an extremely variable species, including groups which are separated by definite characteristics. As a working classification, that proposed by Sturtevant is the best which has yet appeared. He describes seven "agricultural species." These are *Zea tunicata,* the pod corns; *Z. everta,* the pop-corns (Fig. 1058); *Z. indurata,* the flint corns; *Z. indentata,* the dent corns; *Z. amlyacea,* the soft corns; *Z. saccharata,* the sweet or sugar corns (Figs. 1058, 1059, 1060); *Z. amylea-saccharata,* the starchy sweet corns. *Z. canina,* Wats., is a hybrid form, as shown by Harshberger. *Z. Mays,* Linn., belongs to the natural order of grasses or Gramineæ. Culms 1 or more, solid, erect, 1½–15 ft. tall, or more, terminated by a panicle of staminate fls. (the tassel): internodes grooved on one side: branches ear-bearing or obsolete: lvs. long, broad, channeled, tapering to the pendulous tips, with short hyaline ligules and open embracing sheaths: fls. monœcious, awnless, usually proterandrous; staminate fls. in clusters of 2–4, often overlapping; 1 fl. usually pedicelled, the other sessile or all sessile; glumes herbaceous; palea membranaceous; anthers 3, linear. The ear contains the pistillate fls. on a hard, thickened, cylindrical spike or spadix (cob), which is inclosed in many spathaceous bracts (husks); spikelets closely sessile, in longitudinal rows, paired in alveoli with hard, corneous margin; fls. 2 on a spikelet, the lower abortive; glumes membranaceous; style single, filiform, very long (silk); ovary usually sessile: ear variable in length and size, often distichous; grain variable in shape and size. The color ranges from white through light and dark shades of yellow, red and purple to nearly black.



1058. Kernels of corn on the cob—sweet corn behind, pop-corn in front. (×½)

Sweet corn (*Zea saccharata*, Sturt.). Figs. 1058–1060. This is a well-defined species-group, characterized by horny, more or less crinkled, wrinkled or shriveled kernels, having a semi-transparent or translucent appearance. Sturtevant, in 1899, lists sixty-one distinct varieties. He gives the first variety of sweet corn recorded in American cultivation as being introduced into the region about Plymouth, Massachusetts, from the Indians of the Susquehanna in 1779. Schenck, in 1854, knew two varieties. It appears, therefore, that the distribution of sweet corn into cultivation made little progress prior to the last half of the nineteenth century, green field corn having largely occupied its place prior to that period.

Sweet corn is preëminently a garden vegetable, although the large kinds are sometimes grown for silage or stover. As a garden vegetable, it is used when it has reached the "roasting ear" stage, the kernel then being well filled and plump but soft, and "in the milk." The kernel is the only part used for human food. When sweet corn is used as a fresh vegetable, it is often cooked and served on the cob. Dried sweet corn, though never an important article of commerce, was formerly much used, especially by the rural population. It is gradually being generally abandoned for canned corn, for other cereal preparations or for other vegetables, but recently desiccated corn has been put upon the market and is finding sale in certain districts, particularly in the South and in mining and lumber camps. It is practically unknown outside North America.

In the last quarter of the last century, canned sweet corn came to be an important article of domestic commerce in the United States and Canada. The total pack for the United States and Canada for the year 1898 was 4,398,563 cases, each containing two dozen two-pound tins. The following statement shows the number of cases packed for the United States for the five-year period from 1907 to 1911:

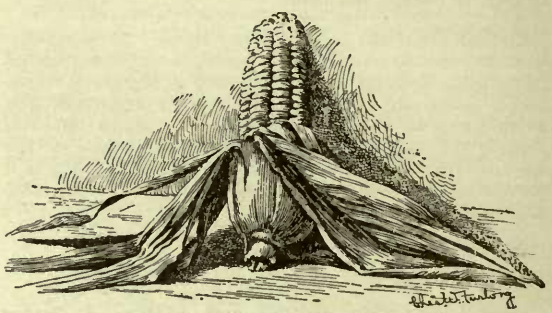
1907	6,653,744
1908	6,779,000
1909	5,787,000
1910	10,063,000
1911	14,301,000

Comparatively little of this corn was sent abroad, most of it being consumed in the States, Canada, and Alaska. In 1911 Iowa took first rank in the output of canned corn with a pack of 2,774,000 cases, which was nearly 20 per cent of the total output of the United States for that year. Illinois, New York, Maryland, Maine, Ohio, and Indiana followed in the order named. These seven states packed about 88 per cent of the total output of this country in 1911. These figures are the best obtainable and give a general idea of the progress and distribution of the corn-canning industry. Maine produces as good canned corn as is put on the market and grows the crop largely in localities having too short a season to mature the seed.

Sweet corn is commonly grown for canneries under contract, the canning company supplying the seed and guaranteeing it to be good and true to name, while the farmer agrees to grow a certain specified acreage and deliver the whole crop to the cannery at a stipulated price. In Iowa the price now paid the grower is about $7 per ton of good ears. A yield of three to four tons to the acre is considered good. The ears are snapped from the stalks with the husks on and hauled in deep wagon-boxes to the canneries. The stalks, when preserved either as ensilage or as stover, make excellent fodder. The overripe and inferior ears, being unmarketable, are left on the stalks and thereby materially increase their value as a stock food. The stover keeps best in loose shocks, as it is liable to mold when closely packed in large stacks or bays.

As a field crop, sweet corn is grown most extensively on medium heavy loams that are well supplied with humus or organic matter. It luxuriates in rich warm soils. The crop rotation should be planned so as to use the coarse manures with the corn, which is a gross feeder. On the more fertile lands of the central corn-belt, nitrogenous manures may not always be used to advantage with corn, but in the eastern and southern states, where the soil has lost more of its original fertility, stable manure may often be used profitably with this crop at the rate of 8 or 10 cords to the acre, or possibly more.

In the northern part of the corn-belt in the central and western states, that is to say north of the Ohio and Missouri rivers, deep fall plowing of corn land is generally favored, but in experiments at the Illinois and Indiana experiment stations, the depth of plowing has had little influence on the crop. In sections of the eastern states, shallow plowing late in spring is favored, especially if the land be in sod. In warmer, drier regions, as in parts of Nebraska and Kansas, listing has been much practised on stubble ground. The listing plow, having a double mold-board, throws the soil into alternate furrows and ridges, the furrows being 8 or 9



1059. Early Marblehead sweet corn.

inches deeper than the tops of the ridges. The corn is planted in the bottom of the furrow, either by means of a one-horse corn-drill or by a corn-drill attachment to the lister plow, consisting of a subsoil plow through the hollow leg of which the corn is dropped.

Great care should be used to secure seed-corn having high vitality as a precaution against the rotting or weak germination of the seed in the soil, should the season be cold and wet after planting. Select the seed-ears early before any hard frosts have come. At this time the large, early, and well-matured ears can be distinguished from the rest of the crop, as the husks about the early-maturing ears will have started to turn brown. Early maturity is a vital point to consider in selecting seed-ears and this quality should never be sacrificed for the size of late unmatured ears. In selecting seed for a field crop, seek systematically for stalks having little or no growth of stools and bearing single, large, and early-maturing ears. For garden use, seed from more productive stalks is desirable, even though the ears be smaller. The seed-ears should be dried at once by artificial heat so that the seed may better withstand unfavorable conditions of temperature or moisture. In many localities so-called kiln-dried seed is much in favor.

In the North, sweet corn should be planted as early as can be done without involving great risk of loss from frosts or from rotting of seed in the soil. In New York, field-planting is generally done from May 10 to May 20; in central Minnesota from May 10 to May 30. The ground having been plowed and prepared so as to make a seed-bed of fine, loose soil 3 inches deep, the seed should be planted to a depth of 1 to 3 inches. The drier and looser the soil, the greater should be the depth of planting. In planting small fields, the ground may be marked in check-rows so that the hills planted

at the intersection of the rows will stand about 3 feet 4 inches to 3 feet 6 inches apart each way, and the corn planted by a hand-planter, which each time it is thrust into the ground drops from four to five kernels, which is usually the number desired. Three feet apart is too close to allow the cultivators to work easily. For large fields, the check-row type of planter should be used. These planters drop and cover the seed in hills at uniform distances apart, planting two rows at one trip across the field. Two types of furrow-openers are now used on corn-planters; these are the runner furrow-openers and the disc furrow-openers. The former are less satisfactory on sod land or in fields covered with trash, as the runners will often ride out and leave the seed uncovered. It is better to use the disc furrow-opener on such land; besides opening the furrow better, it also pulverizes the soil about the seed. Field corn is often planted in drills by planters adapted to this purpose, but sweet corn should be in hills so that the surface of the ground may be kept loose and entirely free from weeds.

Till for the purpose of retaining soil-moisture as well as to kill weeds. This requires frequent shallow cultivation, pulverizing the surface of the soil so that it will act as a mulch to retard the evaporation of soil-moisture. Tillage should begin as soon as the planting is done, using the slanting-tooth harrow and the weeder types of implements until the corn is nearly 6 inches high, providing that the weeds are small and the ground is in friable condition. After this time the spring-tooth cultivators or the two-horse cultivators, having preferably three or four shovels on a side, are generally used, depending somewhat upon the kind of soil to be cultivated. This type of two-horse cultivator is preferable to the double-shovel type which was formerly much used. The two-horse revolving disc cultivator is sometimes used in damp, weedy ground. One great objection to this type is that too much earth is thrown toward the corn and the middles between the rows are usually left either untouched or bare of the loose soil which is needed for a mulch. For the later cultivations the two-horse surface cultivator is coming more and more into general use.

Till at intervals of seven to ten days. At first the cultivator may run from 2 inches deep near the plant to 4 inches deep midway between the rows. Each successive cultivation should gradually increase in depth towards the middle between the rows; throw ½ inch or more of earth towards the corn and cover the weeds. At the last cultivation the cultivator may be kept a little farther from the corn. It should leave the soil pulverized to a depth of 2 to 3 inches over the entire field. The earlier cultivation may be deepened, if necessary, to kill weeds, even though some corn roots are severed, but cutting the roots by deep cultivation near the plants late in the season is to be especially avoided. Till the soil until the corn gets so large as to prevent the use of a two-horse cultivator. Occasionally a later cultivation, with a one-horse cultivator, may be necessary if heavy rains leave the surface soil hard and start the weeds. Often catch-crops for late pasturage, cover-crops or crops of winter wheat or rye are sown in the cornfield and cultivated in with the last cultivation. The seed is covered deeply by cultivating it in because the weather is apt to be dry at this period. The lower part of the furrow-slice is thus left compact, furnishing a compact seed-bed, in which small grains delight.

The cultivation of sweet corn in the garden should follow the general lines indicated for field culture, but stable manure and commercial fertilizers may be used more liberally. Except on very fertile soils, it is well to put a small amount of a complete commercial fertilizer in each hill and mix it well with the soil before planting the corn. A fertilizer which has a large amount of nitrogen in quickly available form should be chosen for this purpose. Dwarf early-maturing varieties may be planted, for early use, as soon as the ground is sufficiently dry and warm. A little later, when the ground is warmer, the second-early main crop and late varieties may be planted. Later successional plantings insure a supply of green corn till frost kills the plants.

Corn is not grown commercially as a forcing crop. Attempts to force it in winter have not given encouraging results, but it may be successfully forced in spring, following any of the crops of vegetables which are grown under glass, providing the houses are piped so as to maintain the minimum night temperature at 65° F. Provide good drainage. Give a liberal application of stable manure and thoroughly mix it with the soil. In the latitude of New York the planting may be made as early as the first of March. As soon as the first leaf has unfolded, the temperature may be allowed to run high in the sun, if the air is kept moist by wetting the floors and walls. The glass need not be shaded. Keep night temperature close to 65° F., not lower and not much higher. After the silk appears, jar the stalks every two or three days, when the atmosphere is dry, and thus insure abundant pollination. Early maturing varieties, like Cory, give edible corn in about sixty days when thus treated. Corn may be forced in the same house with tomatoes, eggplant, and other vegetables which require similar range of temperature.

Varieties of sweet corn.

Some of the desirable varieties for the garden, the market, and for canning are listed below. These varieties are named to show the range of variation and to indicate the leading groups or types, rather than to recommend these particular kinds. New varieties are continually supplanting the old.

For the home garden.—Extra-early: Golden Bantam, an extra-early sort, has recently become very popular, on account of its productiveness, good flavor, and desirable size for table use, and because the kernels separate very easily from the cob; many plant it in succession so as to cover the entire season with this variety alone. Peep o'Day and Minnesota are other good extra-early varieties. Second-early: Early Crosby; Early Evergreen. Medium or standard season: Hickox Improved, Stowell Evergreen, White Evergreen. Late: Black Mexican, Country Gentleman.

For market.—Extra-early: Cory (red cob), White Cob Cory, and Extra-Early Adams, which, though not a sweet corn, is largely grown for early use. This last-named variety is recommended in the South because of its comparative freedom from the attacks of the ear worm. Second-early: Shaker, Crosby, Early Champion; Early Adams also is extensively grown for market, though not a true sugar corn. Midseason and Late: Stowell Evergreen, Country Gentleman, Late Mammoth, Egyptian.

For canning.—Stowell Evergreen is the standard variety for canning factories everywhere. Country Gentleman is also grown to a considerable extent for fancy canned corn. Other varieties that are used for canning include Early Evergreen, White Evergreen, Egyptian, Potter Excelsior, and Hickox Improved.

Diseases and pests of sweet corn.

The most widespread and destructive disease of corn in the United States is the smut produced by the parasitic smut-fungus, *Ustilago Zeæ*. The sorghum-head smut, *Ustilago Reiliana*, also attacks maize. Smut causes most injury when it attacks the ears. The grains are transformed into a mass of dark-colored smut spores, and become exceedingly swollen and distorted out of all semblance to their normal outlines. Infection may take place at any growing point of the plant from early till late in the season, hence treatment of seed corn by fungicides is of no value as a

remedy for corn smut. The destruction of smutted parts of the plants, and taking especial care that the smut does not become mixed with manure which is used for the corn crop, are measures which may be expected to lessen the prevalence of the disease. No remedy is known.

Another disease of sweet corn in the United States is the bacterial blight caused by *Pseudomonas Stewartii*. It has been found in New York, New Jersey, and Michi-



1060. Golden Bantam sweet corn.

gan, but thus far has been seriously destructive only on Long Island on early dwarf varieties of sweet corn. It is characterized by wilting and complete drying of the whole plant, as if affected by drought, except that the leaves do not roll up. The fibro-vascular bundles become distinctly yellow, and are very noticeable when the stalk is cut open. The disease attacks the plant at any period of growth, but is most destructive about the time the silk appears. No remedy is known.

These two diseases are of the most economic importance in the United States. Two others of somewhat minor importance which deserve mention are rust and leaf blight. The leaf-blight fungus causes round, brownish, dead spots on the foliage. The maize rust, *Puccinia sorghi*, is found principally where rainfall is abundant. It is rather common throughout the corn-belt. The fungus is similar in nature to that which causes the rust of small grains. It cannot be controlled economically.

Over 200 species of insects are known to be injurious to corn, either to some part of the growing plant or to the stored product. The corn-ear worm, known South as the cotton-boll worm, is especially injurious to sweet corn. It burrows in tender green corn, ruining the ear for either canning or market purposes. It is known to do serious damage as far north as western New York and central Iowa. Recent experiments in dust-spraying promise well. Spraying is done weekly, beginning when silks appear, using equal weight powdered lead arsenate and lime. Shallow fall plowing to kill pupæ is a partial remedy. Wire-worms, northern corn-root worms, white grubs, and certain other grass insects attack corn plants. One of the best preventive measures is to plan the rotation so that corn does not immediately follow any cereal or grass crop.

Pop-corn (*Zea everta*, Sturt.). Fig. 1058. Pop-corn is characterized by the excessive proportion of the corneous endosperm and the small size of the kernel and ear. The kernel split laterally shows the chit and corneous matter enveloping, and in some cases a fine, starchy line. The small size of the kernel and the property of popping makes identification certain. This species-group extends throughout North and South America and has claims for prehistoric culture.

The preparation of the ground recommended for sweet corn holds for pop-corn. Tillage should be started early in the spring to conserve as much of the soil-moisture as possible, thus protecting the crop against possible injury from drought later in the season.

On good clean ground the pop-corn is very often drilled, dropping the kernels 6 to 8 inches apart in the row. More often, however, it is check-rowed with the rows 3 feet 4 inches apart and from four to six kernels in the hill. The ordinary corn-planters are used with special plates for pop-corn planting. For dwarf varieties of pop-corn such as the Tom Thumb, when planted in home gardens and tilled by hand, the hills may be as near together as 2½ feet.

Pop-corn is much slower in germinating than field corn and the plant is not so vigorous a grower. Shallow cultivation is recommended just as for other corns, especially for the later cultivations, since deep cultivating cuts too many roots.

Pop-corn is planted earlier than field corn. It should be planted deep enough to reach the moist soil, usually 1½ to 2 inches, but in a dry season it may need to go 3 inches deep.

The White Rice, which is grown more extensively for market than any other variety, mixes with field corns readily. The resulting hybrid types have larger ears and larger, smoother kernels and give heavier yields than do the pure pop-corns. These hybrid types were for a time quite in favor with the commercial growers because of their greater yield. Now they are being discriminated against by the buyers because of their inferior popping qualities, and the tendency among the growers is to get back to the pure types, even though they give smaller yields.

Pop-corn matures earlier than field corn. For this reason in many sections of the country it is regarded as a surer crop. In the region about Odebolt, Iowa, where pop-corn is grown more extensively than in any other district in the world, harvesting sometimes begins as early as the middle of September, but more often it is delayed till the first of October or later to let the corn dry on the stalk. There are two methods of harvesting. One is to snap the corn and pile it in the crib, then shuck it during the winter. However, this is not generally practised because it makes more work and takes more crib room. The other and common method is to pick and shuck the ears from the standing stalks directly into the wagon, the same as with field corn.

On account of the heavy expense of hand-picking, some are now using the harvesting apparatus called the corn-picker and husker. Opinions differ as to the economy of using this picker. The rows should be long and the corn should stand up well to justify its use. For hand-picking the price per bushel usually ranges from 10 to 12 cents. A good hand can pick about forty bushels in a ten-hour day if the corn is good.

It is very important that the pop-corn be thoroughly dried. After it is picked it is placed in the crib which usually has ventilators through the center. These extend along the middle of the floor, are slatted to admit air, and are about 1½ feet wide by 2½ feet high. The corn is usually left in the crib through the winter season. Sometimes it is marketed on the cob. Formerly it was a common practice to ship it on the cob in sacks, but now it is generally held over winter in the crib, shelled the next spring, and shipped in two-bushel sacks. It is usually marketed from June to September.

It is ready to use for popping just as soon as it is dry enough. It can be popped immediately after it is gathered if the season is dry and the corn is allowed to dry sufficiently in the field. Usually it is left on the stalk till it is so dry that it shells some when thrown into the wagon.

Various companies make a practice of contracting for a certain number of acres of pop-corn at a certain price in the spring of the year, so that the farmer may know just what price he will get for his corn in the fall or at some stated time at which it is to be delivered. The contracting firm does not as a rule supply the seed but does specify the grade of the corn and objects to the coarse hybrid types.

The prices for corn in the ear are ruling from 1 cent to 2 cents a pound; for shelled corn from 1½ cents

to 3 cents a pound. Pop-corn is considered a very profitable crop and less likely to fail than field corn because it matures earlier. A good return to the acre would be twenty to twenty-five bushels of ear corn, worth from $20 to $50, averaging about $30. Field corn in the same region averages about fifty-five bushels, worth usually from $20 to $25 an acre.

Varieties.

In 1899, Sturtevant described twenty-five varieties of pop-corn. Tracy, in his "American Varieties of Vegetables for the Years 1901 and 1902," enumerated fifty-four varieties. The rice pop-corns are generally used for commercial plantings. White Rice is now the leading commercial variety of pop-corn, since it gives the greatest yield and also brings the highest price on the market. In the noted region about Odebolt, Iowa, this variety is grown almost exclusively. The following list includes the leading varieties:

White Rice.—Ear 4 to 8 inches long. This vigorous, late variety is widely cultivated. With other rice corns, it is characterized by deep, tapering, beaked kernels.

White Pearl.—Ear 4 to 8 inches long. Matures somewhat earlier than Rice and later than Dwarf Golden. Kernels round and silvery white.

Dwarf Golden.—Ear 1 to 3 inches long. An early-maturing sort, with broad, golden yellow kernels. A favorite garden variety.

Golden Tom Thumb.—Ear 2 to 2½ inches long. An ornamental variety for home gardens. The stalks only grow to a height of about 20 inches. The kernels are bright and golden yellow.

Other kinds of pop-corn worthy of mention are Golden Queen, Silver Lace, and California Yellow.

S. A. Beach.

CORN COCKLE: *Lychnis Githago.*

CORNEL, CORNELIAN CHERRY: *Cornus mas.*

CORNFLOWER: *Centaurea Cyanus.*

CORN POPPY of Europe is the weed of the grain fields from which some of the garden poppies have been raised, *Papaver Rhœas.*

CORN-SALAD (*Valerianélla olitòria*, Poll.). *Valerianàceæ.* A spring and summer salad and pot-herb plant.

Annual: mature plant 4–6 in. tall, forking: radical lvs. tufted (the parts used), oblong and obtuse, narrowed at the base, entire or few-toothed; st.-lvs. narrow, often clasping: fls. very small, in small terminal cymes, whitish: fr. (seed) nearly globular, gray, not crested. S. Eu. *V. eriocárpa*, Desv., of S. Eu. and N. Afr., is sometimes cult. as salad: lvs. longer and lighter-colored: fr. (seed) flattened, pale brown, crested. Known also as lamb's lettuce, fetticus, and vetticost.

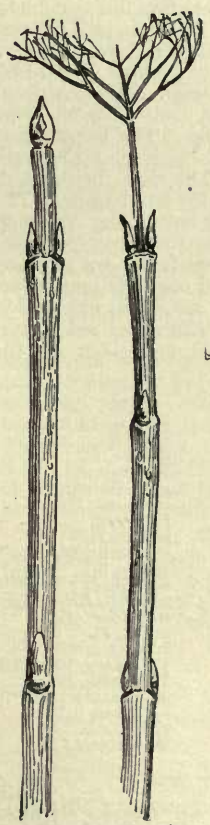
Sow the seed of corn-salad in early spring, at the time of the first sowing of lettuce, and make successional plantings as often as desired. For very early salads the seeds are planted in September, and the young plants are covered with a light mulch and wintered exactly as spinach is often managed. Sow in drills a foot or 18 inches apart and cover lightly. Work the ground thoroughly, and give an abundance of water. The leaves may be blanched, but are usually eaten green. It matures in sixty to sixty-five days during good spring weather. Only one variety is offered by most American seedsmen, but several sorts are known to European gardeners. It is sometimes used for a pot-herb, being served like spinach, but is chiefly valuable for salads. It is rather tasteless, and is not so popular as cress or lettuce on that account, but persons who prefer a very mild salad, or who would rather taste the salad dressing, will doubtless fancy corn-salad. It is best served in mixture with other herbs, as lettuce, water-cress or white mustard. It is easy to grow. There are no special enemies.

F. A. Waugh.

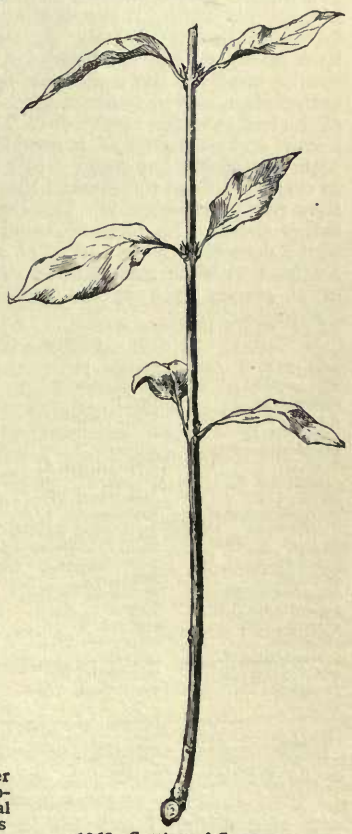
CÓRNUS (ancient Latin name of *Cornus mas*). *Cornàceæ.* Dogwood. Woody plants (one or two infrequently cultivated herbs), grown for their attractive flowers and fruits; some species also for the winter effect of their brightly colored branches.

Shrubs or trees, rarely herbs: lvs. opposite, rarely alternate or whorled, deciduous, entire: fls. small, 4-merous, usually white, in terminal cymes (Fig. 1061) or heads; calyx-teeth minute; petals valvate; style simple, filiform or cylindric; ovary inferior, 2-celled: fr. a drupe with a 2-celled stone.—About 40 species in the temperate regions of the northern hemisphere and one in Peru. Monograph by Wangerin in Engler, Pflanzenreich, hft. 41, pp. 43–92, quoted below as Wang.

The dogwoods are hardy ornamental shrubs with handsome foliage, often assuming a brilliant fall coloring, and with attractive flowers and fruits. Nearly all are very desirable for planting in shrubberies. They grow nearly as well in shady places under large trees as in sunny exposed situations, and thrive in almost any soil. One of the most beautiful in bloom is *C. florida*, with extremely showy flowers in spring. *C. racemosa* is one of the best for shrubberies, blooming profusely in June. The red-branched species, as *C. alba*, *C. Amomum*, *C. Baileyi*, *C. sanguinea* are very attractive in winter. Propagated by seeds, which usually do not germinate until the second year. The species with willow-like soft wood, as *C. alba* and its allies, grow readily from cuttings of mature wood, while the others are sometimes increased by layers. They are often grown in this country from nearly ripened cuttings



1061. Cornus winter shoots, showing the opposite buds and terminal flower-clusters.—Cornus Baileyi.



1062. Cutting of Cornus.

(Fig. 1062), handled in frames in summer. Horticultural varieties of other species are mostly budded in summer on seedlings of the type, or grafted in early spring in the propagating-house.

Various species of Cornus have many interesting uses. Our native *C. florida*, which in flower is the showiest



1063. Cornus alternifolia.

member of the genus, furnishes a useful substitute for quinine. The bark of all parts contains the same substances found in cinchona, but in different proportions. It is inferior in effectiveness and more difficult to secure in large quantities. It is sometimes possible to ward off fevers by merely chewing the twigs. The powdered bark makes a good tooth-powder, and the fresh twigs can be used for the same purpose. The bark mixed with sulfate of iron makes a good black ink. The bark of the roots yields a scarlet dye. The wood, being hard, heavy, and close-grained, is good for tool handles. The cornelian cherry has pulpy fruits resembling cornelian in color and about the size and shape of olives, for which they can be substituted. The ripe fruits are soft and rather sweet. The name dogwood comes from the fact that a decoction of the bark of *C. sanguinea* was used in England to wash mangy dogs. The small red berries of *C. suecica* (not in the trade) are eaten by the Esquimaux.

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Thelycanis, 12.
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variegata, 2, 8, 16.
viridissima, 16.
Wilsoniana, 13.

A. *Plants, shrubs or trees.*

B. *Fls. in cymes or panicles without involucre.* (*Svida.*)

C. *Foliage alternate: fls. in umbel-like cymes, cream-colored.*

1. **alternifòlia**, Linn. (*Svida alternifòlia*, Small). Fig. 1063. Shrub or small tree, to 25 ft.: lvs. slender-petioled, elliptic or ovate, usually cuneate, acuminate, nearly glabrous above, pale or whitish beneath and appressed pubescent, 3–5 in. long: cymes 1½–2½ in. wide: fr. dark blue, globular, ⅓in. across, on red peduncles. May, June. New Bruns. to Ga. and Ala., west to Minn. S.S. 5:216. Em. 463. Wang. 51.—Of very distinct habit, the branches being arranged in irregular whorls, forming flat, horizontally spreading tiers, as in the picture. A variety which shows this habit more distinctly than the common form is var. **umbraculífera**, Dieck. Var. **argéntea**, Temple & Beard, is a form with white-marked foliage. Var. **ochroleùca**, Rehd., has yellowish frs.

2. **controvérsa**, Hemsl. (*C. brachýpoda*, Koch, not C. A. Mey. *C. macrophýlla*, Koehne, not Wall.). Tree, to 60 ft.: lvs. slender-petioled, broadly ovate or elliptic-ovate, usually rounded at the base, abruptly acuminate, whitish and slightly hairy beneath, 3–5 in. long: cymes 3–4 in. wide: fr. bluish black. June. Himalayas to Japan. B.M. 8261. S.I.F. 1:77. R.B. 30:63.—With the habit of the former, but of more vigorous growth; not hardy N. Var. **variegàta**, Rehd. (*C. macrophýlla variegàta*, Barbier). Lvs. edged white. Gng. 3:67; 16:291. J.H. III. 28:129; 47:147.

CC. *Foliage opposite.*

D. *Fr. white or blue.*

E. *The fls. in umbel-like flat cymes.*

F. *Color of fr. white or bluish white.*

G. *Under side of lvs. with appressed hairs, glaucous.*

3. **stolonífera**, Michx. (*C. álba*, Wang.). Red-Osier Dogwood. Fig. 1064. Shrub, to 8 ft., usually with dark blood-red branches and prostrate st., stoloniferous: lvs. obtuse at the base, ovate or oblong-lanceolate, acuminate, 2–5 in. long: cymes dense, 1–2 in. wide; disk usually red: fr. white, globose, with the stone broader than high. May, June. From Brit. N. Amer. to Ill. and Calif. G.C. II. 8:679.—Habit bush-like, as in Fig. 1064. Var. **flaviràmea**, Spaeth. Branches yellow. There are also varieties with variegated lvs. Var. **nítida**, Schneid. (*C. álba* var *nítida*, Koehne). Branches green: lvs. glossy above. Var. **coloradénsis**, Schneid. (*C. álba* var. *C. coloradénsis*, Koehne). Branches brownish red, strongly recurved: fr. bluish white. Colo. Var. **péndula**, Ell. Low shrub with pendulous branches.

4. **álba**, Linn. (*C. tatárica*, Mill.). Shrub, to 10 ft., with usually erect st. and bright blood-red branches, mostly with glaucous bloom when young: lvs. obtuse at the base, ovate or elliptic, somewhat bullate or rugose above, acute, 1½–3½ in. long: cymes dense, small; disk



1064. Cornus stolonifera.

yellow: fr. ovoid, bluish white, sometimes whitish; stone usually higher than broad, flat. Siberia, N. China. Var. **argênteo-marginâta,** Rehd. (*C. álba* var. *elegantíssima variegàta,* Hort.). Lvs. edged white. Var. **Spàethii,** Spaeth. Lvs. broadly edged yellow. Gn. 64, p. 378; 69, p. 343. Var. **Gouchaùltii,** Rehd. (*C. sibírica Gouchaùltii,* Carr.). Lvs. variegated with yellowish white and pink. Var. **sibírica,** Lodd. Branches bright coral-red. C.L.A. 21, No. 4:29. G.M. 54:249. Var. **Kesselríngii,** Rehd. (*C. sibírica* var. *Kesselríngii,* Wolf). Branches very dark purple, nearly purplish black. There are also some other varieties with variegated lvs.

GG. *Under side of lvs. with woolly hairs.*

5. **Bàileyi,** Coult & Evans. Fig. 1065. Erect shrub, with reddish branches: lvs. ovate to lanceolate, acute or acuminate, white beneath, with woolly and with appressed hairs, 2–5 in. long: fls. in small rather compact woolly cymes: stone of the white fr. much broader than high, compressed and flat-topped. Pa. to Minn. and Wyo. G.F. 3:465 (adapted in Fig. 1065).—A very handsome species of upright growth, with dark red branches, blooming nearly all summer, and of a distinct grayish hue due to the slightly upward curled lvs. The fall color of foliage and winter color of twigs are unequaled. Well adapted for sandy soil. Early observed on dunes, S. Haven, Mich., but brought to the attention of systematists from specimens collected in extreme N. E. Minn. in 1886.

6. **asperifòlia,** Michx. Shrub, 8–15 ft.: branches reddish brown: lvs. slender-petioled, elliptic to ovate, acuminate, rough above, pale and woolly-pubescent beneath, 1–4 in. long: cymes rather loose, rough-pubescent: fr. globose, white; stone nearly globose, slightly furrowed. Ont. to Fla., west to Texas. G.F. 10:105.

FF. *Color of fr. blue or bluish, sometimes partly white or greenish white.*

G. *Lvs. densely woolly-pubescent beneath.*

7. **rugòsa,** Lam. (*C. circinàta,* L'Her.). Shrub, 3–10 ft.: the young branches green, blotched purple, older ones purplish: lvs. orbicular or broadly ovate, acute or short-acuminate, slightly pubescent above, pale and densely pubescent beneath, 2–6 in. long: cymes rather dense: fr. light blue or greenish white. May, June. Em. 464. Wang. 61.—Bark has medicinal properties.

GG. *Lvs. pubescent only on the veins or nearly glabrous beneath.*

8. **Amòmum,** Mill. (*C. sericea,* Linn. *C. cærùlea,* Lam.). Shrub, 3–10 ft., with purple branches: lvs. usually rounded at the base, elliptic-ovate or elliptic, dark green and nearly glabrous above, pale green beneath, usually with brownish hairs on the veins, 2–4 in. long: cyme compact: fr. blue or sometimes partly white. June, July. Mass. to Ga., west to N. Y. and Tenn. Em. 466.—Bark has medicinal properties. Var. **variegàta,** Hort. Lvs. variegated with yellowish white.

9. **oblìqua,** Raf. (*C. Púrpusii,* Koehne). Shrub, similar to the preceding, usually broader and more loosely branched: branches purple to yellowish red: lvs. usually narrowed at the base, elliptic-ovate to oblong, dark green and glabrous above, glaucous beneath, on the veins usually with whitish or brownish hairs, 2–3½ in. long: cyme compact: fr. blue or partly white. May, June in the S., July in the N. Que. to Minn. and Kans. south to Pa., Ill. and Mo. S.T.S. 1:39. R.H. 1888:444 (as *C. stolonifera*).

EE. *The fls. in broad panicles: fr. white or pale blue.*

10. **racemòsa,** Lam. (*C. candidíssima,* Marsh., not Mill. *C. paniculàta,* L'Her. *C. oblongàta,* Hort.). Shrub 6–15 ft., with gray branches: lvs. cuneate, ovate-lanceolate or lanceolate, acuminate, appressed-pubescent or nearly smooth, whitish beneath, 1½–4 in. long: petals white, lanceolate: fr. white. May, June. Maine to N. C., west to Minn., and Neb. Wang. 58 (as *C. femina*).—Free-flowering; very handsome when in bloom, and with its white frs. on red peduncles in fall.

11. **fémina,** Mill. (*C. stricta,* Lam. *C. fastigiàta,* Michx.). Shrub, to 15 ft., with purplish branches: lvs. ovate or ovate-lanceolate, sparingly and minutely appressed-pubescent, green on both sides, 1½–3 in. long: petals white, ovate-lanceolate: fr. pale blue. April, May. Va. to Ga. and Fla.—Tender N. Closely allied to the former, and perhaps only variety.

DD. *Fr. black (green in a var. of No. 16).*

E. *Fls. in broad panicles.*

12. **brachýpoda,** C. A. Mey. (*C. ignoràta,* Shiras. *C. macrophýlla,* Hemsl., not Wall. *C. Thelycànis,* Lebas. *C. Theleryàna,* Hort.). Shrub or small tree: branches yellowish or reddish brown: lvs. slender-petioled, elliptic-ovate to elliptic-oblong, abruptly acuminate, rounded or broadly cuneate at the base, dark green above and nearly glabrous, glaucous beneath and sparingly appressed hairy, with 6–8 pairs of veins, 2½–6 in. long: panicle rather loose, 3–6 in. across; style below the stigma abruptly enlarged into a disk: fr. bluish black. Aug. Japan, Cent. China. S.T.S. 1:41. S.I.F. 1:77. R.H. 1875, p. 395. F. 1876, p. 123.—One of the handsomest dogwoods on account of its large lvs. and large panicles of white fls.; not quite hardy N.



1065. Cornus Baileyi. (Spray ×½)

13. **Wilsoniàna,** Wang. Tree, to 40 ft.: branches brownish: lvs. elliptic, narrowed at the base, acuminate, above sparingly, beneath more densely appressed-pubescent, green or glaucescent beneath, with 3–4 pairs of veins, 2–4 in. long: panicle 2½–4 in. across; style cylindric, scarcely enlarged below the stigma: fr. bluish black. Cent. China. Wang. 66.—Very handsome, similar to the preceding, but hardier. Page 3567.

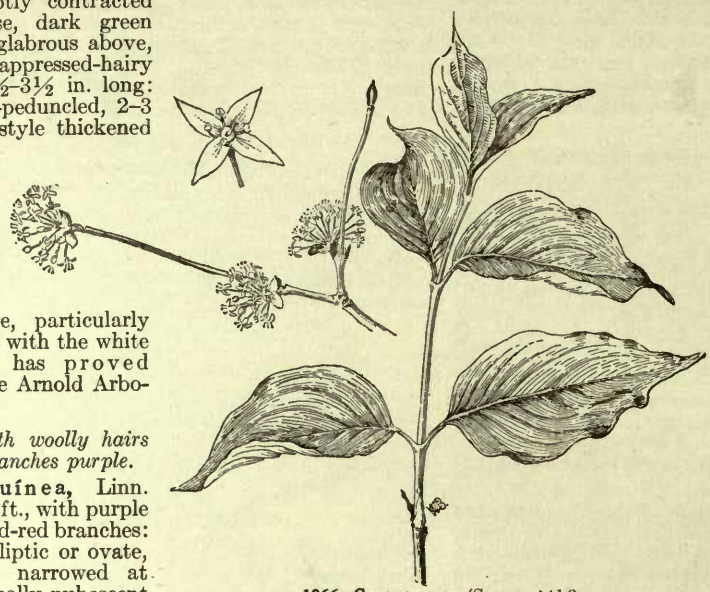
EE. *Fls. in umbel-like cymes: lvs. green beneath.*

F. *Lvs. with appressed hairs beneath.*

14. **paucinérvis,** Hance (*C. quinquenérvis,* Franch.). Shrub 4–6 ft.: young branches quadrangular, usually reddish brown: lvs. short-petioled, of firm texture, oblong-obovate to elliptic-lanceolate, acute, cuneate at the base, dark green above, paler beneath with appressed hairs, with 3–4 pairs of veins, 1½–3½ in. long: cymes long peduncled; style thickened below the apex:

fr. black. June. Cent. China. G.C. III. 50:95. G.M. 54:593. Gt. 1896, p. 285. Wang. 72.—Handsome shrub nearly half-evergreen, but not hardy N. P. 3567.

15. **pùmila,** Koehne (*C. más* var. *nàna,* Dipp.). Dense shrub, to 6 ft.: branchlets terete, glabrous: lvs. crowded, broadly ovate to oblong-ovate, short-acuminate, abruptly contracted at the base, dark green and nearly glabrous above, paler and appressed-hairy beneath, 1½–3½ in. long: cymes long-peduncled, 2–3 in. broad; style thickened below the apex: fr. black. July. Origin unknown.—Handsome with its dense dark green foliage, particularly when dotted with the white fl.-clusters; has proved hardy at the Arnold Arboretum.



1066. Cornus mas. (Sprays ×½)

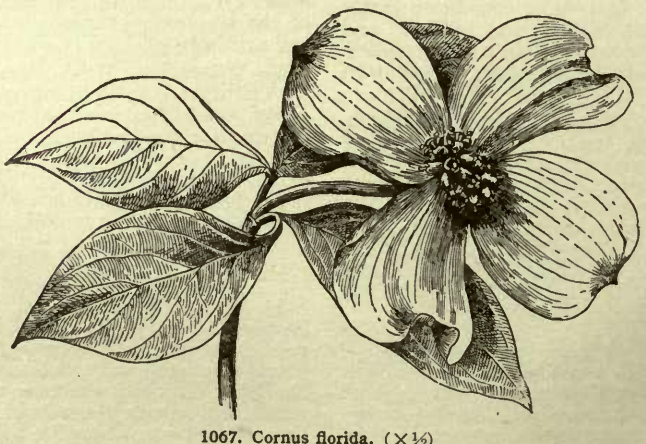
FF. *Lvs. with woolly hairs beneath: branches purple.*

16. **sanguínea,** Linn. Shrub, to 12 ft., with purple or dark blood-red branches: lvs. broad-elliptic or ovate, rounded or narrowed at the base, usually pubescent on both sides, pale green beneath, 1½–3½ in. long: fls. greenish white, in dense cymes: fr. black. May, June. Eu., Orient. Var. **variegàta,** Dipp. Lvs. variegated with yellowish white. G.W. 9, p. 247. Var. **viridíssima,** Dieck. With green branches and green fr.

BB. *Fls. in dense heads or umbels, with an involucre.*

C. *Color of fls. yellow; involucre yellowish, not exceeding the fls.* (*Macrocarpium.*)

17. **más,** Linn. (*C. máscula,* Hort.). CORNELIAN CHERRY. Fig. 1066. Shrub or small tree, to 20 ft.: lvs. ovate or elliptic, acute, appressed-pubescent, and green on both sides, 1½–4 in. long: fls. in sessile opposite umbels, before the lvs.; pedicels not exceeding the involucre: fr. oblong, scarlet, ¾in. long, edible. March, April. S. Eu., Orient. Mn. 5:192. G.C. II. 9:399. H.W. 3, p. 61.—Handsome shrub of dense growth with glossy foliage, very attractive in early spring with its yellow fls., and again in fall with its shining scarlet frs. Var. **macrocárpa,** Dipp. Fr. larger. Var. **albocárpa,** Schneid. (var. *luteocárpa,* Wang.). Fr. yellowish. Var. **aùrea,** Schelle. Lvs. yellow. Var. **aùreo-elegantíssima,** Schelle. Lvs. variegated with pink or yellow. F. 1877: 109. G.Z. 21:169. Var. **argénteo-marginàta,** Hort. Lvs. bordered white. Var. **nàna,** Simon-Louis. Dwarf form. It has been confused with *C. pumila* (No. 15) which has lenticillate branchlets and usually 4 pairs of veins.



1067. Cornus florida. (×½)

18. **officinàlis,** Sieb. & Zucc. Shrub or small tree, to 15 ft.: lvs. elliptic, acuminate, pale green beneath and with large tufts of dark brown hairs in the axils of the veins: fls. like those of the former; pedicels longer than the involucre: fr. scarlet, oblong. Japan, China. S.Z. 50.—Very similar to the last.

CC. *Color of fls. greenish yellow, sessile, with a showy white involucre, much exceeding the fls.*

D. *Frs. in dense clusters, but individually distinct.* (*Benthamidia, Cynoxylon*).

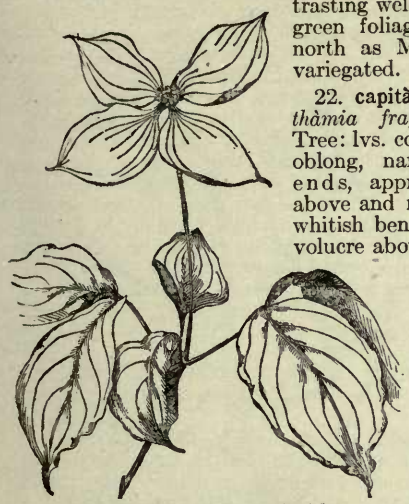
19. **flórida,** Linn. (*Cynóxylon flóridum,* Raf.). FLOWERING DOGWOOD. Fig. 1067. Shrub or small tree with spreading branches, 10–15 ft., rarely to 40 ft.: lvs. oval or ovate, acute, dark green and glabrous above, glaucous or whitish beneath, usually only pubescent on the veins, 3–6 in. long: involucre white or pinkish, 3–4 in. wide; bracts 4, obovate, emarginate: fr. ½in. long, scarlet. May. Mass. to Fla., west to Ont. and Texas, also E. and S. Mex. S.S. 5:112–13. Em. 468. G.F. 3:431. B.M. 526. Gn. 33, p. 441; 43, p. 153; 52, p. 177; 53, p. 222. J.H. III. 28:453.; 55:331. F.E. 23:511. G. 34:531. Gn. M. 5:138. M.D.G. 1898:405. V. 5:230; 20:51.—One of the most beautiful American flowering trees; hardy N. Var. **péndula,** Dipp. With pendulous branches. F.E. 17, p. 68. V. 13:333. Var. **rùbra,** André. With pink involucre. R.H. 1894:500. A.G. 18:441. F.E. 9:572. B.M. 8315. G. 28:689. Neither variety as hardy as the type.

20. **Núttallii,** Audubon. Tree, to 80 ft.: lvs. ovate or obovate, usually pubescent beneath, 4–5 in. long: involucre white or tinged with pink, 4–6 in. across; bracts 4–6, oblong or obovate, sometimes roundish, mostly acute: fr. bright red or orange, crowned with the broad, persistent calyx. Brit. Col. to S. Calif. S.S. 5:214–15. Gng. 6:274. B.M. 8311. G. 27:366.—This species surpasses the former in beauty, but is more tender, particularly while the plants are young, and has rarely been successfully cult. outside of its native country.

DD. *Frs. connate into a globular fleshy head.* (*Benthamia.*)

21. **Koùsa,** Buerg. (*Benthàmia japónica,* Sieb. & Zucc. *C. japónica,* Koehne, not Thunb.). Fig. 1068. Shrub or small tree, to 20 ft.: lvs. cuneate, elliptic-ovate, acuminate, dark green above, glaucous and appressed-pubescent beneath, 2–4 in. long: involucre creamy white, 2½–3 in. wide; bracts ovate, acute: frs. forming a globular head. June. Japan, China. S.Z. 16. S.I.F. 2:59.

Gn. 43:152; 60, p. 165. G.C. III. 19:783. A.G. 9:329 (adapted in Fig. 1068); 13:674. Gng. 3:149. J.H. III. 35:9; 63:187. M.D.G. 1899:328–9. R.B. 30:64. G. 27:367. Gn.W. 8:741. G.M. 35, suppl. Oct. 8.—Fls. very showy, appearing after the lvs. in June and contrasting well with the bright green foliage; hardy as far north as Mass. Sometimes variegated.



1068. Cornus Kousa. (×⅓)

22. **capitàta,** Wall. (*Benthàmia fragifera,* Lindl.). Tree: lvs. coriaceous, elliptic-oblong, narrowed at both ends, appressed-pubescent above and more densely and whitish beneath, 2–4 in.: involucre about 2½–3 in. wide, creamy white; bracts ovate, acute: fr.-head over 1 in. across, scarlet. June. Himalayas. B. R. 19:1579. Gn. 54, p. 310; 60, p. 165; 64, p. 135; 70, p. 123; 73, p. 411. G.C. III. 16:501; 45:83; 48:447. J. H. III. 30:213. M.D.G. 1898:568.—Evergreen tree, with showy fls. and frs.; hardy only S.

AA. *Plants low herbs: fls. in dense heads, with a white (or pinkish) involucre.* (*Arctocrania, Chamæpericlymenum.*)

23. **canadénsis,** Linn. Herb, ⅓–⅔ ft. high, with creeping rootstock: lvs. whorled, sessile, elliptic or obovate, glabrous or nearly so, 1–3 in. long: head greenish, long-peduncled; involucre white, 1–1½ in. wide: fr. bright red, globose. May–July. N. Amer., south to Ind., Colo., and Calif. B.M. 880. G.C. III. 47:363.—Handsome plant for half-shady places.

C. Arnoldiàna, Rehd. (C. obliqua × C. racemosa). Intermediate between the parents: last year's branches purple, older gray or grayish brown: fls. as profusely as in C. racemosa, but the white or bluish white fr. appears rather sparingly. Originated at the Arnold Arboretum. S.T.S. 1:40.—*C. austràlis,* C. A. Mey. Closely allied and very similar to C. sanguinea, but lvs. beneath with appressed hairs and branches less brightly colored. Asia Minor, Caucasus.—*C. Bretschneideri,* Henry (C. aspera, Wang.) Shrub, to 12 ft.: branches green or purplish: lvs. ovate to elliptic-ovate, usually rounded at the base, rough-pubescent on both sides, 2–4 in. long: cyme dense: fr. bluish black. N. China. Hardy.—*C. corynóstylis,* Koehne=C. macrophylla.—*C. glabràta,* Benth. Shrub, to 10 ft.: branches gray: lvs. small, nearly glabrous, green and shining on both sides: fr. white. Ore. to Calif.—*C. Hèssei,* Koehne. Allied to C. alba. Dwarf, dense shrub: lvs. crowded, small, very dark green: fr. bluish white. Probably from E. Asia.—*C. Koènigii,* Schneid. (C. australis var. Koenigii, Wang.). Allied to C. sanguinea. Lvs. larger, 3–5½ in. long, sparingly appressed-puescent beneath. Transcaucasia.—*C. macrophýlla,* Wall. (C. corynostylis, Koehne). Allied to C. brachypoda. Tree, to 30 ft.: lvs. broadly ovate to elliptic-ovate, acuminate: infl. cymose; style club-shaped at the apex. Himalayas. B.M. 8261. J.H.S. 27, p. 860. Gt. 1896, p. 285.—*C. oblónga,* Wall. Shrub or tree, to 30 ft.: lvs. narrow-oblong, nearly glabrous, glaucous beneath, coriaceous: fls. white, fragrant, in cymose panicles. Himalayas.—*C. poliophýlla,* Schneid. & Wang. Shrub, to 12 ft.: branches brown: lvs. subcoriaceous, elliptic or elliptic-ovate, slightly villous above, beneath more densely so and grayish white, 2½–4½ in. long: cymes long-peduncled: fr. black. Cent. China.—*C. pubéscens,* Nutt. Shrub, to 15 ft., with purple branches: lvs. nearly glabrous above, glaucous and woolly-pubescent beneath: fr. white. Brit. Col. to Calif.—*C. Slàvinii,* Rehd. (C. rugosa × C. stolonifera). Intermediate between the parents: branches purple: lvs. more or less woolly beneath: fr. bluish, rarely white. Originated at Rochester, N. Y.—*C. suécica,* Linn. (Chamæpericlymenum suecicum, Aschers. & Graebn.) Allied to C. canadensis: lvs. all opposite: fl.-head purple, the white involucre 1 in. or less wide. Arctic Amer., N. Eu., N. Asia. Gn. 55, p. 239. S.E.B. 4:634.

ALFRED REHDER.

CORÒKIA (from the native name). *Cornàceæ.* Evergreen shrubs, adapted to outdoor planting in the S. Upright, with tortuous or straight branches and black bark: lvs. alternate or fascicled, stalked, entire: fls. perfect, small, yellow, in axillary or terminal clusters; calyx-tube top-shaped, the limb 5-lobed; petals 5, each with a scale at base; stamens 5: fr. an ovoid or oblong 1–2-celled drupe. Three or four species in New Zeal. **C. Cotoneáster,** Raoul, is offered abroad as a bush of curious growth, very attractive when covered with its very small yellow star-like fls.: rigid, densely branched, 4–8 ft., the branches crooked and interlaced, tomentose: lvs. 1 in. or less long, the blade orbicular to obovate or oblong-ovate, obtuse or emarginate, shining above, flat-stalked. B.M. 8425. I.T. 2:73.

L. H. B.

CORONÍLLA (Latin, a *little crown:* from the arrangement of the flowers). *Leguminòsæ.* CROWN VETCH. Shrubs and herbs, some grown in the hardy garden and some in greenhouses, for their yellow or purple bloom.

Annuals or perennials, often woody, smooth or rarely silky-hairy, with odd-pinnate lvs., entire lfts., and purple or yellow fls. in peduncled heads or umbels; calyx 5-toothed; corolla papilionaceous, the standard orbicular and the keel incurved, wings obovate or oblong; stamens 9 and 1: pod jointed, terete or 4-angled; seeds oblong.—Species about 20, Medit. region and Canary Isls., W. Asia. The shrubby *C. Emerus* and *C. glauca* are useful in S. Calif. and the southern states. The species are occasionally grown in borders. *C. glauca* is sometimes grown under glass for spring bloom, after the manner of Cytisus. All are of easy cult.

A. *Fls. yellow.*

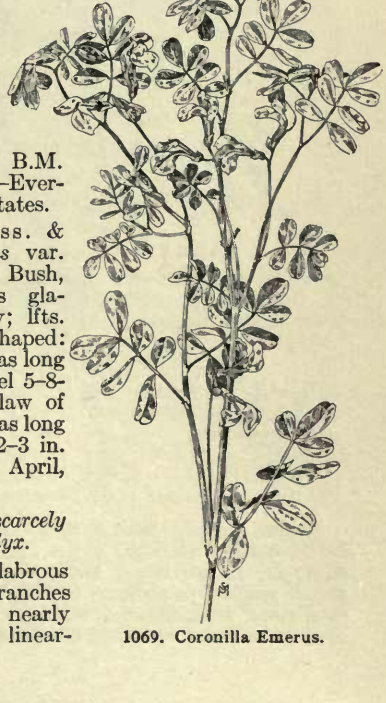
B. *Plant herbaceous.*

cappadòcica, Willd. (*C. ibèrica,* Bieb.). Low perennial herb, about 1 ft. high: lfts. 9–11, obcordate, ciliate: umbels 7–8-fld.; fls. yellow, large, July, Aug.: stipules membranaceous, rounded, ciliate-toothed. Asia Minor. L.B.C. 8:789. B.M. 2646.—A good trailer for rock-gardens and the margins of borders.

BB. *Plant shrubby, at least at base.*

C. *Claw of the petals much longer than the calyx.*

Émerus, Linn. (*Émerus màjor,* Mill.). SCORPION SENNA. Fig. 1069. Dense, symmetrical shrub, 3–5 ft. high, the branches green and striate: lvs. deep glossy green; lfts. 5–7, obovate; stipules small: peduncles 3-fld.; fls. large, yellow, tipped with red. Blooms freely, May–July. Showy, half-hardy. S. Eu. B.M. 445. Gng. 5:36.—Evergreen in southern states.



1069. Coronilla Emerus.

emeroìdes, Boiss. & Sprun. (*C. Émerus* var. *emeroìdes,* Wohlf.). Bush, 3–6 ft.: branches glabrous or soft-hairy; lfts. 2–3 pairs, heart-shaped: peduncle 2–3 times as long as the lf., the umbel 5–8-fld.; fls. yellow; claw of petals about twice as long as the calyx: pod 2–3 in. long, very narrow. April, May. S. Eu.

CC. *Claw of petals scarcely exceeding the calyx.*

júncea, Linn. Glabrous gray-green shrub: branches rush-like, terete, nearly naked: lfts. 3–7, linear-

oblong, obtuse, somewhat fleshy, scattered: fls. golden yellow, in 5–7-fld. umbels: pod hanging, lance-linear. S. France. B.R. 820. L.B.C. 3:235.

mínima, Linn. Glabrous, diffuse, soft gray-green sub-shrub, 3 or 4 in. high, procumbent: lfts. 7–13, ovate, obtuse or retuse, scattered or at base of plant: fls. golden yellow in 7–8-fld. umbels, sweet-scented. In dry sands. Eu. B.M. 2179.

glaùca, Linn. Glabrous shrub 2–4 ft. high: stipules small, lanceolate: lfts. 5–7, obovate, very blunt, glaucous: fls. 7–8 in each umbel, yellow, heavy-scented. S. Eu. B.M. 13.—One of the common garden shrubs of S. Calif., flowering all the year. There is a variegated form.

AA. *Fls. white and pink.*

viminàlis, Salisb. Trailing shrub: stipules soon deciduous, ovate, membranaceous: lfts. 13–21, obovate, notched, glaucous: umbels 6–10-fld.; fls. pale red or white with a red stripe on the banner. Algeria.—Promising as a florists' plant for cut-fls. Fls. all the year in S. Calif.

vària, Linn. CROWN VETCH. Fig. 1070. Straggling or ascending smooth herb, 1–2 ft. high: lvs. sessile; lfts. 11–25, oblong or obovate, blunt and mucronate, ½–¾in. long: peduncles longer than lvs.; fls. in dense umbels, ½in. long, pinkish white. June–Oct. Eu. B.M. 258. Gng. 5:337.—Trailing plant for hardy herbaceous border.

JARED G. SMITH.
L. H. B.†

CORRÈA (after Jose Francesco Correa de Serra, Portuguese author, 1750–1823). *Rutàceæ.* Tender Australian shrubs, rarely cultivated under glass.



1070. Coronilla varia. (×½)

Shrubs, usually with dense, minute, stellate hairs: lvs. opposite, stalked, entire, and with transparent dots: fls. rather large, showy, red, white, yellow or green, usually pendulous, solitary or 2 or 3 together; petals and sepals each 4; stamens 8: carpels 4, nearly distinct.—Seven species. *C. speciosa* is probably the best and most variable species. It is a native of barren sandy plains, and belongs to the large and much-neglected class of Australian shrubs.

speciòsa, Ait. (*C. cardinàlis,* F. Muell.). Tender shrub, 2–3 ft. high: branches slender, brown, opposite, covered with minute rusty hairs: lvs. opposite, about 1 in. long, elliptic, about a fourth as wide as long, wrinkled, dark green above, whitish below, margin entire, recurved: peduncles opposite, axillary, longer than the lvs., 1-fld., with a pair of leafy bracts; fls. 1½ in. long, pendent, tubular, bright scarlet, with a very short limb of 4 spreading, greenish yellow segms.; calyx small, cup-shaped, with 4 almost obsolete teeth; stamens 8, exserted, about ¼in. B.M. 4912.—There are several varieties.



1071. Correa alba. (×½)

álba, Andr. Fig. 1071. A compact and much-branched shrub, 3–4 ft., the branches rusty-tomentose: lvs. variable, orbicular to obovate or elliptic, very blunt, ½–1 in. long: fls. white or pink, 2 or 3 together, not over ½in. long, and not so showy as preceding. B.R. 515.—Offered in S. Calif.

WILHELM MILLER.
N. TAYLOR.†

CORTADÈRIA (from *Cortadero,* the native name in Argentina). *Gramíneæ.* PAMPAS-GRASS. Large reed-like perennials with numerous long, narrow blades and a large striking plume-like inflorescence. Species six, South America. See *Gynerium.*

argéntea, Stapf (*Gynèrium argénteum,* Nees). PAMPAS-GRASS. Culms numerous, in large thick tussocks, 3–6 ft. high, excluding the panicle: lvs. mostly basal, the upper sheaths gradually elongated; blades firm, long and slender, very scabrous on the margins, ⅛–¼ in. wide, tapering to a slender point: panicle large, compact, 1–3 ft., silvery white or in cult. varieties tinged with purple, dicœcious; spikelets 2–3-fld., the pistillate silky with long hairs, the staminate naked; glumes white and papery, long and slender; lemmas bearing a long slender awn. A.G. 14:323. G. 1:412. G.C. III. 40:295; 43:195. Gn. 62, p. 346; 66, p. 375. G.W. 3:415. Gn.W. 5:85; 23:20. J.H. III. 35:483; 49:27. R.H. 1862, p. 150. V. 3:369, 391. S. Brazil and Argentina. *C. Lámbleyi fòliis variegàtis,* Hort. G.C. III. 25:335, appears to be a form of *C. argentea.*

Quìla, Stapf (*Gynèrium Quìla,* Nees. *G. jubàtum,* Lem. *G. arcuàto-nebulòsum,* Hort.). Differs from pampas-grass in the rather laxer, more graceful plume, with longer, more flexuous, nodding branches, somewhat smaller spikelets, and more delicate glumes, and in the longer, very slender staminodes of the pistillate fls.: plume lavender-colored, 1–2 ft. long, the spikelets 3–5-fld. B.M. 7607. G.C. III. 26:102. Gn. 15, p. 179; 55, p. 93. R.H. 1885, p. 200; 1899:52, 53.—Grows in a dense tuft; perennial, but with biennial culms; the plant has been killed by a temperature of 3° F. Intro. by Lemoine, of

Nancy, France. Probable synonyms are *Gynerium roseum Rendlateri* and *G. argenteum carminatum Rendlateri*. F.S. 20:2075. Not so well known as *C. argentea*.

A. S. Hitchcock.

CORTÙSA (named by the herbalist Matthiolus after his friend Cortusus, professor of botany at Padua). *Primulàceæ*. Scapose, perennial, pubescent herbs with long-stalked, cordate-ovate lvs. and purple umbellate fls. **C. Matthiòli,** Linn., from the Swiss Alps, has long been a choice and delicate but not very popular plant, suited for shady parts of the rockery. It was long considered the only species of the genus. It is an herbaceous perennial, about 6 in. high, pubescent, rhizomatous, with a few long-stalked, cordate, 7–9-lobed, dentate lvs., and a slender scape bearing an umbel of about 7 small, rosy purple, drooping fls., which appear in early spring. B.M. 987. L.B.C. 10:956. It has some resemblance to *Primula cortusioides*. The genus has possibly 4 species, and is distinguished from Primula and Androsace by its stamens attached to the base of the corolla, and its long-acuminate anthers. Its culture is similar to that of the hardy primulas, but it needs winter protection in the northern states. Prop. by division of the roots.

CORYÁNTHES (Greek, *korys*, helmet, and *anthos*, flower, referring to the shape of the lip). *Orchidàceæ*. Epiphytic orchids requiring warmhouse conditions.

Pseudbulbous: lvs. plicate, lanceolate: fls. in racemes; sepals spreading, dilated, flexuose, conduplicate, lateral ones largest, distinct at the base; petals small, erect; lip large, tridentate, basal portion forming a hood, continued into the column; distal portion bucket- or pouch-like; column pointing downward, elongated, terete, bicornute at the base, apex recurved; pollinia 2, compressed, caudicle linear, arcuate. The bucket part of the lip is provided with a spout-like structure, by means of which the bucket overflows when about half full of a secretion which drops from a pair of glands near the base of the column. The fls. of the species known are not lasting, the sepals being of such delicate texture that although at first they fully expand, they soon collapse and become unsightly. Although much interest attaches to the species of Coryanthes, the genus is not generally cult., since the fls. last too short a time and are not particularly brilliant. This complex genus, which is closely related to Stanhopea, is represented by several interesting species inhabiting Trop. Amer. For cult. see *Stanhopea*.

macrántha, Hook. Fls. few, in drooping racemes; ground-color rich yellow dotted with red; hood and part of bucket brownish red. Caracas. P.M. 5:31. B.R. 1841. B.M. 7692. G.C. III. 28:355. O.R. 3:41.

maculàta, Hook. Fls. in a drooping raceme; sepals and petals dull, pale yellow, bucket blotched on the inside with dull red. B.M. 3102; 3747. B.R. 1793. F.S. 8:755 (as *C. Albertinæ*). A.F. 30:325. C.O. 1. Var. **punctàta,** Hort., has the petals and sepals bright yellow, speckled with red, the hood yellow, blotched with reddish orange, the pouch pale, speckled and spotted with red. Demerara. *C. Cóbbii* is an unspotted form of this.

C. Balfouriàna, Hort. Similar in habit to a stanhopea, with a long pendulous scape bearing 2 or 3 large and curiously shaped fls. Peru.—*C. leucocòrys*, Rolfe. Sepals yellowish green, marked with brownish purple, the petals white, marked with light purple, the lip white with the bucket marbled with light rosy purple. Peru. Lind. 7:293.—*C. Mastersiàna*, Lehm. Raceme erect; fls. 2 or 3, yellowish, tinged and spotted with copper-red. Colombia. G.C. III. 29:19.—*C. Sánderi*, Hort. A very large-fld. plant allied to C. macrantha.—*C. speciòsa*, Hook. Raceme of 2 or 3 fls.; sepals and petals pale yellow; lip brown-red, the stalk brownish yellow. Brazil. G.C. III. 36:106. B.M. 2755 (as Gongora). C.O. 2.

George V. Nash.†

CORÝDALIS (Greek, *lark*, the spur of the flower resembling a lark's spur). *Fumariàceæ*. Hardy plants allied to the Dutchman's breeches.

Erect or prostrate herbs, usually perennially rooted, but often annuals: lvs. lobed and finely dissected in nearly all the species: fls. racemose, often yellow, less frequently blue, purple or rose; petals 4, spurred as in the Dutchman's breeches; stamens 6, in 2 groups.—Ninety species, natives of the north temperate regions. They are all of easy cult. They prefer full sunlight but will grow in half-shade. Prop. by division or seed.

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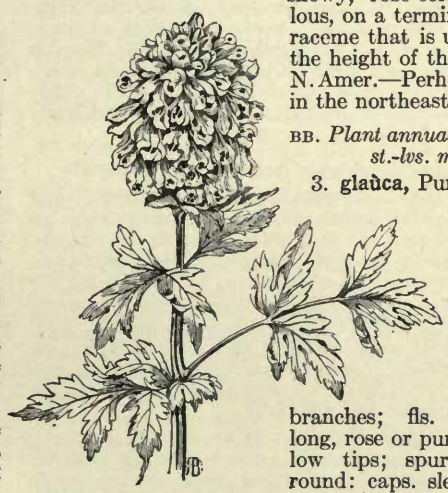
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A. *Fls. chiefly purple or rose, sometimes tipped yellow.*

B. *Plant perennial: root tuberous: st.-lvs. few.*

1. **bulbòsa,** DC. (*C. sólida*, Swartz). Erect, 6 in. high: lvs. 3–4, stalked, biternately cut, segms. wedge-shaped or oblong: root solid: fls. large, purplish. Spring. Eu.

2. **Allenii,** Fedde. A perennial caulescent herb, with glaucescent foliage: lvs. usually alternate with finely divided segms., the whole lf. not over 10 in. long: fls. showy, rose-colored, pendulous, on a terminal dense-fld. raceme that is usually about the height of the lvs. N. W. N. Amer.—Perhaps not hardy in the northeastern states.



1072. Corydalis nobilis.

BB. *Plant annual: root fibrous: st.-lvs. many.*

3. **glaùca,** Pursh. Annual, 1–2 [ft. high, very glaucous: lobes of the lvs. mostly spatulate: racemes short, panicled at the naked summit of the branches; fls. barely ½in. long, rose or purple with yellow tips; spur short and round: caps. slender, linear; seeds with minute, transverse wrinkles. Summer. Rocky or sterile ground, Nova Scotia to Rocky Mts., and even Arctic coast, south to Texas. B.M. 179 (as Fumaria).—Not advertised for sale, but probably worth cult.

AA. *Fls. chiefly yellow.*

B. *Foliage not tomentose.*

C. *Plant perennial: root tuberous or woody: st.-lvs. few or none.*

D. *The fls. at least 1 in. long.*

4. **nóbilis,** Pers. Fig. 1072. Perennial, erect: lvs. bipinnately cut; segms. wedge-shaped and lobed at the apex: fls. white, tipped with yellow, and a dark purple spot; spur 1 in. long. Spring. Siberia. B.M. 1953 (as *Fumaria nobilis*). G.C. II. 19:725.

5. **thalictrifòlia,** Franch., not Jameson. Rhizome woody, elongated: lvs. large, long-petiolate, rigid, but spreading, the pinnæ of the finely dissected lvs. petiolulate: fls. yellow, in large spreading racemes, which are opposite the lvs.; sepals persistent, ovate.—A very showy species from China, the foliage strongly resembling Thalictrum.

6. **Wílsonii,** N. E. Br. A glabrous, often glaucescent perennial, with a rosette of radical much-dissected lvs. about 5 in. long: fls. in an erect raceme 7 in. high, which is usually leafless; corolla deep canary-yellow, about 1 in. long, the blunt spur about ⅛in. long. G.C. III.

35:306.—Useful for the Alpine garden and more profuse bloomer than *C. tomentosa*, its nearest relative. China.

DD. *The fls. not over ½in. long.*

7. **cheilanthifòlia,** Hemsl. A small low perennial with radical, fern-like, much-dissected, erect lvs. about 8 in. long: scape usually taller than the lvs., bearing numerous fls. not over ½in. long, yellow. China. May.—Suitable for moist places in the alpine garden. Probably unknown in U. S. as it is a rare plant in nature.

CC. *Plant annual or biennial: root fibrous: st.-lvs. numerous.*

D. *Height of plants 2 ft. or more.*

8. **ophiocárpa,** Hook. f. & Thoms. Root fibrous, the st. 2–3 ft. and branched: lvs. pinnatisect, 4–8 in. long, and glaucous beneath: fls. yellow, in many-fld., lax racemes which are opposite the lvs.; sepals orbicular, finely toothed and fimbriate. Moist valleys of the Himalayas.

DD. *Height of plants usually less than 1 ft.*

E. *Raceme spike-like; fls. almost sessile.*

9. **curvisíliqua,** Engelm. Probably a biennial: commonly more robust than *C. aurea*, ascending or erect, 1 ft. high or less: fls. golden yellow, over ½in. long, in a spike-like raceme; spur as long as the body, commonly ascending: caps. quadrangular, 1½ in. long; seeds turgid to lens-shaped, with acute margins densely and minutely netted. Woods in Texas.

EE. *Raceme not spike-like; fls. pedicillate.*

10. **aùrea,** Willd. Annual, 6 in. high, commonly low and spreading: fls. golden yellow, about ½in. long, on rather slender pedicels in a short raceme; spur barely half the length of the body, somewhat decurved: caps. spreading or pendulous, about 1 in. long; seeds 10–12, turgid, obtuse at margin, the shining surface obscurely netted. Rocky banks of Lower Canada and N. New England, northwest to latitude 64°, west to Brit. Col. and Ore., south to Texas, Ariz. and Mex.; not Japan.—The western forms have the spur almost as long as the body of the corolla and pass into

Var. **occidentàlis,** Engelm. More erect and tufted, from a stouter and sometimes more enduring root: fls. larger; spur commonly ascending: caps. thicker; seeds less turgid, acutish at margins. Colo., New Mex., W. Texas, Ariz.

11. **lùtea,** DC. Erect or spreading, 6–8 in. high, annual, or forming a tufted stock of several years' duration: lvs. delicate, pale green, much divided; segms. ovate or wedge-shaped, and 2–3-lobed: fls. pale yellow, about ½in. long, in short racemes; spur short: pod ¼ or ⅓in. long. Stony places of S. Eu., and runs wild in Eu.

BB. *Foliage tomentose.*

12. **tomentòsa,** N. E. Br. A low rock-loving perennial, with a rosette of radical lvs. 4–7 in. long, oblong in outline and tomentose, the tomentum whitish pink, pinnæ finely dissected: racemes erect, 5–7 in. tall; corolla about ¾in. long, light canary-yellow, the spur very blunt and about ¼in. long. China.—A good plant for the rock-garden.

C. angustifòlia, DC., is a little-known perennial with bi-ternately divided lvs. and flesh-colored fls.=Fumaria angustifolia, Bieb. G.C. III. 35:307.—*C. cava,* Schweigg. & Kort. (probably a form of C. tuberosa, DC.) is somewhat larger than C. bulbosa, with pretty fls. varying into purplish and white. Eu.—*C. ochroleùca.* Koch. One ft. high, blooming June–Sept.: fls. yellow-white, the spur yellow: caps. linear: petiole winged. Italy.—*C. Scoùleri,* Hook., grows 3 ft., and is cult. in some European gardens. W. Amer.

N. Taylor.†

CORYLÓPSIS (*Corylus* and *opsis,* likeness; in foliage resembling the hazel). *Hamamelidàceæ.* Woody plants, grown chiefly for their yellow fragrant flowers appearing in early spring and for the handsome foliage.

Deciduous shrubs, rarely trees: lvs. alternate, strongly veined, dentate: fls. in nodding racemes with large bracts at the base, appearing before the lvs., yellow; calyx-lobes short; petals clawed, 5; stamens 5, alternating with entire or 2–3-parted short staminodes; styles 2; ovary half-superior, rarely entirely superior: fr. a 2-celled, dehiscent, 2-beaked caps., with 2 shining black seeds.—About 12 species in E. Asia and Himalayas.

These are low ornamental shrubs, with slender branches and pale bluish green distinct foliage; all are very attractive in early spring, when covered with numerous nodding spikes of yellow, fragrant flowers. Not hardy north of New York, except in sheltered positions. They grow best in peaty and sandy soil. Propagated by seeds sown in spring, best with slight bottom heat, and by cuttings of half-ripened wood in summer under glass; also by layers, rooting readily in moderately moist, peaty soil.

A. *Fls. in many-fld. racemes.*

B. *Petals obovate to oblong-obovate.*

C. *Young branchlets and lvs. beneath pubescent, at least on the veins.*

spicàta, Sieb. & Zucc. Shrub, to 4 ft.: lvs. oblique and rounded or cordate at the base, roundish ovate or obovate, sinuate-dentate, glaucous beneath and pubescent, 2–3 in. long: racemes 7–10-fld., 1–2 in. long, their bracts ovate; fls. bright yellow; stamens slightly longer than the obovate petals; calyx hairy. Japan. S.Z. 19. B.M. 5458. F.S. 20:2135. R.H. 1869, p. 230; 1878, p. 198; 1907, p. 403. G.C. II. 15:510; III. 25:210. Gn. 33, p. 441. S.I.F. 2:26.—This species has larger and handsomer foliage and fls. of a deeper yellow, in longer racemes, but *C. pauciflora* flowers more profusely and is somewhat hardier.

sinénsis, Hemsl. Shrub, 6–15 ft.: lvs. obovate to oblong-obovate, abruptly acuminate, obliquely subcordate or cordate at the base, sinuate-denticulate, pubescent at least on the veins and grayish green beneath, 2–4 in. long: racemes about 2 in. long, their bracts nearly orbicular; petals orbicular-obovate, slightly longer than style and stamens; calyx hairy. Cent. China. G.C. III. 39:18. Var. **glandulífera,** Rehd. & Wilson (*C. glandulifera,* Hemsl.). Young branchlets and petioles with scattered glandular bristles: calyx glabrous. H.I. 29:2819.

CC. *Young branchlets glabrous; lvs. glabrous or only with a few silky hairs on the veins beneath when young.*

Veitchiàna, Bean. Shrub, 3–6 ft.: lvs. short-petioled, elliptic, abruptly acuminate, subcordate at the base, sinuate-denticulate, glaucous beneath, 3–4 in. long: racemes 1–2 in. long; petals obovate, slightly shorter than the stamens; calyx hairy; nectaries 2-parted. Cent. China. B.M. 8349. Gn. 76, p. 184.

BB. *Petals with the blade as broad as or broader than long.*

Wíllmottiæ, Rehd. & Wilson. Shrub, to 12 ft.: lvs. oval to obovate, cordate or truncate at the base, sinuate-denticulate, glaucescent beneath, 1–3½ in. long: racemes 2–3 in. long; petals suborbicular; calyx glabrous; nectaries 2-parted, slightly shorter than the sepals. Cent. China. G.M. 55:191 (as *C. multiflora*).

platypétala, Rehd. & Wilson. Shrub, 3–8 ft.: young branchlets with scattered glandular bristles: lvs. on glandular petioles, ovate or broadly ovate, cordate or subcordate at base, sinuate-denticulate, on both sides sparingly silky-hairy when young, soon glabrous 2–4 in. long: racemes 1–2 in. long; petals hatchet-shaped, ⅛in. broad; nectaries emarginate at the apex; stamens and styles much shorter than petals; calyx glabrous. Cent. China. Var. **lèvis,** Rehd. & Wilson. Branchlets and petioles without any glands. W. China.—Less showy than most other species.

AA. *Fls. in 2–3-fld. racemes.*

pauciflòra, Sieb. & Zucc. Low, much-branched shrub, 2–3 ft.: lvs. obliquely cordate, ovate, sinuate-dentate, ciliate, pubescent and glaucous beneath, 1–2 in. long: racemes 2–3-fld., ½–¾in. long; fls. light yellow; petals obovate, about as long as stamens and style. Japan. S.Z. 20. G.F. 5:342. Gt. 48:1467. B.M. 7736. G.W. 15, p. 101. J.H. III. 48:381. S.I.F 2:26.

C. Griffithii, Hemsl. (C. himalayana, Hook., not Griff.). Shrub or small tree, to 20 ft.: young branchlets and lvs. beneath densely pubescent: lvs. subcordate: racemes 1–2½ in. long; stamens and styles much shorter than the obovate petals. Himalayas. B.M. 6779.

ALFRED REHDER.

CÓRYLUS (ancient Greek name). *Betulàceæ.* HAZEL. FILBERT. COBNUT. Woody plants grown for their handsome rather large foliage and some species for their edible nuts.

Deciduous shrubs, rarely trees: lvs. alternate, stipulate, petioled, serrate and usually more or less pubescent: fls. monœcious, appearing before the lvs.; staminate in long, pendulous catkins, formed the previous year, and remaining naked during the winter (Fig. 1073), each bract bearing 4 divided stamens; pistillate included in a small, scaly bud with only the red styles protruding (Fig. 1074): fr. a nut, included or surrounded by a leafy involucre, usually in clusters at the end of short branches.—Fifteen species in N. Amer., Eu. and Asia, all mentioned below. Monograph by Winkler in Engler, Pflanzenreich, hft. 19, pp. 44–56 (1904), quoted below as Winkl.



1073. Winter catkins of filbert.

Numerous varieties are cultivated in Europe for their edible nuts. They are also valuable for planting shrubberies, and thrive in almost any soil. The foliage of some species turns bright yellow or red in autumn. Propagated by seeds sown in fall, or stratified and sown in spring; the varieties usually by suckers, or by layers, put down in fall or spring; they will be rooted the following fall. Budding in summer is sometimes practiced for growing standard trees, and grafting in spring in the greenhouse for scarce varieties. They may also be increased by cuttings of mature wood taken off in fall, kept during the winter in sand or moss in a cellar and planted in spring in a warm and sandy soil. Illustrated monograph of the cultivated varieties by Franz Goeschke, Die Haselnuss (1887). See, also, bulletin on Nut-culture by the U. S. Dept. of Agric. For the culture of the nuts, see articles *Filberts* and *Hazels.*

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A. *Husk or involucre consisting of 2 distinct bracts (sometimes partly connate).*

B. *Involucre densely spiny: lvs. nearly glabrous.*

1. **fèrox,** Wall. Tree, to 30 ft.: young branchlets silky-hairy: lvs. oblong to obovate-oblong, usually rounded at the base, acuminate, doubly serrate, glabrous except on the veins beneath, with 12–14 pairs of veins, 3–5 in. long: involucre tomentose, forming a spiny bur about 1½ in. across, longer than the small nuts. Himalayas. Winkl. 45. Var. **thibética,** Franch. (*C. thibética,* Batal.). Lvs. broadly ovate to obovate: involucre glabrescent. Cent. and W. China. R.H. 1910:204.

BB. *Involucre not spiny.*

C. *Bracts of the involucre deeply divided into linear lobes, much longer than the nut: tree.*

2. **Colúrna,** Linn. Tree, to 70 ft.: petioles ¾–2 in. long, usually glabrescent: lvs. deeply cordate, roundish ovate to obovate, slightly lobed and doubly crenate-serrate, at length nearly glabrous above, pubescent beneath, 3–5 in. long: frs. 3–10, clustered: involucre open at the apex, usually densely beset with glandular hairs: nut roundish ovate, ¾in. long. From S. Eu. to Transcaspia. G.C. III. 40:256. Gn. 31, pp. 260–1. H.W. 2, p. 29. G.W. 14, p. 642. Gng. 16:163.—Ornamental tree, with regular pyramidal head, not quite hardy N. Rarely cult. for the fr. under name of filbert or of Constantinople or Constantinople nut. Var. **glandulífera,** DC. Petioles and peduncles glandular-setose: lobes of the involucre less acute and more dentate.

3. **chinénsis,** Franch. (*C. Colúrna* var. *chinénsis,* Burk.). Tree, to 120 ft.: petioles ⅓–1 in. long, pubescent and setulose: lvs. ovate to ovate-oblong, cordate and very oblique at the base, glabrous above, pubescent on the veins beneath, doubly serrate, 4–7 in. long: fr. 4–6, clustered; involucre constricted above the nuts, with recurved and more or less forked lobes, finely pubescent, not glandular. W. China. Winkl. 49 and 50.

CC. *Bracts of the involucre divided into lanceolate or triangular lobes: shrubs.*

D. *The involucre not or only slightly longer than the nut, open or spreading at the apex.*

E. *Lobes of bracts serrate or dentate.*

4. **Avellàna,** Linn. Shrub, to 15 ft.: lvs. slightly cordate, roundish oval or broadly obovate, doubly serrate and often slightly lobed, at length nearly glabrous above, pubescent on the veins beneath: involucre shorter than the nut, deeply and irregularly incised: nut roundish ovate, ½–¾in. high. Eu., N. Afr., W. Asia. H.W. 2:16, p. 28. Var. **atropurpùrea,** Kirchn. (var. *fúsco-rùbra,* Goeschke). Lvs. purple. Var. **aùrea,** Kirchn. Lvs. yellow. Var. **laciniàta,** Kirchn. (var. *heterophýlla,* Loud.). Lvs. laciniately incised or lobed. Var. **péndula,** Goeschke. With pendulous branches. G.W. 2, p. 13. There are also many varieties cult. for their fr.



1074. Pistillate flowers of Corylus rostrata. (Natural size)

5. **póntica,** Koch. Shrub: lvs. cordate, roundish ovate or broad-oval, doubly serrate, pubescent beneath: involucre finely pubescent, with few glandular hairs at the base, campanulate, somewhat longer than the nut, with large spreading lobes: nut large, broad-ovate. W. Asia. F.S. 21:2223–4 (as *C. Colurna*).—From this species the cobnuts seem to have originated; also the Spanish nuts are probably mostly cross-breeds between this species and *C. Avellana* or *C. maxima,* or between the two latter species.

EE. *Lobes of the bracts entire or sparingly dentate, triangular.*

6. **heterophýlla,** Fisch. Shrub, to 12 ft.: petioles about ¾in. long: lvs. orbicular-obovate, cordate at the base, nearly truncate at the apex and with a very short point, incisely serrate, pubescent on the veins beneath, 2–4 in. long: involucre somewhat longer than the nuts, striate, glandular-setose near the base. Japan to W. China. S.I.F. 1:20.—Several varieties apparently not yet in cult. occur in China: var. *Crista-Gálli,* Burkill, var. *setchuenénsis,* Franch., and var. *yunnanénsis,* Franch.

DD. *The involucre about twice as long as the nut, usually tightly inclosing the nut.*

7. **americàna,** Walt. Shrub, 3–8 ft.: young branchlets pubescent and glandular bristly: lvs. slightly cordate or rounded at the base, broadly ovate or oval, irregularly serrate, sparingly pubescent above, finely tomentose beneath, 3–6 in. long: involucre compressed, exceeding the nut, the 2 bracts sometimes more or less connate, with rather short, irregular, toothed lobes: nut roundish ovate, about ½in. high. From Canada to Fla. west to Ont. and Dak. Var. **calyculàta,** Winkl. (*C. calyculàta,* Dipp.). Involucre with 2 very large bracts at the base.

AA. *Husk or involucre tubular, narrowed above the nut and forming an elongated beak.*

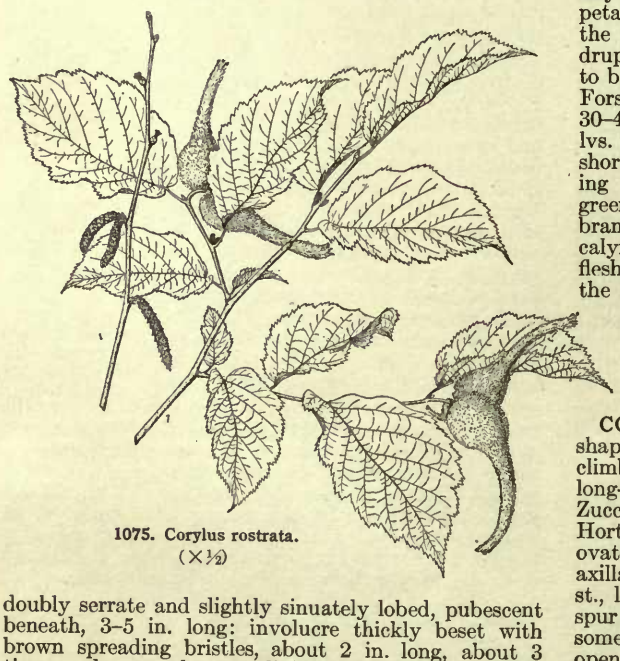
B. *Involucre finely pubescent outside with rather wide gradually narrowed beak.*

8. **máxima,** Mill. (*C. tubulòsa,* Willd.). Shrub, sometimes small tree, to 30 ft.: lvs. cordate, roundish-ovate, slightly lobed and doubly serrate, 3–6 in. long: involucre finely pubescent outside: nut oblong, large; kernel with thin red or white skin. S. Eu. H.W. 2, p. 30. Winkl. 49. Var. **purpùrea,** Rehd. (*C. Avellàna purpùrea,* Loud. *C. máxima* var. *atropurpùrea,* Dochnahl). Lvs. deep purplish red darker than in *C. Avellana atropurpurea.* F.E. 21:325.—Many varieties, with large nuts, known as filberts or Lambert's filberts. The cult. forms are partly hybrids with *C. Avellana.*

BB. *Involucre densely beset with bristly hairs, and usually rather abruptly constricted into a narrow beak.*

C. *Petioles usually longer than ½in.*

9. **mandshùrica,** Maxim. (*C. rostràta* var. *mandschùrica,* Regel). Shrub, to 15 ft.: young branchlets pubescent: lvs. suborbicular to elliptic or obovate,



1075. Corylus rostrata.
(×½)

doubly serrate and slightly sinuately lobed, pubescent beneath, 3–5 in. long: involucre thickly beset with brown spreading bristles, about 2 in. long, about 3 times as long as the nut, divided at the the apex into narrow entire segms. Manchuria, Korea. Winkl. 49.

10. **Sieboldiàna,** Blume (*C. rostràta* var. *Sieboldiàna,* Maxim.). Shrub, to 15 ft.: lvs. elliptic to oblong or obovate, usually rounded at the base, doubly serrate and slightly lobed, 2–4 in.; the young lvs. often with a purple blotch in the middle: involucre with less stiff bristles, about 1½ in. long, 2 or sometimes 3 times as long as the nut, narrowed toward the apex. Japan. S.I.F. 1:20.

CC. *Petioles shorter than ½in.*

11. **rostràta,** Ait. Fig. 1075. Shrub, 2–6 ft.: branchlets pubescent or glabrous, not bristly: lvs. rounded or slightly cordate at the base, oval or obovate, densely serrate and sometimes slightly lobed, nearly glabrous at length, except sparingly pubescent on the veins beneath, 2½–4 in. long: involucre densely beset with bristly hairs, beak long and narrow: nut ovoid, ½in. long. E. N. Amer., west to Minn. and Colo. G.F. 8:345 (adapted in Fig. 1075).

12. **califórnica,** Rose (*C. rostràta* var. *califórnica,* DC.). Allied to *C. rostrata.* Shrub, to 20 ft.: lvs. more villous beneath: involucre with a short beak, which is often flaring and sometimes torn. Calif. to Wash.

C. cólchica, Alboff. Low shrub, to 3 ft.: lvs. ovate or obovate, densely doubly serrate, sparingly pilose: involucre connate, with a short lacerated beak, pubescent. Caucasus. Winkl. 53. Not in cult.—*C. colurnoides,* Schneid. (C. intermedia, Lodd., not Fingerh., C. Colurna×C. Avellana). Similar to C. Colurna: small tree or large shrub. bark darker: involucre shorter, scarcely glandular. Garden origin.—*C. Fárgesii,* Schneid. (C. mandshurica var. Fargesii, Burkill). Tree to 45 ft.: lvs. narrow-obovate to oblong: involucre soft-pubescent, sometimes only slightly so. W. China.—*C. Jacquemóntii,* Decne. (C. Colurna var. lacera, DC.). Allied to C. chinensis. Tree: lvs. ovate, lobed toward the apex, less pubescent, 5–8 in. long: involucre pubescent, not constricted, lobes not or rarely forked, often dentate. Himalayas.

ALFRED REHDER.

CORYNOCÁRPUS (Greek, *club-fruit,* alluding to the shape). *Anacardiàceæ;* by Engler made the sole representative of *Corynocarpàceæ.* A very few New Zeal. and Polynesian evergreen trees, one of which is intro. in Calif. Glabrous: lvs. large, alternate, simple and entire, without stipules: fls. perfect, small, whitish green, inodorous, in terminal or subterminal panicles; calyx-lobes petal-like, unequal, 2 exterior smaller; petals much like the calyx-lobes; stamens 5, opposite the petals and shorter; staminodia 5, petal-like: fr. drupaceous, narrowly ovoid, 1-seeded, the pulp said to be edible; seed very bitter, poisonous. **C. lævigàta,** Forst. NEW ZEALAND LAUREL. Attractive leafy tree, 30–40 ft., the trunk sometimes more than 2 ft. diam.: lvs. to 8 in. long, elliptic-oblong or oblong-ovate, with a short stout petiole, margins slightly recurved, suggesting those of *Magnolia grandiflora:* fls. very small, greenish or whitish, short-pedicelled, in a terminal branched panicle; petals concave, little exceeding the calyx-lobes: drupe 1½ in. or less long, orange-colored, fleshy, plum-like. N. Zeal., in lowlands not far from the sea. B.M. 4379.—*C. símilis,* Hemsl., and *C. dissímilis,* Hemsl., from New Hebrides and New Caledonia respectively, are not listed among cult. plants.

L. H. B.

CORYNOPHÁLLUS: *Hydrosme.*

CORYNÓSTYLIS (Greek, describing the club-shaped style). *Violàceæ.* A monotypic genus of woody climbers, with alternate lvs. and terminal racemes of long-stalked violet-like fls. **C. Hybánthus,** Mart. & Zucc. (*Calýptrion Aublètii,* Ging. *Corynóstylis Aublètii,* Hort.), is native of Trop. Amer. The lvs. are 2–5 in. long, ovate, or orbicular, bright green, serrate: fls. white, in axillary showy racemes which are contiguous along the st., long-spurred, 2 or 3 times as large as a violet, the spur half-twisted. F.S. 21:2213. B.M. 5960.—A handsome, vigorous warmhouse climber, and cult. in the open in S. Calif. Prop. by cuttings and seeds.

CÓRYPHA (Greek for *summit* or *top,*—where the leaves grow). *Palmàceæ,* tribe *Córypheæ.* Tall fan-leaved palms with a spineless stout trunk.

Leaves terminal, large, orbicular, flabellately divided to the middle into numerous linear-lanceolate segms.; segms. induplicate in the bud; rachis none; ligule small; petiole long, stout, concave above, spiny on the



XXX. Chrysanthemum.—Two of the florist's types.

margins; sheaths split: spadix solitary, erect, paniculately much branched; spathes many, tubular, sheathing the peduncle and branches; fls. green, the plant dying after once flowering and fruiting: frs. as large as a cherry, with a fleshy pericarp.—Species 6, Trop. Asia and Malay Archipelago. G.C. II. 24:362. These fan-palms are cult. the same as Chamærops and Livistona. They are warmhouse plants, prop. by seeds. Large fans, umbrellas and tents are made of the talipot palm by the natives of Ceylon. Coryphas are but little grown commercially, the growth of young plants being slow. Good loam well enriched with stable manure, a night temperature of 65° and abundant moisture, are the chief requisites in their cult., with a moderately shaded house during the summer.

elàta, Roxbg. (*C. Gebánga*, Blume). Fig. 1076. Trunk straight, 60–70 ft. high, 2 ft. diam., spirally ridged: lvs. lunate, 8–10 ft. diam.; segms. 80–100, separated nearly to the middle, ensiform, obtuse or bifid; petioles 6–12 ft., with black margins and curved spines: spadix about one-fourth the length of the trunk, but narrow. Bengal and Burma.

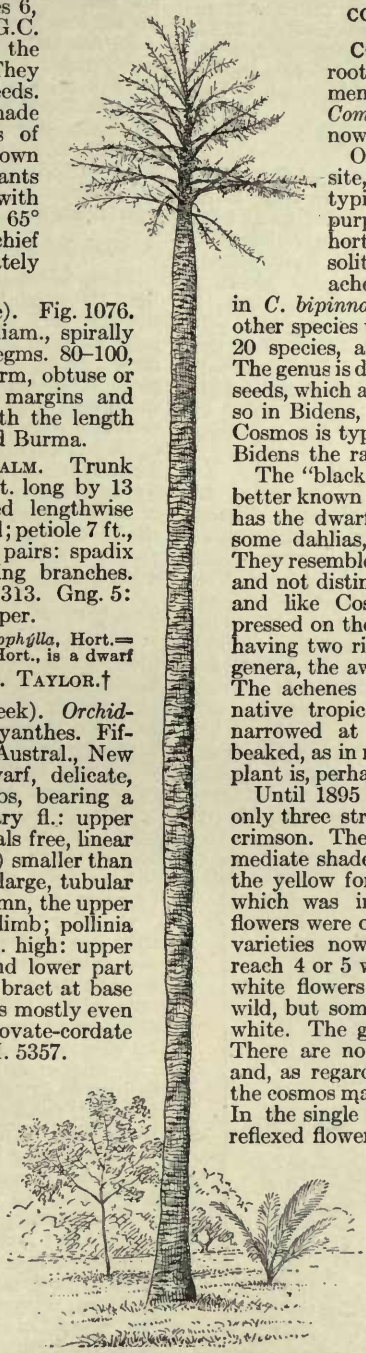
umbraculífera, Linn. Talipot Palm. Trunk ringed, 60–80 ft.: lvs. sub-lunate, 6 ft. long by 13 ft. wide, palmately pinnatifid, folded lengthwise above the middle; segms. obtusely bifid; petiole 7 ft., the spines along its margins often in pairs: spadix sometimes 20 ft. long, with spreading branches. Malabar coast and Ceylon. A.F. 12:313. Gng. 5: 213.—Lvs. used as a substitute for paper.

C. austràlis, R. Br.=Livistona.—*C. macrophýlla*, Hort.=(?).—*C. mìnor*, Jacq.=Sabal.—*C. Wòganii*, Hort., is a dwarf round-lvd. plant. A.G. 15:307.

N. Taylor.†

CORYSÁNTHES (*helmet-flower*, Greek). *Orchidàceæ*. Not to be confounded with Coryanthes. Fifteen or more terrestrial orchids of Austral., New Zeal. and Malaysia, little cult. Dwarf, delicate, tuberous-rooted or fleshy-rooted herbs, bearing a solitary broad lf. and a large solitary fl.: upper sepal large, helmet-shaped; lateral sepals free, linear or filiform; petals (sometimes wanting) smaller than lateral sepals and similar to them; lip large, tubular at base, the margins inclosing the column, the upper part extended into a broad reflexed limb; pollinia 4. *C. pícta*, Lindl., Malaya, is 3–4 in. high: upper part of fl. deep purple and yellow, and lower part with four long awl-like segms. and a bract at base of ovary. *C. limbàta*, Hook. f., Java, is mostly even lower, with fl. purple and white, the ovate-cordate lf. with reticulating white veins. B.M. 5357.

CORYTHOLÒMA (referring to the helmet-shape). *Gesneriàceæ*. By some referred to Gesnera: a half-hundred or more leafy-stemmed tuberous herbs of Trop. S. Amer., with mostly red or speckled tubular fls. in terminal umbels or racemes, or solitary or few in the axils: lip of corolla erect, concave; disk 5-glandular; stamens didynamous. It is doubtful whether any of the species are in the trade. *C. macrópodum*, Sprague, recently mentioned, is a glandular-hirsute herb, 6–9 in. high, from a subglobose tuber: lvs. 3–5 in. across, suborbicular: fls. in solitary axillary cymes, 5–7-fld., cinnabar-red, the corolla-tube about 1 in. long and nearly cylindric, the limb only slightly 2-lipped, the 3 lower lobes blotched purple. S. Brazil. B.M. 8228.—A handsome little plant. These plants are probably to be handled after the manner of gloxinias and similar things.



1076. Corypha elata, having spent itself in blooming.

COSMÁNTHUS: *Phacelia.*

CÓSMEA: *Cosmos.*

COSMÍDIUM: *Thelesperma.*

COSMOPHÝLLUM: *Podachænium.*

CÓSMOS (from the Greek word with a root idea of orderliness; hence an ornament or beautiful thing). Syn., *Cósmea. Compósitæ*. Annual or perennial herbs, now popular as flower-garden subjects.

Often tall, usually glabrous: lvs. opposite, pinnately cut in the garden kinds fls. typically shades of rose, crimson and purple, with one yellow species, and white horticultural varieties, long peduncled, solitary or in a loose corymbose panicle: achenes glabrous: chaff of the receptacle in *C. bipinnatus* with a long and slender apex, in other species with a blunt and short apex.—Perhaps 20 species, all Trop. American, mostly Mexican. The genus is distinguished from Bidens chiefly by the seeds, which are beaked in Cosmos but not distinctly so in Bidens, and by the color of the rays, which in Cosmos is typically some form of crimson, while in Bidens the rays are yellow or white.

The "black cosmos" (*C. diversifolius*) is, perhaps, better known to the trade as a Bidens or Dahlia. It has the dwarf habit and dark red early flowers of some dahlias, but the achenes are very puzzling. They resemble those of Bidens in being four-angled, and not distinctly beaked. They are unlike Bidens, and like Cosmos, in being not distinctly compressed on the back. They resemble both genera in having two rigid persistent awns, but, unlike these genera, the awns have no retrorse barbs or prickles. The achenes are linear, as in Cosmos and all our native tropical species of Bidens; but, although narrowed at the apex, they are not distinctly beaked, as in most species of the genus Cosmos. The plant is, perhaps, nearest to Bidens.

Until 1895 there were in the two leading species only three strongly marked colors: white, pink and crimson. These and the less clearly defined intermediate shades have come from *C. bipinnatus*; and the yellow forms have come from *C. sulphureus*, which was introduced in 1896. At first cosmos flowers were only an inch or two across. The best varieties now average 3 inches, and sometimes reach 4 or 5 without thinning or disbudding. Pure white flowers of cosmos are rarely if ever found wild, but some of the cultivated varieties are clear white. The group is lacking in bright deep reds. There are no full double forms of cosmos as yet, and, as regards strongly marked types of doubling, the cosmos may be decades behind the China asters, In the single forms, flat, incurved, or cupping, and reflexed flowers are to be looked for. Stellate forms are now offered; and also dwarfs, and other variants.

It is a mistake to grow cosmos in too rich soil, as one gets too vigorous growth and too few flowers, which are also late. A sandy soil is to be preferred as being earlier, and not too rich. It is well to pinch out the leading shoots of young plants in order to make them bushy and symmetrical, instead of tall and straggling. In the East, for best results it is still necessary to sow seed indoors in April and transplant outdoors as soon as danger of frost is past. Seed sown in the open ground often fails to produce flowers in some northern localities before frost. The early frost kills the typical species, but some of the new strains are said to resist a degree or two of frost.

A. *Rays white, pink or crimson: disk yellow.*

bipinnàtus, Cav. Fig. 1077. Glabrous annual, 7–10 ft. high: lvs. bipinnately cut, lobes linear, remote, entire: involucral scales ovate-lanceolate, acuminate: fls. white, pink or crimson: seeds smooth, with an abrupt beak much shorter than the body. Mex. B.M. 1535. Gn. 41:10. R.H. 1892:372.—The older and commoner species. *C. hýbridus,* Hort., is presumably a trade name for mixed varieties of *C. bipinnatus,* but see G.F. 1:474 for note.

AA. *Rays yellow: disk yellow.*

sulphùreus, Cav. Fig. 1078. Pubescent, 4–7 ft. high, much branched: lvs. often 1 ft. or more long, 2- or 3-pinnately cut, lobes lanceolate, mucronate, with rachis and midrib ciliate or hispid; pinnæ alternate, entire or 2–3-toothed: peduncles 7–10 in. long, naked: outer involucral bracts 8, linear, acuminate, green, 2 lines long; inner ones 8, oblong, obtuse, scarious, 5 lines long; fls. 2–3 in. across, pale, pure or golden yellow; rays 8, broadly obovate, strongly 3-toothed at the apex, ribbed beneath; anthers of the disk exserted, black, with orange tips: seeds linear, 1 in. long, including the slender beak. Mex. G.F. 8:485 (adapted in Fig. 1078).—Intro. 1896; parent of the yellow forms.

AAA. *Rays dark red: disk red.*

diversifòlius, Otto (*Bìdens atrosanguínea,* Ortg. *B. dahlioìdes,* Wats. *Dáhlia Zimapànii,* Roezl). Black Cosmos. Tender annual, 12–16 in. high, with tubers more slender, and requiring more care in winter than those of common dahlias: lvs. pinnately parted; lfts. 5–7, entire or slightly serrate, the terminal lfts. largest: peduncles each bearing 1 head 6 in. or more above foliage; rays dark velvety red, sometimes tinged dark purple. Mex. B.M. 5227. Gt. 1861:347. F.C. 2:47. J.H. III. 33:403. Var. **supérba,** Hort., is sold.—Prop. almost exclusively by seeds. Wilhelm Miller. †

COSSÍGNIA (Jos. Fr. Charpentier de Cossigny, 1730–1789, French naturalist). *Sapindàceæ.* Shrubs or little trees of about 3 species, sometimes mentioned for cult. in warmhouses. *C. pinnàta,* Comm., of Mauritius, has white fls. in terminal panicled corymbs, and odd-pinnate lvs., with 3–5 oblong and entire lfts.



1077. Cosmos bipinnatus.

COST-ACCOUNTING. The keeping of profit-and-loss records, and the drawing of conclusions from them for the improvement of the business.

In recent years, the application of cost-accounting and efficiency methods to farming operations has opened practically a new approach to the discussion of agricultural problems and is forcing a reorganization in practices and in the sub-divisions of the business. Careful and extended studies have not yet been made of the efficiency principles in most horticultural occupations; but the suggestions drawn from orchard records may show the nature and scope of the work.

Annual inventory.

There is no single account that is more important than the annual inventory. This inventory should list the land and each important building separately. The total value of these items should equal the value of the farm. It should list each cow, horse and important piece of machinery separately. All the cash, notes, mortgages and accounts due the farmer should be recorded with his property. A separate list should be made of all notes, mortgages or accounts due to others. The difference between these and the value of property owned gives the net worth of the farmer. A comparison of the net worth at the beginning and end of the year shows the gain or loss for the year unless money or property has been added to the business from some other sources or taken from it.

Cost-accounts.

But an inventory does not show on which enterprises gains or losses have occurred. Usually a business is made up of both profitable and unprofitable enterprises, or of enterprises that are unequally profitable. In order to know how to develop the business to the best advantage, it is important to know which enterprises pay best for the use of land and labor. Cost accounts also have very many uses aside from determining the relative profitableness of different enterprises. If all the time spent, labor costs, and other costs, and the receipts are known, it is often possible to see ways of changing the management of a crop so as to increase profits.

In order to keep a complete cost-account with any crop, it is necessary to know all the labor of men, teams and machinery for the crop; to know all receipts and expenses caused by the cropping, and to keep track of any outlays contributed to the crop from the farm or other enterprises, also whatever this crop contributes to other enterprises.

A work-report of the time of man and horse should be kept in an ordinary account-book. At the end of the year, the total time is charged to each crop-account in the ledger. The ledger should have wide pages, so that there may be room for full descriptions. The left-hand page is used for charges, and the right-hand page for credits.

Each evening one should record any cash spent during the day under the proper crop or enterprise. The number of hours that have been spent on each enterprise for both man and horse labor are also recorded in the form shown on the next page. For convenience, the horse time is reduced to terms of one horse. A three-horse team working 10 hours is put down as 30 hours. If one desires, he may keep an account with only one enterprise. It is better to keep accounts with all the enterprises on the farm, so that one may study each part of his business and the business as a whole.

The best method of discussing the subject is to show an account as kept by a farmer. The following account with a 3-acre apple orchard was kept by a New York farmer in 1912:—

WORK REPORT FOR APPLE ORCHARD.—THREE ACRES

1912		Man		Horse	
		Hrs.	Min.	Hrs.	Min.
April 1..	Manured	9	45	18	
May 8..	"	2	30	5	
15..	Pruned	3			
25..	Brush hauled and burned	1	30	3	
27..	Sprayed	16	30	13	
28..	"	4	30	5	
31..	"	10	15	10	
June 1..	"	13	45	3	45
3..	"	16	30	9	
4..	"	9	30	5	
5..	"	14		7	
7..	Cleaned and put up sprayer	1	15		
July 31..	Removed borers	7	15		
Aug. 19..	Thinned	11	30		
20..	"	4			
	Manured	8	30	17	
Sept. 7..	Picked	4	15		
Oct. 11..	Hauled barrels	8		16	
12..	Picked and packed	34	30	2	30
14..	" " "	7		2	
15..	" " "	11	30	5	
	Hauled to station	2	30	5	
17..	Picked and packed	15	45	4	
18..	" " "	12	30		30
19..	" " "	28	30	2	
21..	" " "	22	15		
25..	" " "	19	30	1	
26..	" " "	25	30	1	
28..	" " "	36			
30..	" " "	34	30		
	Hauled to station	5	30	11	
31..	Picked and packed	21	30	1	
Nov. 4..	Selling	2		1	30
6..	Packed	7	30		
	Picked up drops	17		3	
8..	Hauled to station	10	15	8	
12..	Got ready for shipping	7	30		
13..	Hauled to station	4	30	9	
14..	"	9		10	
15..	" "	9	30	14	
Dec. 10..	Hauled manure	2		4	
	Total hrs. and mins	492	45	196	15



1078. Cosmos sulphureus. (×⅛)

LEFT-HAND PAGE.

1912		
Jan. 1..	Inventory—barrels on hand	$12 00
Mar. 25..	100 lbs. arsenate of lead	8 10
April 5..	Freight on arsenate of lead	34
	1 bbl. lime-sulfur, $8; freight 28 cts.	8 28
June 10..	3 loads manure	1 50
Sept. 5..	6½ loads manure	3 25
Oct. 11..	Freight on barrels	6 00
18..	150 barrels	75 00
31..	Barrel liners, 60 cts.; freight, 25 cts.	85
Nov. 8..	Postage	20
Dec. 2..	Post-cards for advertising	3 52
	Adv., "Apples for sale"	37
	Telephone	25
31..	Use of land	40 00
	493 hrs. man-labor @ 18.3 cts.	90 22
	196 hrs. horse-labor @ 13.3 cts.	26 07
	196 hrs. equipment-labor @ 5.1 cts.	10 00
	Interest on costs	3 00
	Total	$288 95
	Gain	51 47
		$340 42

RIGHT-HAND PAGE.

Aug. 11..	4 empty barrels sold	$1 58
12..	1 bus. King, $1; 1 bus. Snow, 75 cts.	1 75
17..	12 bus. drop apples	3 00
	2 empty barrels	1 10
21..	2 bus. Spy, 1 bus. Baldwin	2 25
22..	25 bus. drops	6 25
Oct. 25..	Mrs. Franklin, 7 bbls. Baldwin, 2 bbls. King, 2 bbls. Greening, 4 bbls. Spy, 1 bbl. Spitz.	35 25
	Archdeacon & Co., 6 bbls. Snow, net	9 39
Nov. 4..	1 bbl. King, $2.25; 1 bbl. Baldwin, $1.85; 1 bbl. Spy, $2.75	6 85
11..	2 bbls. Baldwin	3 95
	15 bus. Baldwin culls	75
20..	12 bbls. Baldwin, $26.50; 4 bbls. Greening, $8.25; 1 bbl. Spy, $2.25; 1 bbl. Wagener, $1.75	38 75
21..	3 bus. culls	1 00
	111 bbls. (1 bbl. Spitzenberg, 1 bbl. King, 6 bbls. Wagener, 1 bbl. Fall Pippin, 9 bbls. Hubbardston, 69 bbls. Baldwin, 24 bbls. Greening)	188 70
22..	2 bbls. Baldwin.....Bill not collected.	
23..	5 bbls. (1 bbl. King, 2 bbls. Baldwin, 1 bbl. Greening, 1 bbl. Spy)	12 75
26..	5 bbls. Baldwin	7 85
	3 bus. Hubbardston, 6 bus. King	5 25
	Kept for home use; 3 bus. Snow, 20 bus. Baldwin	11 50
	25 bus. drops to chickens	2 50
	Total	$340 42

This mere keeping of cost-accounts is not the end. The accounts must be studied. The following are a few of the facts that the farmer used in the preceding records and the suggestions derived from them:

Total crop:	Bus.
Baldwin	421
Greening	93
Hubbardston	30
Spy	23
King	22
Snow	22
Carried forward	611

Total crop:	Bus.
Brought forward	611
Wagener	21
Spitzenberg	6
Fall Pippin	3
	641
Drops and culls	105

From the foregoing records he was able to determine the yields per tree of different varieties.

Yields per acre good apples, 214 bushels.

Yield per acre culls and drops, 33 bushels.

Per cent of culls and drops, 14.

Total receipts, good apples, less cost of barrels, $233.07.

Average price per bushel, good apples, without barrels, 36 cents.

Hours of man-labor, per acre, 164.

Hours of horse-labor, per acre, 65.

Profit, per acre, $17.

Profit, per hour, of man-labor, 10 cts.

Cost, per bushel, good apples, without barrels, 28 cents.

Profit, per bushel, 8 cents.

It will be seen that the cost of barrels was very high owing to buying late in the season. Ten cents a barrel extra cost is more than equal to the profit on a bushel of apples, or one-third the entire profit. Usually the profit on an enterprise can be greatly changed by small changes in cost.

The profit per acre is in addition to pay for use of land. If all the profit is expressed in terms of land, the orchard paid $27 per acre rent, or gave a profit of $14 per acre.

If the profit is all expressed in terms of labor, the orchard paid 28 cents per hour for time spent on it, or gave a profit of 10 cents per hour.

Records similar to those given above may be kept with each crop or enterprise on the farm. If this is done, an account is kept with horses from which the cost of an hour of horse-labor is determined. At the end of the year, the labor on each crop for the year is charged at this rate. Similarly, the cost of man-labor is found and charged. The cost of machinery-labor is charged in proportion to the hours that horses worked for the enterprise. This is how the costs per hour given above were determined. But if a complete set of accounts is not kept, the charge for labor of men and horses is placed at the usual rate of pay for such work in the region, including the cost of board. References: "Farm Management," G. F. Warren, pp. 428–93 (1913). Minnesota Bulletins, Nos. 97, 117, and 124. "Farm Accounts," J. A. Vye. G. F. WARREN.

COSTMARY: The rayless form of *Chrysanthemum Balsamita*, known as var. *tanacetoides*.

CÓSTUS (old classical name). *Zingiberàceæ*. SPIRAL FLAG. Perennial thick-rooted tropical herbs, cultivated under glass for their flowing-limbed showy flowers, which are in terminal bracteate spikes.

Stems short or tall and leafy (plant rarely acaulescent), roots often tuberous: fls. golden yellow, red, saffron-colored or white; corolla tubular, cleft, not showy; 1 staminodium, enlarged and bell-shaped, usually with a crispy limb, and forming the showy part of the fl. (called the lip), cleft down the back; ovary 3-loculed; filaments petaloid. — About 100 species, widely distributed in the tropics. More or less fleshy plants, prized in warmhouses, and grown in the open in S. Fla. and other warm regions. Monogr. by Schumann in Engler's Pflanzenreich hft. 20 (1904).

This interesting genus of tropical herbs thrives in any rich moist soil, but luxuriates in that of a gravelly or sandy character, when under partial shade. The plants are readily propagated by cutting the canes, or stalks, into short pieces of an inch or two in length, and planting in sifted peat, or fine moss and sand, covering but lightly. The roots may also be divided, but this is a slow means of propagation. Specimen plants require rather high temperature to bring out the rich colors of the leaves, which in some species are prettily marked with a purplish tint, and are usually arranged spirally on the ascending stem. This gives rise to the name "spiral flag." (E. N. Reasoner.)

speciòsus, Smith. Somewhat woody at base, 4–10 ft., stout, erect: lvs. oblong or oblanceolate, acuminate, nearly 1 ft. long, silky beneath: bracts red: fl. large, with a flowing white limb and yellowish center, 3–4 in. across, not lasting. E. Indies. I.H. 43:56. Gn. 47:166.

ígneus, N. E. Br. One to 2 ft.: lvs. oblong or elliptic-lanceolate, 4–6 in. long: bracts not colored nor conspicuous: fls. clustered, orange-red. Brazil. I.H. 31:511. B.M. 6821. J.H. III. 28:11.

Few species of Costus are offered in this country, but others may occur in special collections.—*C. Frièdrichsenii*, Petersen. 6 ft. or more: lvs. sessile, lanceolate, acuminate, 1½ ft. or less long: fls. very large, bright yellow in thick terminal spikes. Gt. 52:15–21. Cent. Amer. (?).—*C. micránthus*, Gagnep. 5–6 ft.: lvs. spirally placed, lanceolate: fls. very small with red tube and orange-red yellow-tipped lobes, the lip tubular and purple, in cone-like spikes 3 in. long. Martinique.—*C. musàicus*, Hort. Lvs. obliquely lanceolate, 4–5 in. long, dark green, marked and tessellated with silvery gray. W. Afr.—*C. zebrinus* is very likely the same as last. L. H. B.

CÓTINUS (ancient Greek name of a tree with red wood). *Anacardiàceæ*. SMOKE-TREE. CHITTAM-WOOD. Woody plants, grown chiefly for the attractive feathery fruiting panicles and for the handsome foliage turning brilliant colors in autumn.

Deciduous shrubs or trees with a strong-smelling juice: lvs. slender-petioled, entire, without stipules: fls. dicœcious or polygamous, small, greenish or yellowish, in large and loose terminal panicles; the pedicels of the numerous sterile fls. lengthen after the fls. have dropped and become clothed with spreading hairs; petals 5, twice as long as the pointed calyx-lobes, the 5 stamens shorter than the petals, inserted between the lobes of the disk; ovary superior with 3 short styles: fr. a small compressed oblique-obovate dry drupelet with the style on one side.— Two species, one in N. Amer. and one in S. Eu. to Cent. Asia. Formerly usually included under Rhus, which differs chiefly in its usually compound and more or less serrate lvs., the globose fr. with terminal style, the absence of plumose pedicels and in the milky juice. Often planted, particularly the European species, for its loose feathery panicles which give almost the effect of a dense cloud of smoke, from which the shrub derives its name. The panicles of the American species are much less showy, but the autumnal coloring is more brilliant. Both species hardy as far north as Mass., the American being somewhat more tender. They prefer a sunny, and in the N., a somewhat sheltered position and well-drained soil, and are adapted for planting in dry and rocky ground. Prop. by seeds; also by root-cuttings and layers.



1079. Cotinus Coggygria. (×⅓)

Coggýgria, Scop. (*C. Cótinus*, Sarg. *C. Coccýgea*, Koch. *Rhus Cótinus*, Linn.) SMOKE-TREE. Fig. 1079. Spreading, rather dense shrub, to 15 ft.: lvs. slender-petioled, oval or ob-

ovate, abruptly narrowed at the base, rounded at the apex, glabrous, 1½–3½ in. long: panicles to 8 in. long, densely plumose, usually purplish: frs. few, about ⅛ in. long. June, July: fr. Aug., Sept. S. Eu. to Cent. China and Himalayas. Gn. 34, p. 162; 54, p. 505; 71, p. 552. Gng. 5:118. M.D.G. 1902:217. G.C. III. 29:92. H.W. 3, p. 32. Var. **atropurpùrea,** Dipp. Panicles with dark purple hairs. Var. **péndula,** Dipp.



1080. Cotoneaster horizontalis.

Branches pendulous. Var. **pubéscens,** Engler. Lvs., at least beneath, and often also the young branches, pubescent.

americànus, Nutt. (*C. cotinoìdes,* Brit. *Rhûs cotinoìdes,* Nutt.). Upright shrub or small tree, to 35 ft.: lvs. gradually narrowed at the base, obovate to elliptic-obovate, rounded at the apex, silky beneath when young, at maturity glabrous or nearly so, 4–6 in. long: panicles 5–6 in. long, with short and rather inconspicuous pale purple or brownish hairs. June, July. Ala. to W. Texas and E. Tenn. S.S. 3:98, 99.—The autumnal tints orange and scarlet, as in the preceding species, but more brilliant. ALFRED REHDER.

COTONEÁSTER (*cotoneum,* quince, and *aster,* similar: the leaves of some species resemble those of the quince). *Rosàceæ,* subfamily *Pòmeæ.* Shrubs, rarely small trees, chiefly grown for their ornamental red or black fruits and some species also for their foliage which turns brilliant colors in autumn.

Leaves alternate, deciduous or persistent, short-petioled, entire, stipulate: fls. solitary or in cymes, terminal, on short lateral branchlets, white or pinkish; petals 5; stamens about 20: fr. a black or red pomaceous drupe, with 2–5 stones.—About 40 species, in the temperate regions of Eu. and Asia, also in N. Afr., but none in Japan.

Cotoneasters are ornamental shrubs, many of them with decorative fruits remaining usually through the whole winter, while only a few, like the hardy *C. hupehensis* and *C. multiflora* and the tender *C. frigida,* and also *C. racemiflora* and *C. salicifolia,* are conspicuous with abundant white flowers. Of the species with decorative red fruits, *C. tomentosa, C. racemiflora* and *C. integerrima* are quite hardy, and *C. Simonsii, C. acuminata, C. rotundifolia, C. microphylla* and others are hardy at least as far north as New York, while *C. frigida* and its allies are the most tender. The foliage of some of the species assumes brilliant colors in autumn; dark crimson in *C. Simonsii, C. horizontalis, C. divaricata* and *C. Dielsiana;* scarlet and orange in *C. foveolata,* bright yellow in *C. Zabelii.* The half-evergreen *C. horizontalis* and *C. adpressa,* and the evergreen *C. Dammeri* and *C. microphylla,* with its allied species, are well adapted for rockeries on account of their low, spreading or prostrate habit. Cotoneasters thrive in any good, well-drained garden soil, but dislike very moist and shady positions. Propagation is effected by seeds, sown in fall or stratified; the evergreen species grow readily from cuttings of half-ripened wood in August under glass; increased also by layers, put down in fall, or by grafting on *C. vulgaris,* hawthorn, mountain ash or quince.

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A. *Petals upright, small, usually pinkish; cymes usually few-fld. or nodding, if many-fld. (Orthopetalum.)*

B. *Fr. red.*

C. *Under side of lvs. glabrous or only pubescent.*

D. *Habit prostrate.*

1. **adprέssa,** Bois (*C. horizontàlis* var. *adprέssa,* Schneid.). Prostrate shrub, with creeping and often rooting sts. irregularly branched: lvs. oval, acutish, wavy at the margin, nearly glabrous, ⅛–½in. long: fls. 1–2, pinkish: fr. subglobose, usually with 2 stones. June: fr. Aug., Sept. W. China. V.F. 116.—Hardy at the Arnold Arboretum.

2. **horizontàlis,** Decne. Fig. 1080. Low shrub: branches almost horizontal and densely distichously branched: lvs. round-oval, acute at both ends, glabrous above, sparingly setosely hairy beneath, ⅛–⅔in. long: fls. erect, 1–2, pink: fr. ovoid, bright red, usually with 3 stones, smaller than in the preceding species. June; fr. Sept., Oct. China. R.H. 1885, p. 136; 1889:348, fig. 1. G.C. III. 32:91. Gn. 66, p. 407. Var. **perpusílla,** Schneid. Lvs. less than ⅓in. long: fr. ¼in. across.—Like the preceding species, one of the most effective fruiting shrubs for rockeries.

DD. *Habit upright.*

E. *Lvs. small, not exceeding 1 in., nearly glabrous beneath.*

3. **Sìmonsii,** Baker (*C. acumináta* var. *Sìmonsii,* Decne.). Shrub, with spreading branches, to 4 ft.: lvs. roundish oval, acute, glabrous above, ½–1 in. long, semi-persistent: cymes 2–5-fld.; fls. white, slightly pinkish; calyx appressed-pubescent: fr. bright red, usually with 3–4 stones. June, July. Himalayas. Refug. Bot. 1:55. B.M. 8010 (excl. fls.; as *C. rotundifolia*). One of the best red-fruiting species, often under the name *C. Simondsii* or *C. Symonsi.*

4. **divaricàta,** Rehd. & Wilson. Upright shrub, to 6 ft.: lvs. deciduous, oval or broadly oval, acute or obtusish, broadly cuneate at the base, lustrous above, ½–¾in. long: fls. usually 3, pink; calyx appressed-pubescent: fr. ovoid, nearly sessile, bright red, ⅓in. long, usually with 2 stones. June; fr. Sept. Cent. and W. China.—Very handsome when studded with its bright red frs.; hardy at the Arnold Arboretum.

EE. *Lvs. larger, 1½–3 in. long, deciduous.*

5. **acumináta,** Lindl. Erect shrub, to 6 ft.: lvs. oblong to ovate-oblong, acute or acuminate, appressed-hairy on both sides, dull above to light green beneath: cymes 2–5-fld., nodding; fls. white or slightly pinkish; calyx pubescent: fr. deep scarlet, turbinate, with 2–3 stones. June; fr. Sept., Oct. Himalayas. L.B.C. 10:919 (as *Mespilus*). R.H. 1889:348, fig. 5 (as *C. nepalensis*).

6. **bullàta,** Bois. Spreading shrub, to 6 ft.: lvs. ovate, acuminate, rounded or broadly cuneate at the base, rugose and finally nearly glabrous above, reticulate, pale grayish green and pubescent beneath: fls. pinkish, few; calyx glabrous: fr. red, subglobose, with 4–5

stones. May, June; fr. Sept., Oct. W. China. V.F. 119. Var. **floribúnda**, Rehd. & Wilson (*C. moupinénsis floribúnda*, Stapf). Cymes many-fld.; calyx slightly pubescent. B.M. 8284. Var. **macrophýlla**, Rehd. & Wilson. Lvs. elliptic to lanceolate-oblong, narrowed at the base, often nearly glabrous, 2–6 in. long: cymes many-fld.—The varieties are much handsomer than the type.

CC. *Under side of lvs. whitish or grayish tomentose: young branchlets densely pubescent.*

D. *Lvs. ¾–2½ in. long, rounded at base.*

7. **integérrima**, Medikus (*C. vulgàris*, Lindl.). Shrub, to 4 ft.: lvs. ovate or oval, acute or obtuse and mucronulate, glabrous and dark green above, whitish and at length greenish tomentose beneath, ¾–2 in. long: cymes nodding, 2–4-fld.; fls. pale pinkish; calyx glabrous outside: fr. globular, bright red. May, June; fr. Aug. Eu., W. Asia, Siberia. H.W. 3, p. 73, figs. *a–i*.

8. **tomentòsa**, Lindl. Shrub, to 6 ft.: lvs. broadly oval, obtuse, dull green above and pubescent when young, whitish tomentose beneath, 1–2½ in. long: fls. 3–12, white, calyx tomentose outside: fr. bright brick-red. June; fr. Sept., Oct. Eu., W. Asia. H.W. 3, p. 73, figs. *k–o*. G.O.H. 105.—Sometimes cult. as *C. speciosa*, Hort.

DD. *Lvs. about 1 in. or less long, slightly pubescent above.*

E. *Apex of lvs. mostly obtuse, base rounded.*

9. **Zàbelii**, Schneid. Shrub, to 6 ft. with slender spreading branches: lvs. oval to ovate, dull green and loosely pubescent above, grayish or yellowish tomentose below, on young plants sometimes more glabrescent and acutish, ¾–1¼ in. long: fls. 5–9 in loose corymbs, pinkish; calyx villous outside, with obtuse teeth: fr. ovoid, red, about ⅓in. long, with 2 stones. May; fr. in Sept., Oct. Cent. China.



1081. Cotoneaster hupehensis. (×⅓)

EE. *Apex of lvs. mostly acute, base often cuneate.*

10. **Dielsiàna**, Pritz. (*C. applanàta*, Duthie). Shrub, to 6 ft. with slender spreading and arching branches: lvs. deciduous, firm, ovate or elliptic, acutish, rounded or broadly cuneate at base, yellowish gray tomentose beneath, ½–1 in. long: fls. few, short-stalked; calyx pubescent: fr. 1–3, subglobose, ¼in. across, red, with 3–4 stones. June; fr. Sept., Oct. Cent. China. Var. **màjor**, Rehd. & Wilson. Lvs. larger and broader: fr. larger. Var. **élegans**, Rehd. & Wilson. Lvs. smaller, sub-persistent, finally nearly glabrous and somewhat shining above: fr. pendulous, coral-red. W. China.

11. **Fránchetii**, Bois. Upright densely branched shrub with spreading branches: lvs. thickish, elliptic or ovate, acute or acuminate, usually cuneate at base, yellowish white tomentose beneath, ¾–1½ in. long: fls. 6–15, in short and dense corymbs, pinkish, small; calyx pubescent outside, with acute teeth: fr. orange-red, ovoid, over ⅓in. long, with usually 3 stones. June; fr. Sept., Oct. W. China. R.H. 1902, p. 379; 1907:256. V.F. 118.

BB. *Fr. black or nearly black.*

C. *Lvs. acute or acuminate, pubescent or nearly glabrous beneath.*

D. *Upper surface of lvs. glabrous and somewhat lustrous: calyx slightly pubescent or glabrous.*

12. **lùcida**, Schlecht. (*C. acutifòlia*, Lindl. *C. sinénsis*, Hort.). Upright, rather dense shrub, to 12 ft.: lvs. elliptic or elliptic-ovate, acute, usually cuneate at the base, slightly pubescent beneath, 1–1½ in. long: fls. 3–6, in nodding corymbs: fr. purplish black, subglobose, with 3–4 stones. May, June; fr. Sept. Altai Mts. G.W. 5, p. 247 (as *C. acutifolia*).—Foliage dark green, remaining green until very late in autumn.

DD. *Upper surface of lvs. pubescent, at least when young, dull green: calyx pubescent.*

13. **acutifòlia**, Turcz. (*C. pekinénsis*, Zabel. *C. acutifòlia* var. *pekinénsis*, Koehne). Shrub, to 12 ft., with spreading slender branches: lvs. elliptic-ovate to oblong-ovate, acute or acuminate, usually rounded at base, slightly appressed-pilose beneath, becoming nearly glabrous, 1½–2 in. long: fls. 2–5, nodding: fr. ovoid, black, to ½in. long, with usually 2 stones. May, June; fr. Sept., Oct. N. China. Var. **villòsula**, Rehd. & Wilson. Lvs. more densely villous beneath, somewhat larger: calyx densely villous: fr. thinly pubescent. Cent. and W. China.

14. **foveolàta**, Rehd. & Wilson. Shrub, to 10 ft. with spreading branches: lvs. elliptic to elliptic-ovate, rarely ovate-oblong, acute or acuminate, soon glabrous above, pubescent beneath, chiefly on the veins, finally nearly glabrous, 2–3 in. long: fls. 3–6, pinkish; calyx pubescent: fr. black, subglobose, ⅓in. across, with 3–4 stones. June; fr. Sept. Cent. China.—The foliage turns bright scarlet and orange in autumn.

CC. *Lvs. obtuse or acutish, tomentose beneath.*

15. **melanocárpa**, Lodd. (*C. nìgra*, Wahlb.). Shrub with spreading branches, to 6 ft.: lvs. oval or ovate, usually rounded at base, dark green and sparingly pubescent above, grayish white tomentose beneath, 1–3 in. long: fls. 3–8; calyx glabrous: fr. black, globose, with 2–3 stones. May, June: fr. Aug. N. and E. Eu. to Siberia. L.B.C. 16:1531. Var. **laxiflòra**, Koehne (*C. laxiflòra*, Jacq.). Corymbs 12- to many-fld., elongated, pendulous. B.R. 14:1305. Var. **commíxta**, Schneid. (*C. laxiflòra*, Hook.). Lvs. acutish, 2 in. long: corymbs 8–15-fld. B.M. 3519.

AA. *Petals spreading, white, roundish: fr. red.* (*Chænopetalum.*)

B. *Fls. in many-fld. corymbs: upright shrubs.*

C. *Lvs. broadly ovate or oval, obtuse or acute, ½–1½ in. long, deciduous.*

D. *The lvs. glabrous beneath at maturity.*

16. **multiflòra**, Bunge (*C. refléxa*, Carr.). Shrub, to 6 ft., with usually slender, arching branches: lvs. broad-ovate, usually acute, slightly tomentose at first beneath, soon becoming glabrous: cymes very numerous, 6–20-fld.; calyx and peduncles glabrous: fr. red, ⅓in. across. May. Spain, W. Asia to Himalayas

and China. R.H. 1892, p. 327; 1893, p. 29. G.W. 6, p. 62. M.D.G. 1914: 7.—Very decorative in bloom, and hardy, but less free fruiting. Var. **calocárpa**, Rehd. & Wilson. Lvs. larger and narrower, slightly hairy below: fr. larger, nearly ½in. across, freely produced. W. China.

DD. *The lvs. tomentose beneath.*

17. **hupehénsis**, Rehd. & Wilson. Fig. 1081. Shrub, to 5 ft., with slender spreading branches, villous while young: lvs. ovate to elliptic, obtuse or acutish, mucronulate, rarely emarginate, above finally glabrous, thinly grayish tomentose beneath, ½–1 in. long: corymbs very numerous, with 6–12 or more white fls.; peduncle and calyx villous; anthers yellow: fr. red, subglobose, about ⅓in. across, with 2 stones. May. Cent. and W. China. M.D.G. 1914: 6 (as *C. acutifolia* var.).—One of the handsomest species in bloom; hardy as far north as Mass.

18. **racemiflòra**, Koch (*C. nummulària*, Fisch. & Mey. *C. Fontanèsii*, Spach). Shrub, to 4 ft., with erect or spreading branches, rarely prostrate: lvs. roundish or broad-ovate, obtuse or acute, whitish or grayish tomentose beneath, glabrous above: cymes very short-peduncled, 3–12-fld.; peduncle and calyx tomentose: fr. red. May, June. From N. Afr. and W. Asia to Himalayas and Turkestan. R.H. 1867: 31.—Very decorative and hardy. Var. **soongàrica**, Schneid. Lvs. oval, usually obtusish, less pubescent. Var. **microcárpa**, Rehd. & Wilson. Similar to the preceding, but fr. ovoid, smaller. Var. **orbiculàris**, Wenz. (*C. Wheèleri*, Hort.). Low and divaricate: lvs. roundish or obovate, ½–¾in. long: cymes 3–6-fld.

CC. *Lvs. elliptic to oblong, acute at both ends, subcoriaceous.*

D. *Length of lvs. ½–1½ in.: corymbs 1 in. across or less.*

19. **pannòsa**, Franch. Half-evergreen shrub, to 6 ft.: lvs. elliptic- to ovate-oblong, mucronate at the apex, glabrous above, densely grayish white-tomentose beneath: calyx tomentose: fr. red, globose-ovoid, ⅓in. long with 2 stones. S. W. China. R.H. 1907: 256. G. 25: 408. Gn. 67, p. 118. J. 12: 120.—Very handsome, but tender.

DD. *Length of lvs. 1½–4 in.: corymbs 1–2 in. across.*

20. **salicifòlia**, Franch. Half-evergreen shrub, to 15 ft.: young branchlets floccose-tomentose: lvs. elliptic-oblong to ovate-lanceolate, acute or acuminate, rugose and glabrous above, floccose-tomentose beneath, 1½–3 in. long: fls. white in dense corymbs 1–2 in. across: fr. subglobose, bright red, ¼in. across, with 2–3 stones. June; fr. Oct., Nov. W. China. Var. **rugòsa**, Rehd. & Wilson (*C. rugòsa*, Pritz.). Lvs. broader and shorter, elliptic-oblong, dull green above, more woolly-tomentose beneath: fr. larger, usually with 2 stones. Cent. China. Var. **floccòsa**, Rehd. & Wilson. Lvs. oblong to oblong-lanceolate, floccose-tomentose beneath while young, later becoming partly glabrous and glaucous, bright green and lustrous above: fr. larger, usually with 3 stones. W. China.—This species is very handsome, particularly in autumn when studded with its clusters of bright red berries. The var. *floccosa* which has been advertised as var. *glaciosa* (misspelled for *floccosa*) seems to be the hardiest and most desirable.

21. **frígida**, Wall. Large half-evergreen shrub, to 20 ft.: lvs. oblong, acute at both ends, glabrous above, tomentose beneath when young, 2–4 in. long: cymes long-peduncled, very many-fld., pubescent: fr. scarlet. April, May. Himalayas. B.R. 15: 1229. L.B.C. 16: 1512.—One of the most beautiful in fl. and fr., but not hardy N.

BB. *Fls. 1–3: low prostrate or trailing shrubs: lvs. persistent.*

C. *Lvs. green beneath.*

22. **Dámmeri**, Schneid. (*C. humifùsa*, Duthie). Prostrate shrub with trailing often rooting branches: lvs. elliptic, usually cuneate at the base, obtusish and usually mucronulate, glabrous or nearly so, about 1 in. long: fls. usually solitary; calyx sparingly pubescent or nearly glabrous: fr. bright red. May, June; fr. Oct., Nov. Cent. China. Var. **radícans**, Schneid. Lvs. often obovate, slender-petioled: fls. 1–2, on peduncles about ½in. long.

CC. *Lvs. glaucous or whitish tomentose beneath.*

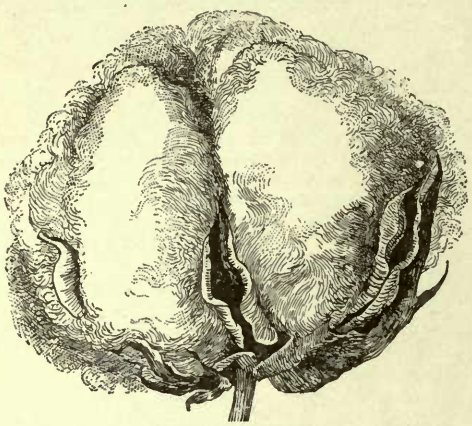
23. **rotundifòlia**, Wall. (*C. microphýlla Ûva-úrsi*, Lindl. *C. prostràta*, Baker). Low or prostrate shrub: lvs. nearly orbicular or broadly oval, dark green above and somewhat pubescent, loosely pubescent beneath or glabrescent and glaucous, ⅓–½in. long: fls. 1–3, about ½in. across: fr. bright red, subglobose, more than ⅓in. across. Himalayas. May, June; fr. Sept. B.R. 14: 1187. Var. **lanàta**, Schneid. (*C. buxifòlia*, Baker, not Wall. *C. Wheèleri*, Hort.) Lvs. elliptic to elliptic-oblong, tomentose beneath: fr. ½in. across. Refug. Bot. 1: 52 (fls. in bud). Gn. 55: 186. R.H. 1889, 348, fig. 4.

24. **microphýlla**, Wall. Low, prostrate shrub, densely branched: lvs. cuneate-oblong or obovate, acute, shining above, densely pubescent beneath, ⅓in. long: fls. usually solitary; calyx pubescent: fr. bright red. May, June. Himalayas. B.R. 13: 1114. L.B.C. 14: 1374. R.H. 1889: 348, fig. 3. G.C. II. 12: 333; 18: 681. Gn. 4, p. 165. Var. **thymifòlia**, Koehne (*C. thymifòlia*, Baker). Very dwarf: lvs. linear-oblong, smaller: fls. and fr. smaller. R.H. 1889: 348, fig. 2. G.C. II. 12: 333; 18: 681. Refug. Bot. 1: 50. Var. **glaciàlis**, Hook. (*C. congésta*, Baker). Lvs. glabrous beneath, oval: fls. smaller, often pinkish. Refug. Bot. 1: 51.

C. affínis, Lindl. Allied to C. frigida. Lvs. broad-elliptic: fr. dark brown, globose. Himalayas. L.B.C. 16: 1522.—*C. ambígua*, Rehd. & Wilson. Related to C. acutifolia. Shrub, to 6 ft.: lvs. elliptic-ovate to rhombic-ovate, villous beneath: fls. 5–10; calyx slightly pubescent or nearly glabrous: fr. ovoid, black. W. China.—*C. amæna*, Wilson. Related to C. Franchetii. Dense shrub, to 5 ft.: lvs. ovate or elliptic, usually ½in. long: corymbs 6–10-fld.; sepals acuminate: fr. globose, orange-red. Yunnan. G.C. III. 51: 2.—*C. angustifòlia*, Franch.=Pyracantha angustifolia.—*C. apiculàta*, Rehd. & Wilson. Related to C. Simonsii. Shrub, to 6 ft.: lvs. orbicular to roundish ovate, apiculate, bright green and lustrous, nearly glabrous, ¼–½ in. long: fr. nearly sessile, globose, bright red. W. China.—*C. arborèscens*, Zabel=C. Lindleyi.—*C. bacillàris*, Wall. Related to C. frigida. Lvs. smaller, usually glabrous beneath at length: fr. dark brown. Himalayas.—*C. buxifòlia*, Wall. Related to C. rotundifolia. Lvs. elliptic, slightly pubescent above at first, grayish tomentose beneath: fls. 2–4, ½in. across: fr. red. India. Wight, Icon. 3: 992. Tender.—*C. dísticha*, Lange. Related to C. Simonsii. Half-evergreen, upright shrub, to 4 ft.: lvs. suborbicular to broadly obovate, apiculate, sparingly pubescent above, nearly glabrous beneath, ½in. or less long: fls. 1–2; calyx glabrous or nearly so: fr. scarlet. Himalayas.—*C. Harroviàna*, Wilson. Related to C. salicifolia. Shrub, to 6 ft.: lvs. elliptic-oblong, sometimes oval, 1–2 in. long, densely villous beneath: corymbs 1½ in. across. S. W. China.—*C. Henryàna*, Rehd. & Wilson (C. rugosa var. Henryana, Schneid.). Related to C. salicifolia. Shrub, to 12 ft.: lvs. thinner, elliptic-oblong to oblong-lanceolate, 2–3½ in. long, and about 1 in. broad, pubescent and only slightly pubescent above, densely grayish pubescent beneath: corymbs many-fld., about 2 in. across; calyx pubescent: fr. red, ovoid, ¼in. across, with 2–3 stones. Cent. China. G. C. III. 46: 339 (not good). M.D.G. 1914: 15.—*C. ignàva*, Wolf. Related to C. melanocarpa. Shrub, to 5 ft.: lvs. ovate or oval, greenish white beneath, pubescent, 1–2 in. long: fls. 8–13, pinkish; calyx pubescent at the base: fr. dark reddish brown, nearly black. E. Turkestan. Yearb. For. Inst., Petersburg, 15: 240.—*C. Lindleyi*, Steud. (C. arborescens, Zabel). Similar to C. racemiflora but fr. black. Himalayas.—*C. moupinénsis*, Franch. Related to C. foveolata. Shrub, to 15 ft.: lvs. elliptic to ovate-oblong, thicker, rugose above, pubescent beneath, at least on the veins, 2–5 in. long: corymbs many-fld.; fls. white or pinkish; calyx sparingly pubescent: fr. black, with 4–5 stones. W. China.—*C. nítens*, Rehd. & Wilson. Related to C. divaricata. Lvs. broadly oval or roundish ovate, glabrous and lustrous above, ⅓–½in. long: fr. ovoid, purplish black, stalked, pendulous. W. China.—*C. obscùra*, Rehd. & Wilson. Related to C. acuminata. Shrub, to 10 ft.: lvs. elliptic-ovate, finally glabrous above, yellowish gray-tomentose beneath, 1–2 in. long: fr. dull brownish red, ovoid, ⅓in. long, usually with 3 stones. W. China.—*C. Pyracántha*, Spach=Pyracantha coccinea.—*C. rósea*, Edgew. Related to C. integerrima. Shrub, with slender upright branches: lvs. elliptic to ovate-oblong, nearly glabrous, grayish green beneath, 1–1½ in. long: fls. 4–9, pinkish with slightly spreading petals: fr. subglobose, dull red. Himalayas.—*C. Silvéstrii*, Pampanini. Allied to C. integerrima. Lvs. elliptic-ovate, densely hairy and cream-colored beneath, 1–2 in. long: calyx pubescent outside: fr. orange-colored. Cent. China.—*C. uniflòra*, Bunge. Allied to P. vulgaris. Lvs. oval to oval-oblong, glabrous when older: fls. solitary: fr. red. Altai Mts.

ALFRED REHDER.

COTTON belongs to the genus Gossypium (name used by Pliny), of the *Malvàceæ*. The species are now much confused, but it is generally agreed that the sea island cotton is of the species *G. barbadense*, Linn. The upland cotton is probably derived chiefly or wholly from *G. hirsutum*, Linn. The former is native in the West Indies. The nativity of the latter is in dispute, but it is probably Asian. The cotton flower is mallow-like, with a subtending involucre of three large heart-shaped bracts. The carpels or cells of the pod are three to five. These carpels break open, and the cotton covering of the seeds makes a globular mass,—the cotton boll (Fig. 1082). Cotton is not a horticultural



1082. A cotton boll.

crop, and is therefore not considered in this work. The reader will find "The Cotton Plant" (published by the Dept. of Agric., Bull. 33), a useful monograph. Consult Cyclo. Amer. Agric., Vol. II, p. 247.

COTTONWOOD: species of *Populus*.

CÓTULA (Greek, *small cup*, the bases of the clasping leaves forming a hollow or basin). *Compósitæ*. Small diffuse or much-branched strong-smelling annual or perennial yellow-flowered herbs, a few of the perennials sometimes used as carpeters in rock-gardens.

Leaves alternate, toothed, lobed or pinnatisect: heads pedunculate, hemispherical or bell-shaped, many-fld. and discoid; outer or marginal florets nearly or quite apetalous, usually pistillate and fertile; disk-florets 4-toothed, fertile or male; torus naked; pappus not evident: achene glabrous, compressed.—About 50 or 60 species, largely in the southern hemisphere.

dioìca, Hook. f. (*Leptinélla dioìca*, Hook. f.). Sts. glabrous or slightly hairy, 1 ft. or less long, creeping: lvs. solitary or tufted, not thick or stiff, stalked, 2 in. or less long, linear-obovate to spatulate, obtuse, serrate to pinnatifid or even pinnate: heads on axillary naked peduncles that are longer or shorter than the lvs., unisexual, the males ¼in. or less diam., and the females a little larger: achene obovoid, curved. New Zeal.—Very variable. A compact dwarf carpeter.

Muèlleri, Kirk. (*C. potentilliàna*, Hort.? *Leptinélla potentillìna*, Muell.). Sts. long and rather stout, creeping and rooting, the branches ascending and somewhat villous towards the tips: lvs. 2–5 in. long, stalk and all, linear-obovate, deeply pinnatifid, glandular-dotted: heads on peduncles that usually are shorter than the lvs., bisexual, about ⅓in. diam.: achene club-shaped and 4-angled. New Zeal.

C. lanàta, Hook. f. (Leptinella lanata, Hook. f.). Stout and woolly: lvs. rather fleshy, pinnate or pinnatifid: florets glandular. New Zeal.—*C. lobàta*, Linn.=Lidbeckia.—*C. plumòsa*, Hook. f. (Leptinella plumosa, Hook. f.). Stout, soft-woolly: lvs. 3–4 times pinnatisect: florets not glandular. New Zeal.—*C. Squàlida*, Hook. f. (Leptinella squalida, Hook f.).—Allied to C. dioica, with lvs. deeply pinnatifid and segms. incised. New Zeal.

L. H. B.

COTYLÈDON (a name used by Pliny, meaning *a cavity*, having reference to the concaved or cup-like leaves of some kinds). *Crassulàceæ*. Succulent herbs or shrubs, rarely annual, grown mostly for their oddity, but some of them making good winter bloomers in pots and some used for summer bedding because of the stiff thick foliage; some are half-hardy North.

Habit very various, rosulate or erect, sometimes of a scandent tendency: branches and lvs. thick and fleshy: lvs. opposite or alternate, petiolate or sessile: calyx 5-parted, as long as or shorter than the corolla-tube; corolla tubular, cylindrical or urn-shaped, sometimes 5-angled, the parts or petals 5, erect or spreading, connate to the middle, longer than the usually 10 stamens; ovary of 5 free carpels, each with a narrow scale at base; fls. erect or pendent, sometimes showy, in terminal racemes or cymes. Differs from Sedum in the connate petals.—Species about 100, in Calif. to Texas, and Mex., Afr., Asia and Eu. See I.H. 10:76 for an account of many of the species. Some of the species make dense rosettes of stiff lvs. on the ground and send up a small bracted scape; they remind one of the house-leek (*Sempervivum tectorum* and related species).

As above defined, Cotyledon comprises the broad group habitually known under that name. Recently, however, Britton and Rose have revised the group, excluding Cotyledon from America, reinstating Echeveria and Pachyphytum for some of the American species and making new genera for others, as Dudleya, Oliveranthus, Urbinia, Stylophyllum. For the convenience of the gardener, the cult. species are here brought together under Cotyledon, and they are also listed at other places under their new generic names.

Cotyledons are little known in this country except among fanciers and for carpet-bedding. Culturally, there are two groups,—the greenhouse kinds and the bedding kinds. The greenhouse kinds are well represented by *C. gibbiflora*. It is attractive both in foliage and flower. It may be expected to begin bloom in January or February. Its period of bloom is short, after which it may be propagated. The top of the main shoot (or of strong side shoots) may be cut off with 2 or 3 inches of stem, and stood in pots so that the cut end will rest on moss in the bottom and the leaves on the rim of the pot, using no earth; fine roots will soon form and the young plant may then be repotted into dryish soil. The old stems of this and similar tall kinds may be placed rather close together in shallow boxes, when it is desired to propagate them, and kept in a warm dry place, where they will form small growths along the stems; these, when large enough, may be put into boxes of dry sand, and potted in thumb- or 3-inch pots when they have made a sufficient quantity of roots. This species should be kept in a warmhouse in winter, where it is rather dry and not exposed to drip. *C. fulgens* is a good greenhouse species, producing showy waxy red flowers in winter; also *C. coccinea*. For this purpose the large plants should be lifted from the beds and carefully potted, as they make a much finer growth in the open ground than when grown in pots.—When it is desired to increase the low-growing carpet-bedding kinds on a larger scale, the plants should be lifted before the ground gets too wet and cold. They may either be boxed in dry soil and kept in a cool dry house, or placed thickly together in a frame, taking care that no drip is allowed on the plants, and giving no water. The most convenient time for propagation by leaves is during the months of November and December, when the fall work of rooting soft-wooded plants is over. Leaves rooted at this time will make plants large enough for planting out the following season. They will take from three to four weeks to root, according to the kind. The leaves must be taken from the plant as follows: Grasp each leaf between the thumb and forefinger, give a gentle twist first to one side then to the other until the leaf comes off, taking care that the dormant bud in the

axil of the leaf accompanies it, otherwise the leaf will root but a plant will not form from it. Make a depression about 2 inches deep in the center and 4 inches wide across the sand-bed, in this lay two rows of leaves with their bases touching each at the bottom of the depression; give no water until the small roots make their appearance, and only slightly afterwards. When the little plants are large enough they should be boxed, using sandy loam, and kept in a temperature of not less than 60° F. at night.—For summer bedding purposes the following have been employed very successfully, being lower growers: *C. atropurpurea, C. fulgens, C. coccinea, C. fascicularis, C. gibbiflora* var. *metallica, C. Pachyphytum, C. Peacockii, C. Purpusii, C. roseata, C. secunda, C. secunda* var. *glauca, C. mexicana.* (G. W. Oliver.)

Other species of Cotyledon occur in collections of succulent plants, but the following probably represent those of commerce in this country.

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A. *Plants of the Old World, of various habit: corolla-tube elongated, usually much longer than the calyx. (Cotyledon and Umbilicus.)*

B. *Lvs. crowded in a rosette (rosulate) at the base of the st.: plant low, more or less stemless: species of the houseleek or hen-and-chickens type, used in rock-gardens and for carpet-bedding.*

C. *Fls. yellow or milk-white.*

1. **Aizòon,** Schoenl. (*Umbílicus Aizòon*, Fenzl). Plant small, minutely pubescent, the st. very short: lvs. densely rosulate, lingulate, obtuse, ciliate, those on the st. oblong-obtuse: fls. golden yellow, on very short pedicels; calyx spreading; corolla-parts lanceolate-acuminate and keeled. Asia Minor.

CC. *Fls. red or greenish.*

2. **Bárbeyi,** Schweinf. Whole plant hoary-white, tall and branching: lvs. thick, fleshy, shovel-shaped: fls. olive-green and red, 1 in. long, in a close panicle. Blooms freely in spring and summer. Abyssinia. Gt. 45, p. 465.—An exquisite plant for carpet-bedding.

BB. *Lvs. variously scattered along the st., or sometimes in rosettes or clusters at the ends of the branches: mostly branching plants, grown in greenhouses, window-gardens, and sometimes used in summer bedding-out but not in carpet-bedding designs.*

C. *Fls. white or ochroleucus.*

3. **reticulàta,** Thunb. Sts. much branched, fleshy: lvs. few at the ends of the branches cylindrical, acute, erect, fleshy, soft, smooth, ⅓in. or less long: fls. ½in. or less long, whitish, in an erect, dichotomous panicle. Cape. G.C. III. 21:282.—The wiry fl.-stalks remain on the plant and give it the appearance of being inclosed in a network. Odd.

4. **chrysántha,** Hort. (*Umbílicus chrysánthus*, Boiss.). Plant pubescent, glandular above, the st. short: lvs. rosulate, short, oblong-spatulate, obtuse, those on the st. elliptic and somewhat acute: fls. large, ochroleucous (milk-white or yellowish), red-striped on the back of the oblong-lanceolate keeled lobes or parts of the corolla. Perennial. Asia Minor.

CC. *Fls. yellow or greenish.*

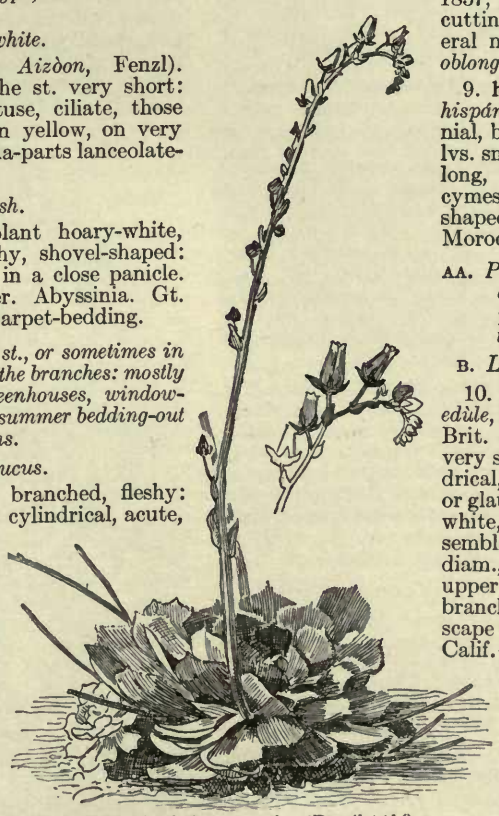
5. **Umbílicus,** Linn. (*Umbílicus pendulìnus*, DC.). Pennywort. Navelwort. Perennial, 6–12 in. high in flower, simple or slightly branched, leafy at base: radical and lower lvs. fleshy, orbicular, crenate, more or less peltate: fls. yellowish green, pendulous, in a raceme; calyx very small; corolla cylindrical, ¼in. long but somewhat enlarging, with 5 short teeth.—On rocks and walls, W. Eu. Adaptable in rock-gardens.

CCC. *Fls. red or purple.*

6. **fasciculàris,** Soland. Smooth, 1–2 ft. high, thick-stemmed, branched: lvs. pale greenish white with a yellowish margin, glaucous, few, sessile, cuneate-obovate, thick, flattened, slightly concave, cuspidate: panicle branches long, scorpioid; fls. large, 1 in. long, pendent; calyx-lobes short, broadly ovate-acute; corolla-tube much longer than the calyx, with a greenish tube and reddish revolute limb. S. Afr. B.M. 5602. J.H. III. 29:443.

7. **Sempervìvum,** Bieb. (*Umbílicus Sempervìvum*, DC.). Houseleek Cotyledon. Plant green, glandular: radical lvs. spatulate, obtuse, attenuate-cuneate at base, the margin denticulate; st.-lvs. oblong: fls. purplish and papillose on the outside, on secund branches in a corymbose panicle; corolla thrice longer than calyx, parted to the middle, the parts lanceolate-acuminate and somewhat recurved. Perennial.—Not to be confounded with *Sempervivum tectorum.*

8. **orbiculàta,** Linn. Erect, 2–4 ft. high: lvs. opposite, flat, obovate-spatulate, obtuse, mucronate, glaucous and mealy, with red margins: fls. large, reddish, panicled. Fls. June–Sept. S. Afr. B.M. 321. R.H. 1857, p. 347.—Grows well from cuttings. Variable, and has several named forms as var. *elata, oblonga, ramosa, rotundifolia.*



1083. Cotyledon secunda. (Detail ×½)

9. **hispánica,** Linn. (*Pistorínia hispánica*, DC.). Annual or biennial, branched, 6 in. high, erect: lvs. small, nearly cylindrical, oblong, few, sessile: fls. erect, in cymes, reddish; corolla trumpet-shaped, lobes spreading. Spain, Morocco. R.H. 1895, p. 472.

AA. *Plants of the New World: corolla-tube usually short, perhaps always shorter than the calyx.*

B. *Lvs. terete.* (*Stylophyllum.*)

10. **edùlis,** Brewer (*Sèdum edùle*, Nutt. *Stylophýllum edùle*, Brit. & Rose). Sts. cespitose, very short and thick: lvs. cylindrical, 3–4 in. long, erect, whitish or glaucous green, not mealy: fls. white, tinged with green, resembling those of Sedum, ½in. diam., short-pedicelled, along the upper sides of the flexuous branches of the cymose panicle; scape 1 ft. high. San Diego, Calif.—Young lvs. eaten by Indians.

BB. *Lvs. linear or nearly so.*

11. **mexicàna,** Hemsl. Plant glabrous, 3–4 in. high, erect, the branches woody: lvs. few, alternate,

crowded on sterile shoots, somewhat fleshy, linear or linear-spatulate, obtuse, ¼–⅓in. long: fls. few short-pedicelled, cymose; sepals free, linear, obtuse; petals plane and strongly coherent, forming a tube, ⅓in.; or less long, the lobes ovate, acute, erect. S. Mex.—One of the dozen known species of Altamiranoa (see p. 267, Vol. I), in that genus becoming *A. mexicana*, Rose.

BBB. *Lvs. broader, flat, often very fleshy.*

C. *Calyx minute.* (*Urbinia.*)

12. **agavoïdes,** Baker (*Echevèria agavoïdes*, Lem. *Urbínia agavoïdes*, Brit. & Rose). Small and compact: lvs. densely rosulate, stiff, acuminate and very sharp-pointed, pale gray-green on both sides, papillose: fls. 4–6, orange, on long pedicels; sepals several times shorter than the corolla. Mex.—Useful for carpet-beddings.

CC. *Calyx evident or prominent.*

D. *Petals always appendaged at insertion of stamens.* (*Pachyphytum.*)

13. **Pachyphỳtum,** Baker (*Pachyphỳtum bracteòsum*, Klotzsch). SILVER-BRACT. Somewhat shrubby, very succulent, pale glaucous blue throughout: lvs. clothing upper part of st., more or less rosulate, large and thick, spreading, obovate, obtuse or obtuse-pointed, the scars from the fallen lvs. orbicular: fls. in spikes 4–6 in. long on lateral peduncles; corolla red, immersed in the large calyx which is about 1 in. long; stamens 5 large and 5 small. Mex. B.M. 4951.—A singular plant, blooming in summer. 1 ft.

DD. *Petals not appendaged.*

E. *Corolla strongly 5-angled.* (*Echeveria.*)

F. *Color of plant* (*or of lvs.*) *dark purple.*

14. **atropurpùrea,** Baker (*Echevèria sanguínea*, Morr.). St. short and stout: lvs. in rosette at top of st., dark purple and glaucous, obovate-spatulate: fls. bright red, in a long raceme terminating the erect st.; corolla 5-angled, white toward base. Mex. See p. 1086.

FF. *Color green, or ordinarily glaucous* (*except var. of No. 19*).

G. *St. wanting or nearly so* (*acaulescent species*).

15. **Peàcockii,** Baker (*Echevèria Peàcockii*, Crouch.). Acaulescent: lvs. about 50 in a dense rosette 6 in. across and standing 4 in. high, obovate-spatulate, mucronate, reddish toward tip, glaucous: st. 12–24 in., with small lf.-like bracts: fls. bright red, in a scirpioid spike; calyx-lobes linear, unequal; corolla about ½in. long, the parts lanceolate-acute. Mex.(?)—Interesting for its glaucous coloring and waxy coating of the lvs. Named for Mr. Peacock, of Hammersmith, England, in whose collection it flowered. See p. 1086.

16. **secúnda,** Baker (*Echevèria secúnda*, Booth). Fig. 1083. Stemless: lvs. in a rosette, crowded, cuneiform, mucronate, glaucous, curving upward: fls. in a 1-sided, recurved spike, reddish yellow; peduncle long, 6–12 in. high. June–Aug. Mex. B.R. 26:57.—Probably the most common species in gardens. Distinguished by its pale green red-tipped rosettes; several forms. Half-hardy. **E. glaûca,** Baker (*E. secúnda* var. *glaùca*, Otto), has glaucous-green foliage. See pp. 1086–7.

GG. *St. evident, often tall* (*caulescent species*).

17. **Schèerii,** Baker (*Echevèria Scheèrii*, Lindl.). Caulescent, branching: lvs. large, glaucous, oval, acute, narrowed into a long plane petiole-like part: fls. dingy red with yellow tips, broadest at base, in drooping racemes; sepals linear, acute, green, spreading, shorter than the corolla. Mex. B.R. 31:27. P. 1087.

18. **fúlgens,** Baker (*Echevèria fúlgens*, Lem.). St. 4–8 in. tall, but bearing long leafy fl.-branches: lvs. obovate-spatulate, pale glaucous green, clustered: fls. bright red with yellow base, in nodding racemes. Mex.

19. **gibbiflòra,** Moc. & Sessé (*Echevèria gibbiflòra*, DC.). Sts. 1–2 ft. high: lvs. flat, wedge-shaped, acutely mucronate, crowded at the ends of the branches: fls. short-petioled; panicle branches 1-sided, spreading; corolla gibbous at the base between the calyx-lobes, the tube white, the tips touched with crimson. Mex. B.R. 1247. Var. **metállica,** Baker (*Echevèria metállica*, Hort.). Lvs. large, obovate-spatulate, 6 in. wide by 7 in. long, a beautiful glaucous purple with metallic reflections: fls. yellowish with red tips. Mex.—An excellent plant for summer bedding. P. 1087.

20. **coccínea,** Cav. (*Echevèria coccínea*, DC.). Plant soft-pubescent, 1–2 ft.: lvs. lance-spatulate: fls. scarlet and yellow or paler within, in axillary long leafy, 15–25-fld., loose spikes. Mex. B.M. 2572. P. 1086.

EE. *Corolla not strongly angled.*

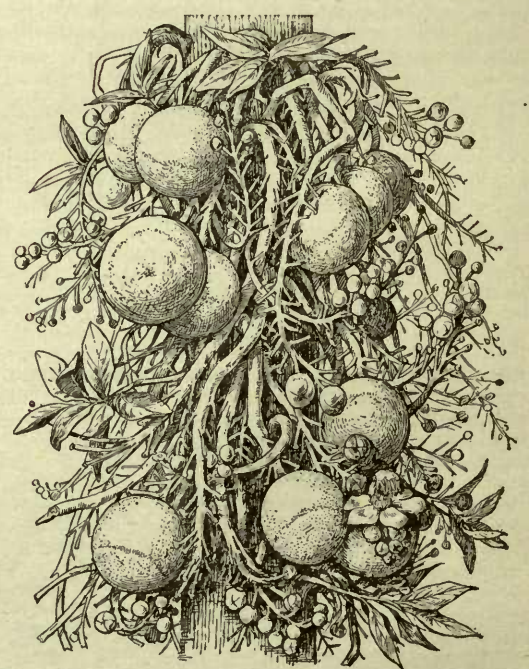
F. *Fls. in a dense spike.* (*Courantia.*)

21. **roseàta,** Baker (*Echevèria ròsea*, Lindl. *Courántia ròsea*, Lem.). Sts. branching, 1 ft.: lvs. oval, erect, acute, mostly in terminal rosettes on the sterile shoots: fls. yellow, in dense rose-bracted spikes; sepals linear-acute, rose-colored; corolla bell-shaped, 5-parted. Mex. B.R. 28:22.

FF. *Fls. in cymes or panicles.* (*Dudleya.*)

22. **pulverulénta,** Baker (*Echevèria pulverulénta*, Nutt. *E. farinòsa*, Hort. *Dudlèya pulverulénta*, Brit. & Rose). Lvs. in a rosette, silvery green, very mealy, spatulate, acute, the tips reflexed, the cauline lvs. gradually diminishing into broadly cordate, clasping bracts: panicles dichotomously branched; pedicels slightly longer than the pale scarlet or coral fls. Plants 1 ft. diam. S. Calif. F.S. 19:1927–8.—A fine plant for carpet-bedding.

23. **Púrpusii,** Nichols. (*Echevèria Púrpusii*, Schum., not Brit. *Dudlèya Púrpusii*, Brit. & Rose). Cespitose, with powdered snow-white foliage: lvs. densely rosulate, broadly spatulate, acuminate: fls. in a branching upright cluster; corolla conico-tubular, much exceeding calyx; segms. scarlet with golden yellow tips. S. Calif. B.M. 7713. G.C. III. 20:698. Gt. 45, p. 609.



1084. Couroupita guianensis, the cannon-ball tree, showing the trunk and the hanging flowers and fruits.

24. **lanceolàta,** Benth. & Hook. (*Echevèria lanceolàta,* Nutt. *Dudlèya lanceolàta,* Brit. & Rose). Green or slightly glaucous, acaulescent: lvs. in a rosette, lanceolate, acuminate, slightly mealy; st.-lvs. or bracts small, cordate, clasping, distant: panicle narrow, dichotomous: fls. red and yellow; calyx-lobes broad-ovate, 1/6in. long; corolla ½in. or more long. S. Calif.

25. **califórnica,** Baker (*D. Cotylèdon,* Brit. & Rose. *Sèdum Cotylèdon,* Jacq. *Echevèria califórnica,* Baker). Plant acaulescent, tinged red: lvs. in a rosette, concave, ligulate, lanceolate, acute, glaucous, mealy, slightly yellowish, 8 in. long: fls. pale yellow, on weak lateral flowering sts. 1–2 ft. long, with short, ovate, clasping lvs. or bracts and bi- or trifid racemes. Calif.

Many garden names occur in Cotyledon, some of which are unidentifiable and some of which probably represent hybrids. *C. devénsis,* Hort. Hybrid between probably C. glauca and C. gibbiflora: fl.-sts. 5–7 ft. long. B.M. 8104.—*C. élegans,* N. E. Br.= Oliveranthus.—*C. exímia,* Hort.=(?).—*C. globòsa,* Hort., see page 1087.—*C. globulariæfòlia,* Baker. Rosulate, 8 in.: lvs. 30–40, obovate-spatulate, 2½ in. or less long: fls. white tinged red, 20–40 in a dense thyrse-like cluster. Syria.—*C. imbricàta,* Hort., described on p. 1087.—*C. insignis,* N. E. Br. About 2 ft., wholly glabrous, erect, light green: lvs. opposite, broad, to 5 in. long: fls. light red with lobes greenish yellow inside, 1½ in. long, in terminal and axillary cymes. Cent. Afr. B.M. 8036.—*C. mirábilis,* Hort., hybrid. —*C. mucronàta,* Baker.=Echeveria, p. 1086.—*C. nàna,* Marl. Very dwarf, 1½ in. or less high, densely branched and forming a tuft: lvs. yellowish green, not apiculate. S. Afr.—*C. Pestalózzæ,* Mast. Lvs. distributed, the radical ones spatulate-obtuse and margins slightly denticulate, the cauline obovate-oblong: fls. pale rose, somewhat secund in a glandular-hairy panicle. Cilicia.—*C. pulvinàta,* Hook. f. =Echeveria, p. 1086.—*C. sedoìdes,* DC. Annual, creeping, smooth: lvs. sedum-like, oblong and obtuse, convex: fls. few, pink, in summer. Pyrenees. Distinguished from Sedum by the gamopetalous corolla. —*C. spinòsus,* Linn. Small and quaint, Apicra-like, with a rosette of flat spoon-shaped spine-tipped lvs., 12 in. or more tall: fls. yellow, in early summer. Siberia to China and Japan, but not hardy.— *C. supérba,* Hort., is an annual with yellow fls.—*C. teretifòlia,* Thunb. St. somewhat woody, 6–8 in. high, simple or branched: lvs. 4–5 in. long, opposite, nearly terete, acute or cuspidate, hirsute or subglabrous: fls. many, corymbed, the peduncle to 18 in., yellow; corolla-tube a little shorter then calyx. S. Afr.

L. H. B.†

COUCH GRASS: *Agropyron repens.*

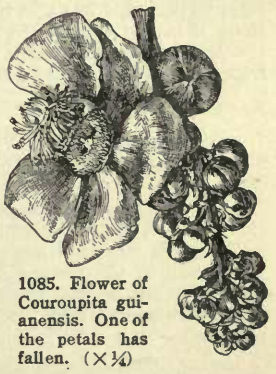
COURÁNTIA (personal name). *Crassulàceæ.* Caulescent: lvs. alternate, closely set, broad: fls. in a dense bracteate spike; calyx-lobes nearly equal, linear, brightly colored; corolla not angled, yellow; stamens 10; filaments united into a tube for half their length. Only one species. First brought into cult. about 1842. For cult., see *Cotyledon.* **C. rôsea,** Lem. (*Cotylèdon roseàta,* Baker). See No. 21, p. 870. J. N. Rose.

COUROUPÌTA (from a vernacular name in Guiana). *Lecythidàceæ.* Trees of Trop. Amer. (about 9 species) sometimes planted as oddities or for shade, particularly for the curiosity of the great ball-like frs. borne on the trunk. Lvs. alternate, oblong, reticulate, entire or crenate-serrate: fls. showy and odd, borne in racemes, often from the trunk and larger branches; calyx-tube top-shaped, the limb 6-lobed or -divided; petals 6, somewhat unequal, spreading and more or less incurved, borne on a disk; stamens many, in 2 sets,—one series forming a ring or cup in the center of the fl. and about the single 5–7-celled ovary, the other longer and rising from one side like a fringed palm or ladle over the pistil: fr. a large nearly or quite globular ball, coriaceous or woody, indehiscent, with many seeds imbedded in the pulp. **C. guianénsis,** Aubl. Cannon-ball Tree. Figs. 1084, 1085. Tall soft-wooded tree in Guiana, where it is native: lvs. oblong-obovate, elliptic or broad-lanceolate, acute, entire or very obscurely toothed: fls. with concave petals about 2 in. long, yellow- and red-tinged on the exterior and crimson-lilac within, very showy, in racemes 2–3 ft. long: fr. nearly or quite globular, 6–8 in. diam., reddish, hard on the exterior, pulpy inside, with very disagreeable odor when ripe. B.M. 3158–9.—Sometimes planted in the tropics, in botanic gardens and elsewhere. Shell of the fr. used for utensils, and the pulp said to be eaten by negroes and to be used for the making of beverages. L. H. B.

COUSSAPÒA (Caribbean name). *Moràceæ.* Fifteen to 20 milky-juiced trees or shrubs of Trop. S. Amer., 1 or 2 sometimes grown under glass, but apparently not in the American trade. They are sometimes scandent and epiphytic, like other Ficus-like things, sending down branches and completely enveloping the supporting tree and strangling it. Lvs. alternate, stalked, thick, penninerved or 3-nerved, entire: fls. diœcious, in globose heads, the peduncles solitary or in pairs and axillary, the male clusters few-fld. and often paniculate, the females on shorter peduncles: fr. oblong, becoming succulent and with the including thickened perianth forming a mulberry-like multiple fruiting body. *C. dealbàta,* André (*Ficus dealbàta,* Hort.), is described as a very beautiful greenhouse subject, with coriaceous elliptic lvs. 1 ft. long and half as broad, white-silky beneath and deep green above. I.H. 17:4.

L. H. B.

COVER-CROPS. Green temporary crops, grown for the purpose of improving the soil, either as protection or to be turned down as green manure; word used chiefly in speaking of fruit-growing operations.



1085. Flower of Couroupita guianensis. One of the petals has fallen. (×¼)

The use of cover-crops has become an essential part of orchard management. The name is derived from the fact that the seed is sown in the fall or late summer, and sufficient growth results so that the ground is covered and protected during the winter. The crops are grown for their effect upon the orchard, not for the direct value of the crop. The term was first used in this connection by Bailey, Bulletin No. 61, of the New York Station at Cornell, p. 333, December, 1893.

Cover-crops make use of the available plant-food at a time when the trees are beginning to use it less and less. In this way, food that otherwise might be lost is stored up until it becomes available to the trees the following spring through the rotting of the cover-crops. The presence of the cover-crop, with its mat of roots, also prevents soil-washing and erosion with its accompanying loss of plant-food. The legumes, through the action of the bacteria found in their root-nodules, are able to add to the total amount of nitrogen present in the soil. This is the only way in which cover-crops increase the total supply of the plant-food elements, but the decay of the cover-crops increases the humus in the soil and, by the activities thus set up, the locked-up plant-food is released in a soluble form and thus the total available plant-food is increased. The ability of a soil to absorb and retain water is greatly increased in proportion to the humus that the soil contains. For this reason, soils rich in humus are less likely to be injured by erosion from the rapid run-off of the rainfall and less liable to suffer from drought. In soils plentifully supplied with moisture and plant-food, the trees are likely to continue growth so long that the wood does not mature and harden before winter, thus rendering them liable to injury during a severe winter. Such trees usually bear fruit that is poor in quality and in color. To produce mature, well-colored apples, it is essential that excessive growth after midsummer be prevented. The best means of doing this is to grow a crop in the orchard that will compete with the trees for the food and water. Soil protected by a cover-crop does not freeze so quickly or so deeply as when uncovered, and therefore the tree roots under a cover-crop are less likely to be injured by freezing and by heaving. Many

of our best fruit soils contain a large proportion of clay. When the humus-content of such soils becomes low, they are stiff and difficult to work and they dry out and bake quickly. Plowing under cover-crops restores the needed humus. This is important from the farm-management point of view. The period of time during which a clay field may successfully be plowed may frequently be doubled by thus increasing the humus supply. As the physical condition of the soil is bettered, the rootlets of the tree can more easily penetrate it in their search for food, and this larger feeding area means a greater supply of food. Orchards that are to be cultivated should be plowed as early as the land can be worked, in order to prevent excessive loss of moisture through evaporation and the demands of any growing cover-crop. This is especially true when rye, clover, or vetch are grown. Fall plowing is seldom advisable, as much of the benefit of the cover-crop is then lost. The time of seeding depends upon the needs of the fruit and the supply of moisture available. In seasons of plentiful rainfall the cover-crop should be put in early, but in a period of drought the trees need all the moisture there is in the soil and the seeding should be late. In the North Atlantic States, the cover-crops are planted from the latter part of July to the middle of August.

Kinds of cover-crops.

In general, cover-crops may be divided into the leguminous or nitrogen-gathering, and the non-leguminous crops.

1. Leguminous cover-crops.—Red and mammoth clover, Canada field peas, and winter vetch are used in the northern states; soybean, cowpea, crimson clover, and vetch in the central and southern states.

2. Non-leguminous cover-crops.—Rye, oats, wheat, and barley; rape and turnips; buckwheat and nearly all weeds.

Average quantity of seed per acre.

Barley	2	to	2½	bushels.
Buckwheat			1	bushel.
Clover, red	10	to	15	pounds.
Clover, mammoth	10	to	15	pounds.
Clover, crimson	15	to	20	pounds.
Cowpea	1½	to	2	bushels.
Millet			1½	bushels.
Oats	2	to	3	bushels.
Peas	2	to	3	bushels.
Rape	2	to	5	pounds.
Rye	1½	to	2	bushels.
Soybean	1	to	1½	bushels.
Turnip			4	pounds.
Vetch	½	to	1	bushel.
Wheat	2	to	2½	bushels.

3. Combinations of cover-crops.—An ideal cover-crop should possess certain characters. It should make a vigorous vegetative growth by fall so as to furnish an abundance of humus and to hasten the maturity of the trees. The seed should be of such a nature that it will catch well when planted at a time of year when the soil is very dry. Preferably, the cover-crop should winter over. All these characters are seldom found in a single crop and, hence, combinations are desirable. Thus buckwheat, which makes a quick growth, does not live through the winter as does the slower-growing rye, so the two combine well. The following combinations are frequently used:

1.	Clover (red or mammoth)	10	pounds.
	Winter vetch	15	pounds.
	Oats	½	bushel.
	Cowhorn turnips	½	pound.
2.	Buckwheat	½	bushel.
	Oats	1	bushel.
	Rye	1	bushel.
3.	Oats	1½	bushel.
	Clover	15	pounds.
4.	Buckwheat	¾	bushel.
	Oats	1	bushel.
5.	Oats	1½	bushel.
	Rye	1	bushel.

In the peach orchard, where large annual growth is not desirable, or in apple orchards making excessive growth, the leguminous crops should be used sparingly, if at all.

C. S. Wilson.

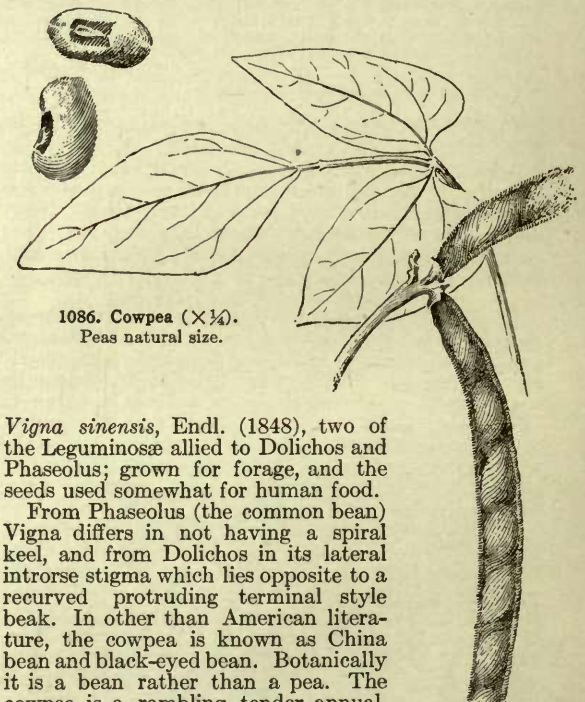
COWÀNIA (after James Cowan, an English merchant, who intro. many Peruvian and Mexican plants into England). *Rosàceæ*. Some 4 or 5 small shrubs from the S. W. U. S. and from Mex., with small crowded lvs. and handsome white or purple fls.; rarely cult. in botanical collections. Closely related to Fallugia, but differing in the absence of bracts at the base of the calyx. Cult. and prop. like Fallugia, but apparently more tender: like that plant well adapted for planting in rockeries. **C. mexicàna**, Don (*C. Stansburiàna*, Torr.), has small crowded cuneate 3–7-lobed lvs. and white fls. about 1 in. across. **C. plicàta**, Don (*C. purpùrea*, Zucc.), has incisely serrate lvs. and purple fls.

Alfred Rehder.

COWBERRY: Usually means *Vaccinium Vitis-Idæa*. In parts of Scotland, *Comarum palustre*.

COW-HERB: *Saponaria Vaccaria*.

COWPEA. Fig. 1086. The American name for the cultivated forms of *Vigna catjang*, Walp. (1839), and



1086. Cowpea (×¼).
Peas natural size.

Vigna sinensis, Endl. (1848), two of the Leguminosæ allied to Dolichos and Phaseolus; grown for forage, and the seeds used somewhat for human food.

From Phaseolus (the common bean) Vigna differs in not having a spiral keel, and from Dolichos in its lateral introrse stigma which lies opposite to a recurved protruding terminal style beak. In other than American literature, the cowpea is known as China bean and black-eyed bean. Botanically it is a bean rather than a pea. The cowpea is a rambling tender annual, native to India and Persia. Its cultivation also extended to China at a very early date. In this country it is extensively grown in the southern states, as a hay crop for stock and as a dry shell bean for human consumption. It is also invaluable as a green-manure crop (see *Cover-crops*). Including both the true cowpeas (*Vigna sinensis*)

and the catjangs (*V. catjang*), Piper lists 270 varieties. As a class the catjangs may be distinguished from the true cowpeas by the smaller size of the seeds and pods and by the latter remaining upright throughout their growth period, never becoming strictly pendulous even after ripening. At the present time the true cowpeas are much more widely grown than the catjangs but the latter may yet come into more prominence on account of the resistance to the weevil of their small hard seeds. The cowpea is to the South what clover is to the North and alfalfa is to the West. It is sown broadcast after the manner of field peas. From three to five pecks of seed are used to the acre. See Cowpeas, Farmers' Bulletin No. 89, U. S. Dept. of Agric., by Jared G. Smith; Bulletin No. 102, pt. VI, and Bulletin No. 229 of the Bureau of Plant Industry, U. S. Dept. of Agric.; Cyclo. Amer. Agric., Vol. II, p. 260. For a botanical discussion of the cowpea and its taxonomic relatives, see *Vigna*. GEO. F. FREEMAN.

COWSLIP. The true English cowslip is *Primula officinalis*. The plant wrongly called cowslip in America is the marsh marigold, *Caltha palustris*. The "American cowslip" is a popular name for *Dodecatheon Meadia*. The name "Virginian cowslip" is sometimes used for *Mertensia virginica*.

CRAB'S-EYE VINE: *Abrus*.

CRAB-APPLE in its widest sense means a small apple. The crab-apples of botanists are particularly fruits of *Pyrus baccata*. For more restricted uses of the word crab, see *Pyrus*.

CRAB-GRASS: One of several names for *Eleusine indica;* also for certain Panicums, as *P. sanguinale* (or *Digitaria sanguinalis*).

CRÂMBE (old Greek substantive). *Cruciferæ*. Herbs or sub-shrubs, one grown in the vegetable-garden, and one or two in the hardy herbary.

Annuals, biennials or perennials, with thickened sts., and more or less fleshy lvs., glaucous: lvs. mostly large, more or less cut, lyrate or pinnatifid: fls. small, white, fragrant, in panicled racemes: fr. 2-jointed, indehiscent, the lower joint st.-like and seedless, the upper one globular and 1-seeded.—About 20 species in Eu., Asia, and 1 in Patagonia. Of easy cult.

cordifòlia, Stev. Excellent foliage plant, withstanding the winters in the northern states: lvs. very large and heavy, cordate and ovate, toothed, glabrous or nearly so: fls. small but very numerous, in great branchy panicles 5–7 ft. high and nearly as broad, overtopping the mass of root-lvs. Caucasus. Gn. 50, p. 349. Gng. 4:291.—For the first 2 years from seed the plant makes only lvs.; but the third year it may be expected to bloom, after which the plant usually becomes weak and dies.

marítima, Linn. SEA-KALE. Perennial, smooth, stout, to 2 ft.: lvs. large, heavy and cut, more or less fringed or curled, glaucous green: fls. many, white, broad, honey-scented, in a tall panicle, in May. Coasts of Eu.—Grown as a garden vegetable. See *Sea-kale*.

C. júncea, Bieb. Biennial: small species with white fls. in an attractively slender-branched panicle. Iberia.—*C. Kotschyàna*, Boiss. Perennial: lvs. somewhat hairy, the radical ones cordate-ovate with rounded dentate lobes, the st.-lvs. few, ovate-oblong, lobed. W. Asia.—*C. tatárica*, Jacq. Perennial, said to be grown in Hungary as "Tartarian bread." Glaucous, more or less rough-hairy: radical lvs. decompound, with linear segms. Hungary, E. L. H. B.

CRANBERRY. A name applied to trailing species of the genus Vaccinium (*Ericàceæ*); much grown in North America for the fruit. Plate XXIX.

Of the true cranberries, there are two species in North America, the small (*Vaccinium Oxycoccus*), and the large (*V. macrocarpon*). The large cranberry, *V. macrocarpon* (Fig. 1087), is now cultivated on thousands of acres in the United States and this cranberry culture is one of the most special and interesting of all pomological pursuits. This cranberry grows wild only in North America, where it is native to acid swamps in the cooler parts of the United States and in Canada. Here it trails its slender stems and small oval evergreen leaves over the sphagnum and boggy turf, and the firm red berries which ripen during September and October often persist on the vines till the following spring or even longer. The curve of the slender pedicel in connection with the bud just before the blossom opens, with its resemblance to the head and neck of a crane, is said to have suggested the name craneberry which is now shortened to cranberry.



1087. Vaccinium macrocarpon, the common cranberry. (×½)

The low-bush cranberry, or wolfberry (*V. Vitis Idæa*), is much used in Nova Scotia and other parts, and is gathered and shipped in large quantities to Boston; but it is not cultivated. This berry is also common in Europe, where it is much prized. The quantities of this fruit imported into the United States from various sources is considerable.

The ideal bog for cranberry-culture should have the following qualifications: (1) Capability of being drained of all surface water, so that free water does not stand higher than 1 foot below the surface in the growing season. (2) Soil that retains moisture through the summer, for cranberries suffer greatly in drought. (3) Sufficient water-supply to enable it to be flooded. (4) A fairly level or even surface, so that the flooding will be of approximately uniform depth over the entire area. (5) Not over liability to frosts.

The water of the streams and pools in the acid swamps or bogs, which are the natural habitat of the cranberry, is usually, but not invariably, of a brownish or amber color, and some of the most common associate plants are the swamp huckleberry or blueberry (*Vaccinium corymbosum*), the cassandra or leather-leaf (*Chamædaphne calyculata*), the red maple (*Acer rubrum*) and the swamp cedar (*Chamæcyparis thyoides*).

There are three centers for the production of cranberries in the United States: Massachusetts, where cranberry-culture began and from which come the most berries; New Jersey second; and Wisconsin third. While the culture is in most respects similar in these three centers, each has its own characteristic methods of preparation and care of the bogs. There is also an important and growing cranberry industry in Nova Scotia.

The cranberry bog. Figs. 1088–1090.

To insure success in cranberry-culture, a prime requisite is to locate the bog on soil on which wild cranberries or some of their common associate plants flourish. This is usually a black peaty formation from a few inches to 7 or 8 feet in depth, overlying sand which in turn is frequently underlaid by a "hardpan" that is nearly impervious to water and the presence of which had much to do with the formation of the peat. Another requisite is to make sure of an ample supply of water, preferably of the brownish color, for winter flooding and for protection from frost in spring and fall. Flooding at special times is also the safest and surest weapon against many kinds of insects.

Without an ample supply of water, cranberry-culture is so hazardous as hardly to be worth undertaking.

The building of the dams is the first step necessary for the improvement of a bog. A foundation for these should be made by digging a trench entirely through the peat, even if it should be 8 feet or more thick, to the clean sand, and this trench should be filled with sand free from all foreign material; above this foundation, embankments are built of clean sand and faced up with sods of live turf to prevent their being washed by the waves of the lake formed. The dams should be sufficiently high to flood the higher parts of the bog a foot deep, which will frequently make the water in the deeper parts 3 to 6 feet or more in depth. Gates or flumes must be constructed at the lowest point in these dams to provide for drawing the water off the bog and provision made for surface drainage. The latter is generally accomplished by opening the natural stream, if there should be one, or by digging an open ditch through the natural drainage center of the piece of land being improved. Side ditches should be dug leading into the stream, or main ditch, in sufficient number to drain off all surface water; they may be made from 1 to 3 feet deep, according to the character of the land to be drained. A reservoir built above the bog is very desirable in facilitating control of the water. In frosty Wisconsin it is considered almost necessary to have three times the area of the bog in reservoir to insure the crops. If a bog is situated on a stream subject to high water, provision must be made for keeping the flood water from the bog, as the crop would be destroyed if it were flooded during blooming time or seriously injured by flooding at any time during the active growing season. Winter flooding of cranberry bogs is to prevent heaving and winter-killing. The water is put on about the first of December or after the vines have become thoroughly reddened by cold weather.



1088. A Massachusetts cranberry bog.—Picking the fruit.

Cranberry bogs, being always lower than the surrounding land, are peculiarly liable to damage by frost, serious loss frequently occurring when an ordinary farmer would not dream of danger,and a good supply of water is the only preventive that has been found efficient. The time of starting growth in the spring may be controlled by the time the water is drained off, and the earlier spring frosts may so be avoided while an ample supply of water permits reflooding when a later severe frost threatens. Reflooding about the first of June, provided the water has not been withdrawn earlier than May 5 to 10, will also furnish protection from a number of damaging insects and will not injure the crop, provided care is taken that the water does not stand on any part of the bog more than forty-eight hours. If a bog should become seriously infested with insects later in the season, it is occasionally profitable to sacrifice what remains of the year's crop and clear the bog of insects by flooding. This sometimes results in a greatly increased yield the following year. Damage from a light frost in the fall, before the berries are picked, may be prevented by raising the water in the ditches and about the roots of the vines. Protection from a heavy frost requires covering the plants with water, but this will cause immature berries to rot and should be done with great caution or the damage from water may be greater than it would have been from frost. During summer the irrigation of the crop is accomplished by holding the water low or high in the ditches, as the varying season may demand.

Preparation and tillage.

Before cranberries are planted, the land must be cleared of all its natural growth, the stumps and roots removed and the ground leveled to a greater or less extent. The more nearly level a bog is made, so that proper drainage is provided for, the more economical it is in the use of water and the easier it is to provide the optimum amount of irrigation during the summer. The first cost of such perfect leveling, however, may be prohibitive or it may require the removal of all the good peaty soil over a considerable area, leaving nothing but pure sand in which the cranberries will not grow well. In many places, the removal of the natural growth may best be accomplished by cutting off the tops of the bushes and trees so that they will not extend above the surface of the water and flooding for two years, thus killing all vegetation. While this flooding entails loss of time, it is much easier and cheaper to clear away the dead roots and stumps than live ones, and when no sand is applied to the surface, as is the rule in New Jersey, it greatly lessens the expense of keeping the bog free from weeds for there are no live roots in the ground to send up suckers. In some places, as in most of Wisconsin, this method of drowning out is impracticable, because the surface soil, in which are the roots of all the living plants, will separate from the more perfectly decomposed peat below and rise to the surface of the water in floating islands making death to vegetation by drowning impossible. In such situations the ground must be turfed and all roots and stumps grubbed out. In either case the roots and stumps are best disposed of by piling in heaps and burning. In Massachusetts, it is the custom to cover the cleared and leveled bog with 3 to 5 inches of sand, which makes it still easier to keep the bogs free from weeds and acts as a moisture-retaining mulch for the

underlying peat. Where sanding is practised, it is the custom to apply a fresh coat of sand an inch or less in depth every two or three years; this keeps the vines short and close.

Cuttings for planting are secured by mowing vigorous vines from an old bog with a scythe. These cuttings, preferably not more than 8 or 10 inches long, are thrust diagonally into the surface of the bog from 12 to 14 inches apart. Not more than 3 or 4 inches of the top should be exposed, and if the bog is sanded, care should be taken that the cutting extends well into the muck below. As the vines grow they send out runners in all directions, netting the ground completely over. These sometimes grow as much as 6 feet in length and root in the soil at frequent intervals. From the runners grow upright stems which, in time, cover the bog with a solid mat of vegetation. The uprights are preferably not more than 6 inches high but under some soil conditions grow to a foot or more when the fruit is likely to be scanty. From the time of planting, three to five years must pass before the ground is matted over and a crop may be expected.



1089. A cranberry bog flooded in winter.

The character of the growth of cranberry vines precludes any cultivation in the ordinary sense of the word. The care of the bogs consists in keeping them free from other plants, which is accomplished almost entirely by hand-pulling; the regulation of the irrigation water, and preventive and curative measures for the many diseases and insect enemies to which they are subject.

Fertilizing of cranberries has met with considerable success in increased crops, various brands of commercial fertilizer having been employed. The subject is not well understood, however, and is attracting the attention of many thoughtful growers and their scientific helpers in the state experiment stations.

The pretty little pinkish white flowers of the cranberry open during June, when the bogs are not flooded, but the holding of the winter water till May throws the fullest bloom into the early part of July.

Diseases and insects.

Spraying with bordeaux mixture is very generally practised to prevent "scald," a fungous disease which has been especially injurious to the growers of New Jersey and which was so named because it was long thought to be caused by the scalding effect of the hot sun shining on berries wet with dew. As it is seldom possible to run heavy spraying machinery over the bogs, spraying involves the use of very long lines of hose or the laying of pipe lines, or both, the spraying of each property being a separate engineering problem.



1090. The flume or outlet at the bottom of a cranberry bog.

Insects of many kinds attack the roots, the leaves, the blossoms and the fruit of the cranberry. Knowledge of the life history of each of these is necessary for successful warfare against it, and detailed information is best secured from the various bulletins of the United States Department of Agriculture and the agricultural experiment stations of New Jersey, Wisconsin and Massachusetts. More varieties of insects may be successfully combated with water than with any other one thing, as already explained. Arsenical poisons are expensive to apply, of indifferent success in destroying insects on the bogs, and they are suspected of being an actual poison to the vines.

Varieties.

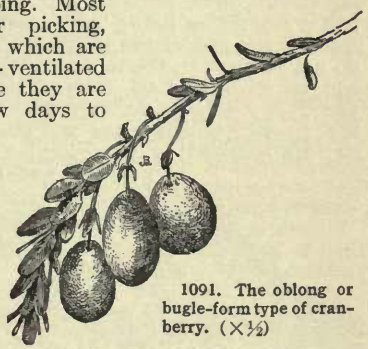
There are now many varieties of cranberries in cultivation, all of them having been selected from wild vines or vines that appeared naturally in cultivated bogs. These varieties vary in shape, color, size, productiveness, time of ripening and adaptation to different soils. Some of the forms are shown in Figs. 1091–1093. The most generally cultivated are the Early Blacks and the Howes, both of which originated in the Cape Cod district and which together make about 50 per cent of the berries marketed from all three of the cranberry states.

The Early Blacks are ready to harvest about the first of September both in Massachusetts and New Jersey, and the last of the Howes are seldom picked before the middle of October. As the pickers advance over a cranberry bog, they pick clean as they go and do not go back for successive relays of ripening berries as with most other small fruits.

Picking and grading.

In Massachusetts most of the picking is done by a scoop, by which the berries are raked from the vines. When the vines are short, the uprights not tangled, and the picker is experienced, berries can be harvested in this way very rapidly and with very little damage to either fruit or vines. The bogs are kept in good condition for "scooping" by pruning every three or four years with a rake the teeth of which are knives placed about 6 inches apart. The scoop (Fig. 1094) is also used to a considerable extent in New Jersey and Wisconsin but in these states a great many berries are still picked by hand.

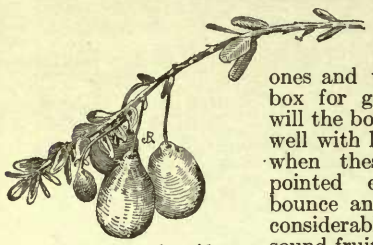
Some of the berries, especially in Massachusetts, are cleaned and packed on the bog as they are picked, and sent directly to market, but this immediate packing tends to poor keeping. Most cranberries, after picking, are put in boxes which are packed in well-ventilated storehouses. Here they are kept from a few days to several months and the cleaning and packing for market is done immediately before they are shipped.



1091. The oblong or bugle-form type of cranberry. (×½)

The machine which has been the standard for cleaning cranberries for many years is provided with a fan to blow away all grass, pieces of vine, dried-up berries or anything of like nature that may have gotten in the berries while being picked. The berries are then allowed to roll down a series of steps; those that are sound are elastic and will bounce like little rubber balls. There are bands of cloth stretched above the steps in such a way that when a berry bounces in the right direc-

tion it is received on the cloth and slides down into the box placed for the good berries without more bouncing. The rotten berries having lost their elasticity are not able to bounce over the cloth partition that separates the good from the bad. With berries that are nearly spherical and not too juicy this machine works very well, provided there are no frozen berries to be taken out. Berries damaged by frost are even more elastic than sound ones and will all go into the box for good fruit. Neither will the bounce machines work well with long or oval berries; when these strike on their pointed ends they fail to bounce and there is always a considerable percentage of sound fruit found in the refuse box. As there may be anywhere from ten to thirty or more steps, it is easily understood that berries going over these machines are not in the best possible condition for long keeping after they are put on the market. Some varieties of berries which are very juicy and tender can not be put through these machines at all as the steps get so sticky with the juice that the berries will not bounce.



1092. The obovoid or bell-shaped form of cranberry. (×½)

In 1903, a machine was patented by Joseph J. White, which avoids the defects of the bounce machines. This has since been put on the market and its use is spreading among the more careful packers of Massachusetts and New Jersey, but the more complicated machinery and greater cost have prevented its adoption by other growers. This machine is provided with a hopper into which the cranberries are emptied through a screen which removes the coarser grass and vines; from the hopper the berries are fed, single file, to screw conveyors on which they are held by trough-like guards. These guards do not quite touch the screw, leaving a crack through which the remaining bits of grass, vines and dried berries are dropped into a box placed below to receive them.

The screw conveyor passes the berries over a series of selecting plates made of some resilient material, the best found so far being the selected spruce wood prepared for piano sounding-boards. These plates are tapped by small hammers placed beneath, the strength of the blow being regulated by a thumb-screw. The sound berries respond to this gentle tapping by jumping off the screw conveyor and falling on an endless belt a few inches below, which delivers all the sound fruit at one end of the machine. The rotten berries do not respond to the tapping of the selecting plates and are carried to the ends of the screw conveyors where they drop in the same box under the machine that receives the fine grass and the like. Frozen berries are removed by this machine nearly as well as rotten ones and the shape of the berries is of no importance, while the berries only drop twice, a few inches each time, and are in much better condition for long keeping than those that go over the bounce machines. After the berries have been cleaned by machine it is customary to place them on tables where women remove any defective berries that may have been missed by the machines.



1093. The globular or cherry-shaped cranberry. (×½)

Marketing; yield.

Most cranberries are marketed in barrels holding about 100 quarts; a few are marketed in crates three of which fill a barrel. Some dealers prefer to buy cranberries "in the chaff," that is, just as they come from the bogs without having been run through any machine. Berries sold in this way are always packed in crates and are cleaned by the dealer, a few crates at a time, as his trade calls for them; they keep better than those that have been cleaned before being shipped.

Evaporated cranberries have been on the market for a number of years and are excellent, there being less difference between the sauce made from them and from fresh fruit than is the case with most kinds of fruit.

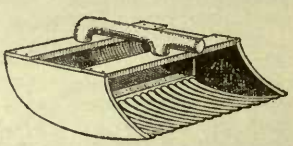
From the cranberry centers, the fruit is shipped in carload lots to the large cities of the United States, and from these distributed to the surrounding towns. There is also a small but steadily growing export trade.

A bog in good bearing should yield fifty barrels to the acre, but as many as 200 barrels have been secured.

In 1895 coöperative selling of cranberries was inaugurated by some of the New Jersey growers, who organized the Growers' Cranberry Co., with Joseph J. White as president and Theodore Budd as vice-president. This company was joined by a number of large New England growers and, though handling only 25 per cent of the crop, prospered greatly. Later, A. U. Chaney organized another coöperative selling company. These two companies consolidated in 1910, forming the American Cranberry Exchange, with George W. Briggs, of Massachusetts, as president. The Exchange controls about 50 per cent of the crop of the country and has been remarkably successful in securing good prices for its members while keeping the retail price as low as during the years of fiercest competition.

History.

Cranberry-culture began about a century ago in Massachusetts on the Cape Cod Peninsula. William Kenrick, writing in 1832 in the "Orchardist," says that "Capt. Henry Hall, of Barnstable, has cultivated the cranberry twenty years;" "Mr. F. A. Hayden, of Lincoln, Massachusetts, is stated to have gathered from his farm in 1830, 400 bushels of cranberries, which brought him in Boston market $600." In the second and subsequent editions, Kenrick makes the figure $400. It is not said whether Hayden's berries were wild or cultivated. At the present day, with all the increase in production, prices are higher than those received by Hayden. In the third (1841) and subsequent editions, it is said that "an acre of cranberries in full bearing will produce over 200 bushels; and the fruit generally sells, in the markets of Boston, for $1.50 per bushel, and much higher than in former years." It was as late as 1850, however, that cranberry-culture gained much prominence. It was in 1856 that the first treatise appeared: B. Eastwood's "Complete Manual for the Cultivation of the Cranberry." About 1845, cranberry-culture began to establish itself in New Jersey.



1094. Cranberry scoop, sometimes used in picking the berries.

The culture of cranberries began in Nova Scotia about thirty years ago. The first attempt consisted in improving some of the patches of wild berries found growing around the central district of the Annapolis Valley. Gradually the idea was entertained of planting new areas, and as this proved successful the new industry was soon fairly established. Farmers in the vicinity of Auburn soon took up the industry, and in the fall of 1892 the first carload of cranberries was shipped to Montreal. Since then, Nova Scotia cranberries have met with a ready sale throughout Canada.

PRODUCTION OF CRANBERRIES IN THE UNITED STATES IN 1899 AND 1909 (13th CENSUS)

State	1899	1909
New England—	Quarts	Quarts
Maine	100,192	49,728
New Hampshire	30,304	31,136
Vermont	1,120	.....
Massachusetts	22,714,496	19,164,992
Rhode Island	34,688	209,888
Connecticut	145,408	221,472
Middle Atlantic—		
New York	327,370	348,064
New Jersey	12,072,288	7,687,072
Pennsylvania	5,728	.....
East North Central—		
Ohio	4,256	.....
Indiana	7,552	139,520
Illinois	13,418	1,696
Michigan	125,536	124,288
Wisconsin	2,549,344	3,555,136
West North Central—		
Minnesota	22,112	35,840
Iowa	.....	1,952
Missouri	6,944	.....
North Dakota	1,120	32
South Dakota	288	704
Nebraska	.....	640
Kansas	.....	1,152
South Atlantic—		
Virginia	18,112	.....
North Carolina	1,024	.....
East South Central—		
Alabama	96	.....
West South Central—		
Arkansas	288	.....
Mountain—		
Montana	32	.....
New Mexico	96	.....
Pacific—		
Washington	9,728	4,416
Oregon	40,864	22,784
California	10,656	.....
United States	38,243,060	31,600,512

Literature.

The standard books on the cultivation of cranberries are Webb's "Cape Cod Cranberries," and "Cranberry-Culture," by Joseph J. White; these are old books and in many respects out-of-date. The best literature on the subject is to be found in the various publications of the United States Department of Agriculture, the bulletins of the agricultural experiment stations of New Jersey, Wisconsin and Massachusetts, the proceedings of the American Cranberry Growers' Association which have been published biennially since 1880, the reports of the Cape Cod Cranberry Growers' Association, and the reports of the Wisconsin State Cranberry Growers' Association.

ELIZABETH C. WHITE.

CRANBERRY TREE: *High-bush cranberry, Viburnum Opulus.*

CRANESBILL. Loosely applied to the whole genus Geranium. In America it usually means *G. maculatum.*

CRANIOLÀRIA (from a fancied resemblance of the pod to a skull or cranium). *Martyniàceæ.* Coarse but interesting flower-garden annual.

Wide-spreading low viscid-hairy rank forking herb: lvs. large, opposite, long-petioled, broadly cordate, reniform or palmately lobed: fls. white, racemed; calyx 3–5-lobed, more or less inflated; corolla very long-tubed, the tube slender and cylindrical, campanulate at the throat, more or less 2-lipped, the 5 lobes rounded and somewhat undulate, the anterior largest; perfect stamens 4, didynamous, affixed at or near the throat; ovary 1-celled: fr. a 2-valved caps. with a long incurved beak, many-seeded.—Two species, Venezuela to Paraguay. Usually confused with Martynia, from which it is distinguished readily by having 4 rather than 2 fertile stamens and by the very long and slender corolla-tube which widens at the throat; the closely related Proboscidea has a much broader tube widening nearly from the base.

ánnua, Linn. (*Martýnia Craniolària,* Glox.). Two feet high: lvs. palmately lobed, the margins dentate: calyx 2-bracted, cut down one side, about one-third the length of the slender straightish corolla-tube; lobes of corolla rounded and not much undulate; style 2-lobed, equaling or slightly exceeding the 2 pairs of stamens. N. S. Amer.—The thick fleshy root is preserved in sugar as a comfit; plant known as "Creole scorzonera" in S. Amer. There appears to be confusion in the seed sold as *Martynia Craniolaria;* some of it may be *M. louisiana* or other species. L. H. B.

CRÁSSULA (Latin *thickish;* referring to the thick leaves and stems). *Crassulàceæ.* Fleshy and leafy greenhouse shrubs or herbs, grown for the grotesque appearance of some of the kinds and also for the bloom.



1095. Crassula quadrifida. (×⅓)

Variable in habit and foliage, mostly erect; rarely annual: lvs. opposite, usually sessile and often connate, fleshy, very entire and the margins sometimes cartilaginous, glabrous or pubescent or scaly: fls. usually small, white, rose or rarely yellow, commonly in cymes but sometimes capitate, usually 5-merous; calyx 5-parted, the lobes erect or spreading; petals 5, free or joined at the base, erect or spreading; stamens 5, shorter than the petals; carpels 5, many-ovuled.—Species 150 or more, mostly in S. Afr., but a few in Abyssinia and Asia. Many species have been intro. to cult., but only a few are actually grown outside of fanciers' collections. The rocheas sometimes pass as crassulas. See *Rochea.*

The genus Crassula gives the name to the order Crassulaceæ, which contains many cultivated succulent plants, and also others of widely different habit. The order is closely related to the Saxifragaceæ, but differs in having the carpels of the ovary entirely free and equal in number to the petals, but the forms pass easily into the Saxifragaceæ through Francoa and Tetilla, and back again through Triactina. The genera, as usually treated, are ill defined, and certain species of Sedum cross over the lines of Crassula, Cotyledon and Sempervivum, while between Crassula and Tillæa no very clear distinction can be made.

Crassulas are greenhouse plants requiring a dry atmosphere during the resting-period. While making growth, they may be treated like other greenhouse plants in the way of watering, placing them in the lightest and airiest part of the house. The pots must be drained so that any surplus moisture will easily pass through. The soil should consist of sand, loam, broken brick, and a very small quantity of leaf-soil or thoroughly rotted cow-manure. Propagation is usually from cuttings. Some of the species, such as *C. falcata,* do not give much material for this purpose, and they should, therefore, be headed over and the tops put in dry sand in the spring, allowing water only when they show signs of shriveling. The cut-over plants should

be encouraged to make side shoots, which may be rooted after they are large enough. (G. W. Oliver.)

A. *Floral parts in 4's.*

quadrífida, Baker. Fig. 1095. Perennial: lvs. oblong-spatulate, the upper ones rounder, decussate: fls. with their parts in 4's, panicled, white, tinged red. Cape.

AA. *Floral parts in 5's, which is considered to be normal in the genus.*

B. *Lvs. petioled.*

cordàta, Soland. Plant slender and shrubby, 1–3 ft., erect or diffused and sometimes rooting at the joints: lvs. dotted, stalked, cordate-reniform, obtuse, entire, glabrous: cymes panicle-like; fls. reddish, sometimes pure white; petals free, lanceolate, spreading. Cape. Winter.—Closely allied to *C. spathulata.*

spathulàta, Thunb. Somewhat shrubby, more slender and trailing than *C. cordata,* decumbent, branching: lvs. stalked, roundish, crenate, glabrous, shining above: corymbs panicle-like; fls. rosy or flesh-colored: petals acute. Cape. L.B.C. 4:359 as *C. cordata*).—Likely to be cult. as *C. cordata.*

BB. *Lvs. not petioled (or only tapering to base).*

C. *Foliage glaucous.*

falcàta, Wendl. (*Ròchea falcàta,* DC.). Height 3–8 ft.: lvs. grown together at the base, thick, glaucous, oblong, falcate: fls. small, numerous (50 or more), in a crimson, rarely white, dense, terminal corymb; corolla-tube ⅓in. long, as long as the limb or shorter. Cape. B.M. 2035.

CC. *Foliage not glaucous.*

láctea, Soland. Plant shrubby, branching, tortuous below, 1–2 ft.: lvs. narrow-obovate, acutish or acuminate, narrowed and grown together at the base, glabrous, spotted along the margin: cymes panicle-like, many-fld.; fls. white, small. Cape. Winter. B.M. 1771. L.B.C. 8:735.—A free-flowering window plant of easy cult. There is a form with variegated lvs. Differs from *C. arborescens* in the narrower acute lvs. that are more tapering at base, and in the color of the fls.

arboréscens, Willd. Fleshy erect shrub, reaching 8–10 ft.: lvs. roundish-obovate and obtuse, tapering to base, fleshy, flat and glaucous, dotted above, the edges smooth: fls. rather large, rose-colored, in trichotomous panicled cymes. Cape. B.M. 384 (as *C. Cotyledon*).

C. atrosanguínea, Barbey. Erect, 12-20 in., rigid: st. reddish, branched at top: lvs. aloe-like, straight or recurved, glabrous, narrowed from base to apex, often 8 in. long, rosulate and on the st.: fls. dark red, in a dense terminal many-fld. cluster. Transvaal.—*C. coccínea.* Linn.=Rochea coccinea.—*C. congésta,* N. E. Br. Only 3½ in. high: lvs. thick and fleshy, ovate-lanceolate: fls. numerous, densely crowded in a sessile terminal head, the petals scarcely ½in. long, white. S. Afr.—*C. conjúncta,* N. E. Br. Lvs. concave: fls. pure white in a compact narrow cluster. S. Afr.—*C. decípiens,* N. E. Br. Dwarf tufted perennial: lvs. densely covered with blunt papillæ or nipple-like projections, fleshy, oblong: fls. very small, white, in terminal 3-branched cymes. S. Afr.(?).—*C. jasmínea,* Ker-Gawl=Rochea jasminea.—*C. sedifòlia,* N. E. Br. Only 1–2 in. high when in bloom: lvs. in small tufts at the base and 3 or 4 pairs on the fl.-sts., bright green, ciliate, with red-brown spots along the margin: fls. white, 3–9 together in terminal cymes. S. Afr.—*C. variábilis,* N. E. Br. Plant 3–6 in. high, branched at base: lvs. in 4 rows, densely imbricated, ovate, small (⅛in. or less long), ciliate on margin: fls. white, or red outside, 5–7 in small cymes disposed in a narrow terminal panicle. S. Afr. L. H. B.†

CRÁTÆ-MÉSPILUS: *Cratægus grandiflora.*

CRATÆGO-MÉSPILUS. This name has been bestowed on a graft hybrid between *Cratægus monogyna* and *Mespilus germanica,* discovered in 1894 in the garden of M. Dardar at Bronvaux near Metz, Germany. Like *Laburnum Adamii,* which is probably the best known of the graft hybrids, it produces at the same time branches intermediate in their characters between the parents and branches resembling more or less closely the parent plants. Two distinct forms produced on different branches of the parent tree have been prop. and distributed under the names *C. Dárdari* and *C. Asnierèsii.* The first form (*C. Dárdari,* Simon-Louis), has the lvs. and the frs. very similar to those of the medlar, but the branches are spiny, the fls. appear in corymbs, are distinctly pedicelled and have 15–20 stamens and the frs. have only 1–3 stones, measure ½–¾in. across, and are crowned by persistent upright connivent calyx-lobes. M.D.G. 1912:101. The second form, *C. Asnierèsii,* Schneid. (*C. Jules d'Asnières,* Simon-Louis) resembles more *Cratægus monogyna,* but is pubescent; the lvs. on the flowering branchlets are usually oval to obovate and often entire, while those of the shoots are ovate or rhombic-ovate and usually with 1 to 3 rounded or rarely acute lobes on either side; the fls. are borne in pubescent, 6–12-fld. corymbs, have 20 stamens and 1–2 styles; the fr. is subglobose and less than ½in. across. G.C. III. 50:183, 185. Gn. 75, p. 310. M.D.G. 1912:100.—While *C. Dardari* is botanically more interesting, *C. Asnieresii* is more ornamental and forms a handsome small tree with gracefully arching branches studded with numerous fl.-clusters. It is prop. by budding or grafting like the horticultural varieties of Cratægus. ALFRED REHDER.

CRATÆGUS (ancient Greek name, derived from *kratos,* strength, on account of the hardiness of the wood). *Rosàceæ,* subfam. *Pòmeæ.* CRATEGUS. HAWTHORN. Woody plants grown for their handsome foliage, attractive flowers and decorative fruit which, in a few species, is edible, and also for their picturesque habit: very valuable for ornament.

Shrubs or small trees, usually spiny: lvs. alternate, deciduous, stipulate, serrate, often lobed or pinnatifid: fls. white, in some varieties red, in corymbs, rarely solitary; petals and calyx-lobes 5; stamens 5–25, usually 10 or 20; styles 1–5: fr. a drupe-like pome, with 1–5 1-seeded bony stones.—A large genus, widely distributed in the temperate regions of the northern hemisphere, most abundant in N. Amer., where between 800 and 900 species have been described, while from the Old World only about 60 species are known. There exists no recent monograph of the genus; a systematic enumeration of the arborescent American species will be found in Sargent, "Manual of the Trees of North America," pp. 363–504; of the species of the southern states in Small, "Flora of the Southeastern United States," pp. 532–569; and of the species of the northeastern states in Gray's Manual, ed. 7, p. 460–79, and in Britton and Brown, Ill. Flor. (ed. 2) 2:294–321; for the species cult. in European gardens, see Lange, "Revisio Specierum Generis Cratægi" (1897), quoted below as Lange.



1096. Thorns of Cratægus. They are modified branches, being in the axils of leaves; sometimes, as in the lower figure, some of the short branches bear leaves.

The hawthorns are hardy ornamental shrubs and trees, mostly of dense and low growth, with handsome foliage, turning, in most species, to a brilliant coloring in the fall. Almost all have attractive white flowers, pink or crimson in some varieties of *C. Oxyacantha* and *C. monogyna.* Most of the species have very decorative fruit which in *C. Phænopyrum, C. nitida, C. viridis, C.*

fecunda, C. pruinosa, C. Carrierei, C. persistens, C. Oxyacantha, C. monogyna and others persist on the trees until late into the winter, while some species, as *C. Arnoldiana*, ripen their large fruits, which soon drop, in August; also *C. dahurica, C. sanguinea* and the black-fruited *C. nigra* ripen about the same time, and *C. submollis* only a little later, but the earliest of all is the southern *C. æstivalis*, which ripens its fruits in May. This and the blue-fruited *C. brachyacantha* are among the most decorative hawthorns for the southern states. The fruit of *C. æstivalis*, and that of *C. mexicana* is made into preserves and jellies; also the fruits of the Molles group are suited for jelly-making, and in South Carolina an excellent jelly similar in quality and taste to Guava jelly is made from the fruits of some species of the Flavæ group. In Europe, *C. monogyna* and *C. Oxyacantha* are counted among the best hedge plants; also many American species like *C. Phænopyrum, C. Crus-galli* and possibly *C. macracantha, C. intricata, C. pastorum, C. rotundifolia*, may be used for hedges, but they are stronger growers and cannot be pruned so closely as the European species. The hawthorns grow well in exposed positions and as a rule do not like much shade; they are not particular as to the soil, but grow best in limestone soil, also in a rich, loamy, somewhat moist one, and even in strong clay. Propagated by seeds, sown in fall or stratified; before stratifying, most of the pulp may be removed by laying the fruits in shallow piles and allowing them to decay. Then they are mixed with sand or sifted soil and buried in the ground or kept in boxes in a cool cellar. The young plants should not be allowed to remain over one year in the seed-beds, as they form long tap-roots and are then difficult to transplant. Varieties and rarer kinds are easily budded or grafted on seedling stock of *C. Oxyacantha*, or other common strong-growing species.

The spines of crategus are modified branches (see Fig. 1096). The fruits are pomes (Fig. 1097), with structure similar to that of the apple.

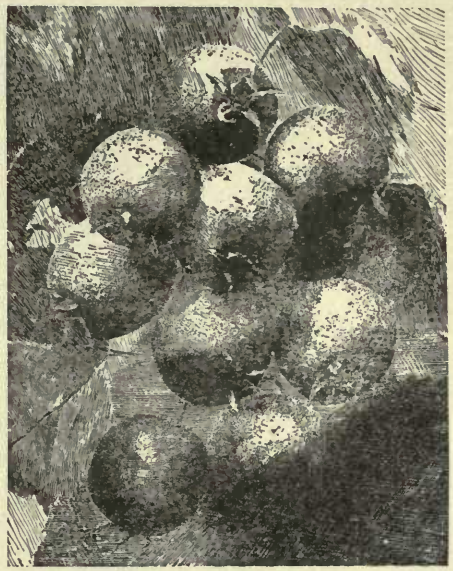
ALFRED REHDER.

The American hawthorns are highly ornamental subjects for the planting of parks and private estates. The showy flowers in spring and early summer, the conspicuous red, crimson, and scarlet fruits of nearly all of them, which extend amongst the different species from August to early winter and midwinter,—and some of the species markedly retain their fruits without shrinkage of pulp or loss of color until early winter,—the absolute hardihood, and the bold rugged branching habits characteristic to most of them, make them very interesting objects when their leafless forms are outlined in a winter landscape. The landscape gardener cannot make any mistake in planting them in liberal quantities in private estates or public parks.

They are easily transplanted. They are much benefited by liberal pruning when transplanted from nursery rows or from the woodland. The side branches should be pruned in severely, and as the centers of good-sized plants are likely to be full of intricate and congested branches, these should be carefully thinned. In a young state they should be grown to one stem whether they are arborescent or shrubby species. Under this treatment they make beautiful garden plants.

The American hawthorns are almost invariably found growing in heavy limestone clay. They may occasionally overlap into sandy soil. In planting them in sandy soil, it should be liberally enriched with well-rotted manure, and they should be kept well mulched.

The seeds of all of the species of American hawthorns germinate slowly. None of the species germinates before the second year after sowing, and many of the seeds in the same "flat" will not germinate before the third year. In many instances, part of the seeds germinate the second year, and the remainder the third. The seeds of *Cratægus geneseensis* have been known to be dormant for three years, and all come up thickly at the same time. In some of the groups the seeds of the species germinate more freely than in others. The species in the Molles, Flabellatæ and Tomentosæ groups germinate abundantly. The germination of the species in the Pruinosæ group have a much lower per-



1097. Pomes of Cratægus, one of the large-fruited forms. (Half size.)

centage than in the former. The species in the Intricatæ group germinate badly.

The fruit can be sown broadcast in beds without any separation of the seeds, and heavily mulched until the spring of the second year, when the mulching should be removed. This method, however, is not considered good, and has been given up. The best way is to soak the fruits in water, and by maceration the seeds or nutlets are separated from the pulp, and the seeds will sink to the bottom of the tub or vessel. The seeds are then dried in the sun as they can then be handled easily. They are sown in "flats" of convenient size to handle, and piled up in the corner of the shade house and fitted tightly above each other to prevent mice getting at them. During this period of rest they must not be allowed to become dry. In the spring of the second year they are spread out to allow the seeds to germinate. Numbered zinc tags are nailed on the "flats" and the corresponding numbers with the names of the species are recorded.

The American hawthorns can be grafted readily on potted seedling stocks in the greenhouse in winter, any of the species in the Crus-galli group being good to use. They are grafted at the crown. This, however, is an unnecessary operation. All of the species of American hawthorns (and there are over 900 of them) come absolutely true from seed, and whilst they germinate slowly, they start to grow rapidly into plants of good stocky size from about two years after they germinate.

Some of the species of American hawthorns have highly colored foliage in the fall. The species in the Pruinosæ, Medioximæ and Intricatæ groups have perhaps the most highly colored foliage. Notable examples are *Cratægus opulens, C. diffusa, C. maineana, C. dissona, C. cognata, C. conspecta, C. promissa, C. exornata, C. perjucunda, C. fætida*, and *C. verecunda*.

The different species vary greatly in the time of ripening their fruits and in the period of duration. In many instances the fruit drops soon after ripening and in others hangs on for a long period. A selection

of twenty-six species that would give a good fruit display from August until early or mid-winter, would be as follows: *Cratægus matura, C. præcox, C. Arnoldiana, C. Dayana, C. Robesoniana, C. pedicellata, C. gloriosa, C. Ellwangeriana, C. lauta, C. submollis, C. champlainensis, C. arkansana, C. Dunbari, C. ferentaria, C. opulens, C. compta, C. gemmosa, C. livoniana, C. geneseensis, C. persimilis, C. maineana, C. Barryana, C. coccinioides, C. leiophylla, C. durobrivensis,* and *C. cordata.* (See pp. 887–889 for some of these.) JOHN DUNBAR.

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KEY TO THE SPECIES.

A. *Veins of the lvs. extending to the points of the lobes or to the teeth only; lvs. usually slightly or not lobed: fr. not black or blue, except in No. 37.*
B. *Stones plain on the inner surfaces.*
C. *Petioles elongated, usually slender.*
D. *The petioles glandular at the apex or sparingly glandular throughout.*
E. *Corymbs many-fld.: petioles glandular only at the apex: lvs. broad at the base, truncate to broadly cuneate.*
F. *Lvs. tomentose or pubescent beneath, at least on the veins.*
G. *Stamens 20; anthers pale yellow: lvs. thick and leathery.*
H. *Fr. ripening in Aug. and Sept.: lvs. broadly ovate.* ..... 1. **mollis**
HH. *Fr. ripening at the end of Oct.: lvs. oblong-ovate to oval.*..... 2. **arkansana**
GG. *Stamens 10: lvs. membranous at maturity.*
H. *Anthers yellow.*
I. *Fr. crimson, villous, ripening the middle of Aug.: lvs. dark green and smooth above*..... 3. **Arnoldiana**
II. *Fr. orange-red, lustrous, puberulous at the base: lvs. dark yellowish green, scabrate above* .... 4. **submollis**
HH. *Anthers rose-color: lvs. scabrate above.*
I. *Plant a tree: lvs. with short lobes: corymbs many-fld*..... 5. **Ellwanger-**
II. *Plant a shrub: lvs. rather deeply lobed: corymbs 4–6-fld.*.. 6. **Robesoniana** [**iana**
FF. *Lvs. glabrous beneath or nearly so.*
G. *Fr. bloomy until nearly fully ripe.*
H. *Stamens 20: lvs. glabrous: fr. subglobose, often 5-angled*..... 7. **pruinosa**
HH. *Stamens 10: lvs. scabrate above, while young: fr. obovoid* ... 8. **Barryana**
GG. *Fr. not bloomy.*
H. *Stamens 20, anthers pink: lvs. truncate at the base.*
I. *The lvs. dull above, villous beneath when young: fr. with conspicuous calyx and with red flesh* ..... 9. **coccinioides**
II. *The lvs. lustrous above, quite glabrous: fr. with yellow flesh and small calyx*... 10. **speciosa**
HH. *Stamens 5–10: lvs. broadly cuneate.*
I. *Anthers pink or rose-purple; stamens usually 10.*
J. *Calyx-lobes coarsely glandular-serrate: stones usually 5: lvs. distinctly lobed*.. 11. **pedicellata**
JJ. *Calyx-lobes entire or obscurely serrate: stones 2–3: lvs. slightly lobed*..... 12. **pastorum**
II. *Anthers yellow; stamens 5–10: lvs. orbicular-ovate: fr. with 2–3 stones*..... 13. **rotundifolia**
EE. *Corymbs usually few-fld.: petioles sparingly glandular throughout: lvs. cuneate at the base: stamens 10.*
F. *Calyx-lobes glandular-ciliate: corymbs slightly villous: anthers yellow*..... 14. **intricata**
FF. *Calyx-lobes entire or glandular above the middle: corymbs glabrous.*
G. *Anthers purplish: calyx-lobes glandular above the middle*..... 15. **Buckleyi**
GG. *Anthers yellow: calyx-lobes without glands*..... 16. **Boyntonii**
DD. *The petioles glandless or with a few minute glands: lvs. cuneate at the base, ovate to lanceolate, not or very slightly lobed, lustrous above, glabrous at maturity: stamens 20.*
E. *Fr. subglobose, ¼in. across or less, bright scarlet or orange: lvs. oblong-obovate to ovate*... 17. **viridis**
EE. *Fr. ovoid, about ½in. across, dull brick-red, bloomy: lvs. lanceolate to oblong-obovate*. 18. **nitida**
CC. *Petioles short; lvs. cuneate at the base, not or very slightly lobed.*
D. *The petioles glandless.*
E. *Corymbs many-fld.*
F. *Lvs. dark green and shining above.*
G. *Stamens 10: under side of lvs. glabrous or nearly so.*

H. *Anthers rose-color or purple.*
I. *Fr. glabrous: corymbs glabrous.*
J. *Shape of lvs. cuneate-obovate to oblanceolate: fr. dull red; stones usually 2*.....19. **Crus-galli**
JJ. *Shape of lvs. oblong to ovate: fr. crimson, lustrous; stones 3–5*.20. **Canbyi**
II. *Fr. villous until nearly fully grown: lvs. oblong-obovate to broadly ovate: corymbs slightly villous*.....21. **fecunda**
HH. *Anthers yellow: lvs. obovate: fr. dull dark crimson*.....22. **Arduennæ**
GG. *Stamens 20.*
H. *Under side of lvs. villous: corymbs densely pubescent*.....23. **Carrierei**
HH. *Under side of lvs. glabrous: corymbs slightly pubescent*....24. **persistens**
FF. *Lvs. dull above: stamens 20.*
G. *Fr. juicy, edible: lvs. cuneate-oblong or elliptic-lanceolate, tomentose beneath*.....25. **mexicana**
GG. *Fr. dry, mealy: lvs. obovate or oval.*
H. *Length of lvs. 2–4 in., pubescent beneath: fr. ovoid, ½–1 in. long, with large dots*.....26. **punctata**
HH. *Length of lvs. 1½–2 in., at maturity hairy only on the midrib beneath: fr. globose, ⅓–½in. across, with small dots*.....27. **collina**
EE. *Corymbs few-fld.: lvs. ½–2 in. long, pubescent beneath: stamens 20–25.*
F. *Fls. with or before the lvs.: fr. ripening in May, juicy, bright red: lvs. 1½–2 in. long*.....28. **æstivalis**
FF. *Fls. after the lvs.: fr. ripening very late, dry, dull red or yellow: lvs. less than 1½ in. long.*
G. *Lvs. obovate, mostly obtuse, crenately serrate: fls. usually solitary*.....29. **uniflora**
GG. *Lvs. oval or ovate, acute, serrate and often lobed: fls. 2–6*.....30. **Vailiæ**
DD. *The petioles, margin of lvs. and corymbs densely glandular: corymbs 3–7-fld.*
E. *Stamens 20, anthers purple: fr. ovoid*.....31. **flava**
EE. *Stamens 10.*
F. *Fr. pyriform: anthers purplish*.....31. **flava** var. [lobata
FF. *Fr. globose: anthers yellow*..32. **aprica**
BB. *Stones with furrows or irregular cavities on the inner surfaces; fr. lustrous, soft at maturity.*
C. *Lvs. not or only slightly lobed.*
D. *Color of fr. scarlet or orange; stones 2–3: lvs. with impressed veins.*
E. *Fr. small, ovoid or pear-shaped, upright, orange-red: lvs. thin, dull above, pubescent below*...33. **tomentosa**
EE. *Fr. subglobose, larger, nodding, scarlet: lvs. subcoriaceous, pubescent only on the veins beneath.*
F. *Anthers rose-color; stamens usually 20*.....34. **succulenta**
FF. *Anthers yellow; stamens 10.*
G. *Foliage glabrous below: stones deeply grooved on the inner surface*.....35. **macracantha**
GG. *Foliage usually pubescent on the veins below while young: stones slightly grooved*.....36. **prunifolia**
DD. *Color of fr. black; nutlets 5: lvs. broadly elliptic to obovate, glabrous (see also No. 42 with blue frs.)*.....37. **Douglasii**
CC. *Lvs. more or less distinctly lobed.*
D. *Length of lvs. more than 2 in.: lvs. pubescent: fr. nearly ½in. across*.....38. **sanguinea**
DD. *Length of lvs. less than 2 in.: lvs. quite glabrous: fr. ⅓in. or less across*.....39. **dahurica**
AA. *Veins of the lvs. extending to the points of the lobes and to the sinuses; lvs. usually distinctly lobed.*
B. *Fr. very small, ½in. long or less, red: calyx deciduous.*
C. *Lvs. triangular-ovate, with shallow and broad lobes, often 3-lobed: fr. subglobose, lustrous; nutlets 3–5*...40. **Phænopyrum**
CC. *Lvs. ovate, deeply 5–7-lobed: fr. ovoid; nutlets 1–3*.....41. **apiifolia**
BB. *Fr. larger: calyx-teeth persistent.*
C. *Color of fr. black or blue.*
D. *The fr. blue, bloomy: lvs. obovate to obovate-oblong, crenate-serrate, usually not lobed*.....42. **brachya-**
DD. *The fr. black; stones with cavities on the inner surfaces.* [cantha
E. *Lvs. with about 5 pairs of lobes: fr. lustrous, subglobose, juicy*.43. **nigra**
EE. *Lvs. with 2–3 pairs of lobes: fr. ovoid, dull black or purplish black*.....44. **pentagyna**
CC. *Color of fr. red or yellow.*
D. *Stones with cavities on the inner surfaces, 1–2.*
E. *Styles 2: lvs. 3–5-lobed with short and broad serrulate lobes*.....45. **Oxyacantha**
EE. *Style 1: lvs. deeply 3–7-lobed, with acute, entire or sparingly toothed lobes*.....46. **monogyna**
DD. *Stones plain on the inner surfaces, 2–5.*
E. *Branchlets and lvs. pubescent.*
F. *Lvs. with glandular toothed lobes, pubescent*.....47. **tanacetifolia**
FF. *Lvs. not glandular-toothed, lobes often nearly entire.*
G. *Upper surface of lvs. dull, pubescent, under surface villous*.....48. **orientalis**
GG. *Upper surface of lvs. glabrescent, lustrous, under surface finely pubescent*.49. **Azarolus**
EE. *Branchlets glabrous: lvs. deeply lobed, glabrous*.....50. **pinnatifida**

1. Molles.

1. **móllis,** Scheele (*C. tiliifòlia,* Koch. *C. acerifòlia,* Hort. *C. coccínea* var. *móllis,* Torr. & Gray). Tree, to 30 ft., with short, stout thorns: lvs. broadly ovate, sharply and doubly serrate and with 4–5 pairs of short acute lobes, densely pubescent beneath, 3–4 in. long: corymbs densely villous-pubescent; fls. with red disk: fr. about ½in. across, usually pear-shaped, scarlet, more or less pubescent, with thick mealy flesh and 4–5 stones. April, May: fr. end of Aug., Sept. Ohio to S. Dak. and Kans. S.S. 13:659. Em. 494 (as *C. tomentosa*). G.F. 5:221.—One of the most decorative species, with large, bright green foliage and showy fls. and frs., ripening in Sept., but dropping soon after maturity.

2. **arkansàna,** Sarg. Tree, to 20 ft.: branches wide-spreading, forming an irregular open head, unarmed or

with straight spines ⅓–½in. long: lvs. oval or oblong-ovate, acute, truncate or broadly cuneate at the base, serrate and with 3–4 pairs of short lobes, pubescent on both sides at first, at maturity dull dark green and glabrous above, villous on the veins below, 2–3 in. long: corymbs villous; fls. nearly 1 in. across: fr. ovoid, bright crimson, slightly villous at the ends, ¾–1 in. long, with thick subacid flesh and usually 5 stones.



1098. Cratægus Arnoldiana (×⅔). No. 3.

May; fr. end of Oct., falling gradually. Ark. S.S. 13:660.—Very handsome in autumn with its abundant brilliant frs. persistent for some time; the lvs. turn clear yellow.

3. **Arnoldiàna,** Sarg. Fig. 1098. Tree, to 20 ft., with stout ascending branches forming an open head with zigzag branchlets, armed with stout spines 2–3 in. long: lvs. broadly ovate to oval, acute, truncate to broadly cuneate at the base, doubly serrate and with many shallow broad lobes, at first hairy above and soft-pubescent below; later smooth, dark green and lustrous above, slightly villous on the veins below, 2–3 in. long: corymbs tomentose; fls. ¾in. across: fr. subglobose, bright crimson, villous toward the ends, ¾in. long, with thick subacid flesh and 3–4 stones. May; fr. middle of Aug., soon falling. Mass. S.S. 13:668.

4. **submóllis,** Sarg. Tree, to 25 ft., with ascending or spreading branches forming a broad handsome head: spines numerous, thin, usually straight, 2–3 in. long: lvs. ovate, acute, broadly cuneate at the base, doubly serrate and with 3–4 pairs of acute short lobes, scabrous above, below at first soft-pubescent, later only puberulous on the veins, 2–3 in. long: corymbs tomentose; fls. 1 in. across: fr. pear-shaped or ovoid, bright orange-red and lustrous, ¾in. long with persistent erect calyx; flesh yellow, mealy; stones usually 5. May; fr. early in Sept., soon falling. Que. to Mass. and E. N. Y. S.S. 4:182 (as *C. mollis*).

5. **Ellwangeriàna,** Sarg. Tree, sometimes to 20 ft., with stout ascending branches forming a broad symmetrical head, and with zigzag branchlets: lvs. oval, acute, rounded or broadly cuneate at the base, coarsely and often doubly serrate with many short acute lobes, at first hairy above and villous below on the veins, later scabrous and light green above, nearly glabrous below, 2½–3½ in. long: corymbs densely villous; pedicels short; fls. 1 in. across: fr. ovoid, bright crimson, very lustrous, slightly villous at the ends, 1 in. long, with thin yellow acid flesh and 3–5 nutlets. May; fr. at the end of Sept., soon falling. N. Y. and Ont. to Mich., south to W. Pa. S.S. 13:671. G.C. III. 47:130. A.F. 24:325. F.E. 33:488.

6. **Robesoniàna,** Sarg. (*C. spissiflòra,* Sarg.) Shrub, with numerous erect sts., to 12 ft., or occasionally small tree, to 20 ft.: spines few, stout, 1–1½ in. long: lvs. oblong-ovate, acute, or acuminate, rounded or broadly cuneate at the base, sharply doubly serrate with many broad acute lobes, pubescent below on the veins while young, glabrous at maturity, scabrate above, 2–3 in. long: corymbs pubescent, 4–6-fld., compact; calyx villous, lobes glabrous outside: fr. ovoid, scarlet, ¾in. long, with small calyx; flesh thin, mealy; stones 4–5. May: fr. Sept., soon falling. N. Y. to S. Ont.—This species was formerly sold by Ellwanger & Barry under the name *C. coccinea.*

2. Pruinosæ.

7. **pruinòsa,** Koch (*C. coccinea* var. *víridis,* Torr. & Gray). Shrub or tree, to 20 ft.: branches spreading with numerous stout straight spines: lvs. elliptic or ovate, acute, usually broadly cuneate at the base, irregularly and often doubly serrate, with 3–4 pairs of short acute lobes, red when unfolding, later dark bluish green above, paler below, glabrous, 1–2 in. long: corymbs rather few-fld.; fls. slender-pedicelled, ¾–1 in. across; stamens 20; anthers pinkish: fr. subglobose, apple-green and glaucous until nearly fully ripe, finely dark purple with yellow sweet flesh and 5 stones: calyx prominent with a well-developed tube. May; fr. Oct. Vt. to Va., and Ill. S.S. 13:648.

8. **Barryàna,** Sarg. Shrub, to 15 ft.: branches spreading or ascending with slender spines: lvs. broadly ovate, rounded or abruptly cuneate at the base, sharply doubly serrate and slightly lobed, scabrate above, glabrous and glaucous below, 2–3 in. long: corymbs glabrous; calyx-lobes entire or sparingly dentate; fls. ¾in. across; stamens 7–10, with purple anthers: fr. obovoid, crimson with small pale dots, pruinose, ¾in. long, with usually 3 nutlets. May; fr. in Oct. W. N. Y.

3. Deltoides.

9. **coccinioìdes,** Ashe. Fig. 1099. Tree, sometimes 20 ft.: branches stout, spreading, forming a broad handsome head: spines thick, 1½–2 in. long: lvs. broadly ovate, acute, rounded or truncate at the base, doubly serrate, with several pairs of broad acute lobes, at first yellowish green and lustrous above, villous on the veins beneath, later dull dark green above, paler and nearly glabrous beneath, 2–3 in. long: fls. ¾in. across, in compact 5–7-fld., sometimes slightly villous corymbs: fr. subglobose, dark crimson and lustrous, ¾in. across, with thick subacid reddish flesh and 4–5 stones. May; fr. early in Oct. and falling gradually. Mo., Ind., and Kans. S.S. 13:674. M.D.G. 1901: 358, 359.—Very handsome small tree, the foliage tinged red when unfolding and turning scarlet and orange in autumn.

10. **speciòsa,** Sarg. Shrub, to 15 ft., usually with many sts.: spines numerous, 1–2 in. long: lvs. ovate, acute or acuminate, rounded or subcordate at the base, doubly serrate and with 4–5 pairs of broad and short acute lobes, tinged red when unfolding and nearly glabrous, at maturity thick, dark green and lustrous

above, paler below and quite glabrous, 2–3 in. long: corymbs glabrous, 5–8-fld.; fls. 1. in. across: fr. depressed-globose, bright crimson and lustrous, nearly 1 in. broad, with thin yellow flesh and 5 stones. May; fr. the middle of Sept., soon falling. Mo. S.T.S. 1:33.—Very handsome with its lustrous lvs., large fls. and brilliant fr.

4. Coccineæ.

11. **pedicellàta,** Sarg. Tree, to 20 ft., with rather slender spreading or ascending branches forming a symmetrical head: spines straight or slightly curved, 1½–2 in. long: lvs. broadly ovate, broadly cuneate or truncate at the base, coarsely and often doubly serrate, above the middle with 4–5 pairs of short acute lobes, at maturity membranous, dark green and scabrous above, paler and nearly glabrous below, 2–4 in. long: fls. ½in. across in loose slightly villous corymbs; calyx-lobes coarsely glandular-serrate: fr. pear-shaped or ovoid, bright scarlet, lustrous, with conspicuous persistent calyx; flesh thin, mealy; stones 4–5. May; fr. Sept. Pa. to Conn., N. Y., and Ont. S.S. 13:677.

5. Tenuifoliæ.

12. **pastòrum,** Sarg. (*C. macrospérma* var. *pastòrum,* Eggleston). Glabrous shrub, sometimes to 15 ft., with many erect sts., armed with numerous stout or slender spines: lvs. ovate, acute, usually rounded at the base, doubly serrate, slightly lobed, at maturity thick, dark dull blue-green, glaucescent below, 1½–2 in. long: fls. ¾in. across in many-fld. corymbs; calyx-lobes lanceolate, entire or obscurely serrate: fr. ovoid, bright scarlet, lustrous, about ½in. long, with thick, yellow and mealy flesh and 2–3 stones. New England. May; fr. Sept. S.S. 4:180 (as *C. coccinea*).

6. Rotundifoliæ.

13. **rotundifòlia,** Moench (*C. coccínea* var. *rotundifòlia,* Sarg. *C. glandulòsa,* Willd.) Shrub or bushy tree, sometimes to 20 ft., with slender, straight or curved spines: lvs. ovate-orbicular to oval, or obovate, acute, broadly cuneate at the base, rather coarsely serrate and usually with 3–4 pairs of short acute lobes, glabrous, 1–2½ in. long: corymbs glabrous or slightly villous; fls. ¾–1 in. across; calyx-lobes and bractlets very glandular: fr. subglobose, about ½in. long, red with yellow sweet flesh and 2–3 stones. May; fr. Sept. Nova Scotia to Sask., Ill. and Va. G.C. II. 14:557. Gn. 22, p. 145; 33, p. 464.—The most northern species. Var. **pùbera,** Sarg. (*C. coccínea,* Linn., in part). Branchlets, petioles and the lvs. on the veins more or less pubescent below while young.

7. Intricatæ.

14. **intricàta,** Lange. Shrub, to 10 ft.: branches upright or spreading, with rather long curved spines: lvs. elliptic-ovate, acute, cuneate at the base, doubly serrate with 3–4 pairs of short acute lobes, at first slightly pubescent, later scabrate above, bright green, slightly paler beneath and nearly glabrous, 1–2½ in. long: corymbs slightly villous; fls. about 1 in. across; calyx-lobes serrate: fr. subglobose to ovoid, sparingly villous or glabrous, dull reddish brown, with usually 3–4 stones. May; fr. Oct., Nov. Mass. and Vt. to Pa. Lange 1.

15. **Búckleyi,** Beadle. Large shrub or tree, often to 25 ft., with stout spreading or ascending branches and stout straight spines ½in. long: lvs. broadly ovate or oval, acute, usually rounded at the base, coarsely serrate and incisely lobed with acuminate lobes, glabrous and thick and firm at maturity: corymbs 3–7-fld., compact, glabrous; fls. ¾in. across; sepals serrate toward the apex and stipitate-glandular: fr. subglobose, usually angled, about ½in. across, yellowish green and flushed red or red, with 3–5 stones. May; fr. Sept. and Oct. Va. to N. C. and Tenn. S.M. 464.

16. **Boyntonii,** Beadle. Tree, occasionally to 20 ft., with stout ascending branches: spines straight, thin, 1½–2 in. long: lvs. broadly ovate to oval, acute, sharply serrate with glandular teeth and often with 2–3 pairs of short acute lobes, bronzy red when unfolding and slightly viscid, at maturity yellowish green, thick and firm and glabrous, 1–2½ in. long; petioles glandular: fls. ¾in. across, in 4–10-fld. glabrous corymbs; calyx-lobes entire or obscurely glandular-serrate above the middle: fr. depressed-globose, yellowish green flushed with red, about ½in. across, with 3–5 stones. May; fr. Oct. Va. to Ky., Tenn. and Ala. S.S. 13:650.

8. Viridæ.

17. **víridis,** Linn. (*C. arboréscens,* Ell.). Tree, to 35 ft., with spreading branches forming a round, rather compact head: spines slender: lvs. oblong-ovate to oval, acute or acuminate, serrate above the cuneate base, dark green and lustrous above, paler below, finally glabrous, 1–3 in. long: corymbs glabrous; pedicels slender; calyx-lobes lanceolate, entire: fr. globose, bright red, ⅛–¼ in. across, with usually 5 stones. Md., Va. to Ill., Iowa, Texas and Fla. May; fr. Oct., persisting through the winter. S.S. 4:187.

18. **nítida,** Sarg. Tree, to 30 ft., with spreading branches unarmed or with thin straight spines: lvs. elliptic to oblong-obovate, acuminate, coarsely serrate except at the cuneate base, often slightly lobed, dark green and lustrous above, paler below, glabrous, 1–3 in. long: corymbs glabrous, calyx-lobes elongated, entire or sparingly glandular-serrate: fr. ovoid or subglobose, dark dull red, about ½in. long with thick mealy flesh and 2–5 stones. May; fr. Oct., persistent through the winter. Ill., Kans. S.S. 13:703.—Like *C. viridis* very ornamental with its lustrous foliage and persistent frs.



1099. Cratægus coccinioides (×⅔). No. 9.

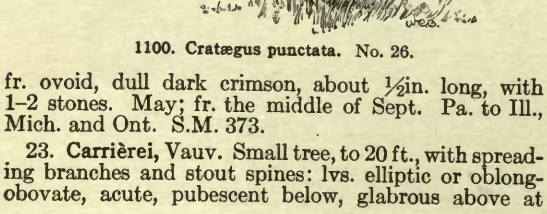
9. Crus-galli.

19. **Crus-gâlli,** Linn. Cockspur Thorn. Shrub or tree, to 40 ft.: branches wide-spreading, rigid, often pendulous, with numerous slender spines: lvs. obovate or oblanceolate, irregularly and sharply serrate, usually rounded at the apex, quite glabrous, 1–2½ in. long, often semi-persistent: corymbs glabrous; calyx-lobes entire or minutely serrate: fr. usually globose, red, with usually 2 stones; flesh thin and dry. May, June: fr. late in Oct. Que., south to N. C., west to Mich. S.S. 4:178. Em. 492. R.B. 1:116. G.F. 7:295. G.C. III. 28:244, suppl. Sept. 29.—A very decorative species of distinct habit, handsome in bloom and with showy, bright red fr., remaining on the branches often until spring; the lvs. assume a brilliant orange and scarlet color in fall. Often used for hedges. Var. **inérmis,** Lange. Spineless form. Var. **lineàris,** Ser. Lvs. linear-lanceolate. Var. **nàna,** Nichols. Dwarf form. Var. **pyracanthifòlia,** Ait. Lvs. elliptic or obovate, usually acute: fr. smaller, brighter red. W. N. Y. and Pa. to Fla. and Tenn. S.S. 13:637. Var. **salicifòlia,** Ait. Lvs. oblanceolate or lanceolate, thinner. Var. **splèndens,** Ait. (var. *lùcida,* Hort.). Lvs. elliptic-oblanceolate, very shining. Var. **ovalifòlia,** Lindl. (*C. pennsylvánica,* Hort., not Ashe). Lvs. elliptic or elliptic-obovate, less lustrous: fr. ovoid. B.R. 22:1860. Gn. 22, p. 146; 33, p. 468.—This is probably not a variety of *C. Crus-galli,* but a distinct species identical with one of the recently described species of this group.

20. **Cânbyi,** Sarg. Shrub or bushy tree, to 20 ft.: branches wide-spreading, with thick usually straight spines: lvs. oblong-obovate to elliptic, acute or obtuse, coarsely and often doubly serrate above the middle, glabrous, 1½–3 in. long: corymbs glabrous; calyx-lobes entire or sparingly serrate: fr. subglobose or ovoid, about ½in. long, dark crimson, with juicy flesh and 3–5 stones. May; fr. Oct. E. Pa., Del., Md. S.S. 13:638.

21. **fecúnda,** Sarg. Small tree, to 25 ft.: branches wide-spreading, with slender spines: lvs. oblong-ovate to oval, usually acute, doubly serrate, with strongly marked veins, 1½–3 in. long: corymbs slightly villous; calyx-lobes glandular-serrate: fr. subglobose to ovoid, ½–¾in. long, orange-red, with thick flesh and 2–3 stones. May; fr. Oct. Mo., Ill. S.S. 13:641.

22. **Arduénnæ,** Sarg. Shrub or tree, to 20 ft.: branches spreading, forming a round-topped head: spines slender: lvs. oblong-obovate, acute, acuminate or rounded, crenulate-serrate from below the middle, with obscure veins, 1½–2½ in. long: corymbs glabrous, pedicels slender; calyx-lobes entire or slightly serrate:



1100. Cratægus punctata. No. 26.

fr. ovoid, dull dark crimson, about ½in. long, with 1–2 stones. May; fr. the middle of Sept. Pa. to Ill., Mich. and Ont. S.M. 373.

23. **Carrièrei,** Vauv. Small tree, to 20 ft., with spreading branches and stout spines: lvs. elliptic or oblong-obovate, acute, pubescent below, glabrous above at length and lustrous, irregularly serrate, 3–4 in. long: corymbs rather few-fld., pubescent; fls. large, with red disk; calyx-lobes linear, serrulate: fr. bright orange or brick-red, ovoid, about ½in. long, with 1–3 stones. May. R.H. 1883:108. G.C. III. 21:118, 119.—Probably hybrid between *C. Crus-galli* and *C. mexicana,* originated in France. Possibly not different is *C. Lavàllei,* Herincq, described with larger subglobose fr.

24. **persístens,** Sarg. Low tree, 12 ft. or more: branches wide-spreading, with numerous stout spines to 2 in. long: lvs. lanceolate to oblong-obovate, acuminate, cuneate at the base, coarsely serrate above the middle, at maturity glabrous, dark green and lustrous above, pale beneath, 2–3 in. long: corymbs slightly villous; fls. over ¾in. across; calyx-lobes glandular-serrate above the middle or entire; stamens 20, anthers white; styles surrounded at the base by a broad ring of pale tomentum: fr. ovoid or slightly obovate, crimson, not lustrous, over ½in. across; flesh thick and mealy, with 2–3 stones. May: fr. in Oct. S.T.S. 2:190. —Of unknown origin, possibly a hybrid of *C. Crus-galli.* Raised at the Arnold Arboretum. The lvs. remain on the branches unchanged until those of all the other hawthorns have fallen and the frs. persist until late into the winter. One of the most conspicuous of winter fruiting plants.

10. Mexicanæ.

25. **mexicàna,** Sess. & Moc. (*C. hypolàsia,* Koch). Small tree, to 30 ft.: branchlets tomentose, unarmed or with short spines: lvs. cuneate-oblong or elliptic-lanceolate, obtuse or acute, crenate-serrate and often slightly lobed toward the apex, pubescent above, sometimes nearly glabrous, tomentose below, 1½–3½ in. long: corymbs white-tomentose; fls. ¾in. wide; calyx-lobes entire or with a few teeth at the apex; stamens 20, with pink anthers: fr. ovoid to pyriform, orange or dull orange-red, ¾–1 in. thick, edible, with 3–5 nutlets. March; fr. Oct., Nov. Mex. B.R. 22:1910.

11. Punctatæ.

26. **punctàta,** Jacq. Fig. 1100. Tree, to 25 ft.: branches horizontally spreading, with short, stout spines or unarmed: lvs. obovate, obtuse or acute, narrowed at the base into a rather long margined petiole, irregularly serrate, on the shoots often slightly lobed, villous below, with impressed veins above, 2–4 in. long: corymbs villous; fls. large; calyx-lobes entire: fr. pyriform or subglobose, dull red, dotted, about ½in. across, with 5 stones. May; fr. Oct., falling soon. From Que. to Ont., Ill. and Ga. S.S. 4:184. A.F. 28:805. Var. **aûrea,** Ait. (var. *xanthocárpa,* Roem. *C. crocàta,* Ashe). Fr. yellow.

27. **collîna,** Chapm. Shrub or small tree, occasionally 25 ft.: branches wide-spreading, with stout spines, on the trunk with large branched spines: lvs. obovate or oval, acute, broadly cuneate at the base, irregularly, often doubly serrate, at maturity yellowish green above, paler below and glabrous except on the midrib: corymbs villous; calyx-lobes glandular-ciliate; anthers yellow: fr. subglobose, dull red, ⅓–½in. long, with yellow mealy flesh and usually 5 stones. May; fr. Oct. Va. to Tenn. and Ala. S.S. 13:654.

12. Æstivales.

28. **æstivàlis,** Torr. & Gray. May Haw. Apple Haw. Tree, to 30 ft., with a round compact head, unarmed or with stout straight spines 1–1½ in. long: lvs. elliptic to oblong-obovate, acute or rounded, gradually narrowed into the ¼–1 in. long petiole, sinuate-dentate or crenate-serrate, at maturity dark green and lustrous above, below, particularly on the veins, densely rusty-pubescent, 1½–2½ in. long: fls. with the lvs., 1 in. across, in 2–5-fld. glabrous corymbs; calyx-lobes entire or minutely glandular-serrate: fr. depressed-

globose, fragrant, ½–¾in. across, bright red, crowned by the conspicuous calyx, with juicy subacid flesh and 3–5 stones. Feb., March; fr. May. Fla. to Ark. and Texas. S.S. 4:192.—The fr. is made into preserves and jellies.

13. Unifloræ.

29. **uniflòra,** Moench (*C. parvifòlia,* Ait. *C. tomentòsa,* Eggleston, not Linn. *C. flórida,* Loud.). Dense, low shrub, with numerous slender spines, rarely spineless, 3–8 ft.: lvs. on short not glandular petioles, cuneate, obovate or oblong-obovate, irregularly or doubly crenate-serrate, pubescent on both sides, at length glabrous above, ½–1½ in. long: fls. ½in. across, 1–3-fld. corymbs; calyx pubescent, with large serrate lobes: fr. pyriform or globose, yellow, ⅓ in. across, with 3–5 stones. May, June. Ga. and Ala. to Fla. S.S. 4:191.

30. **Vailiæ,** Brit. Shrub, to 12 ft., with slender straight spines: lvs. oval or ovate, acute, cuneate at the base, crenate-serrate and often slightly lobed, at maturity glabrous and lustrous above, pubescent below, ½–1½ in. long: fls. ½in. across, in 2–6-fld., pubescent corymbs; calyx-lobes glandular-serrate: fr. globose, ⅓in. across, dull red, with 3–5 stones. May; fr. Oct. Va. to Ga. and Ala.

14. Flavæ.

31. **flàva,** Ait. Tree, to 20 ft.: branches wide-spreading, with thin nearly straight spines: lvs. broadly obovate or elliptic, acute or nearly rounded, cuneate at base, coarsely and doubly serrate, on vigorous shoots usually slightly lobed, the teeth tipped with red glands, at maturity puberulous only on the veins below, about 2 in. long; petioles glandular, short: corymbs few-fld., slightly villous; calyx-lobes glandular-serrate; fls. ¾in. across; stamens 20, with purple anthers: fr. ovoid, dark orange-brown, ½in. long, with dry and mealy flesh and 5 stones. April; fr. in Oct. Ga. and Fla. S.S. 13:693.—The true *C. flava* is not in cult.; the plant now cult. as *C. flava* is quite different and is apparently not very closely related to this species; it has so far not been found growing wild in E. N. Amer., though it was apparently intro. from the southern states. As it has not yet been determined to which species it belongs, it may be enumerated here as var. **lobàta,** Lindl. Shrub or small tree: lvs. ovate or obovate, cuneate at the base, acute, crenately serrate and often slightly lobed, at maturity pubescent on the veins beneath, 1–2 in. long: corymbs pubescent, few-fld.; stamens 10: fr. pyriform, green or reddish with hard flesh, and 3–5 stones. B.R. 23:1932, 1939. G.C. III. 27:404.—Tender.

32. **áprica,** Beadle. A shrub or small tree, sometimes to 20 ft., with spreading branches and slender zigzag branchlets armed with thin straight spines 1–1½ in. long: lvs. broadly obovate or oval, acute or rounded at the apex, narrowed into the short petiole, serrate usually only above the middle and often slightly lobed, with gland-tipped teeth, pubescent on both sides while young, at maturity glabrous, dark yellow-green and thickish, ¾–1½ in. long: fls. ¾in. across, in 3–6-fld. compact pubescent corymbs; calyx-lobes glandular-serrate: fr. globose, ½in. across, dull orange-red, with 3–5 stones. May; fr. Oct. Va. to Ga. and Tenn. S.S. 13:698.—This species has proved hardy at the Arnold Arboretum.

15. Tomentosæ.

33. **tomentòsa,** Linn. (*C. Calpodéndron,* Medikus. *C. pyrifòlia,* Ait. *C. leucophlœos,* Moench. *C. Chápmanii,* Ashe). Fig. 1101. Shrub or small tree, to 20 ft., with spreading branches unarmed or with short spines: lvs. cuneate, obovate-oblong or elliptic, acute, serrate and often slightly lobed, dull green and usually finely glabrous above, below pubescent, 2–5 in. long: corymbs pubescent, compound and many-fld.; fls. ½in. across; calyx-lobes serrate: fr. usually oval, dull yellow or yellowish red, ¼–½in. across, sweet and succulent, in upright corymbs; stones 2–3, with 2 furrows on the inner side. June; fr. Oct. Ont. to Minn., south to Tenn. and Mo. S.S. 4:183. G.F. 2:425 (adapted in Fig. 1101). Gn. 22, p. 145. B.R. 22:1877.

34. **succulénta,** Link (*C. macracántha* var. *succulénta,* Rehd.). Tree, sometimes to 20 ft., with stout ascending branches, armed with numerous stout



1101. Cratægus tomentosa.
(×½). No. 33.

slightly curved spines: lvs. elliptic, acute or acuminate, gradually narrowed into the stout winged petiole, coarsely and usually doubly serrate and with many short acute lobes, at maturity dark green, thickish and somewhat lustrous above, pale green and usually puberulous on the veins below, 2–3 in. long: fls. ⅔in. across, in many-fld. villous corymbs; stamens usually 20, sometimes 15: fr. globose, bright scarlet, ½–⅔in. across, with juicy sweet flesh and 2–3 stones. May; fr. Sept., Oct. Que. and Ont. to Mass. and Ill. S.S. 4:181 (as *C. coccinea* var *macracantha*).

35. **macracántha,** Lodd. (*C. coccínea* var. *macracántha,* Dudley). Fig. 1102. Shrub or small tree, to 20 ft., of dense growth, with numerous long and slender spines: lvs. rather slender-petioled, broadly elliptic or ovate, doubly serrate, glabrous, at maturity thickish, shining and dark green above, almost glabrous beneath, 1–2½ in. long: corymbs slightly villous; fls. ¾in. across; stamens 10; calyx-teeth glandular-serrate: fr. subglobose, ½in. diam., dark cherry-red, shining, with usually 2–3 stones. May, June. W. N. Y. and Vt. to Pa. S.S. 13:689. B.R. 22:1912. L.B.C. 11:1012 (as *C. glandulosa*). A.G. 11:509. M.D.G. 1906:561. G.W. 5:245.—Sometimes cult. under the name of *C. Douglasii.* See page 3567.

36. **prunifòlia,** Pers. Shrub or tree, to 30 ft.: branches spreading or somewhat ascending, spiny: lvs. obovate, or roundish obovate, doubly serrate, glabrous or pubescent on the veins beneath when young, 2–3 in. long: corymbs pubescent; stamens 10; anthers pink: fr. red; stones with 2 furrows on the inner side, sometimes nearly plain. May, June.—Origin unknown; by some thought to be a hybrid between *C. Crus-galli* and *C. macracantha* or *C. succulenta.* B.R. 22:1868. G.W. 8:114. Var. **variegàta,** Hort. Lvs. variegated with yellowish white. F.W. 1877:65.

16. Douglasianæ (page 3567).

37. **Doûglasii,** Lindl. (*C. sanguínea* var. *Doùglasii,* Torr. & Gray). Tree, to 40 ft., with slender, often pendulous branches, unarmed or with short spines: lvs. short-petioled, broadly ovate or oblong-ovate, acute, gradually narrowed at the base, serrate and slightly lobed, nearly glabrous, pubescent on the midrib above, chartaceous, 1–4 in. long: corymbs glabrous; fls. ⅓–½ in. across; stamens 20; calyx-lobes triangular-ovate, usually glandular-serrate above the middle: fr. ovoid, ½in. long, black and lustrous, with sweet, light yellow flesh and 3–5 nutlets. May; fr. Aug., Sept. Brit. Col. and N. Calif. to Wyo. S.S. 4:175. B.R. 21:1810.

17. Sanguineæ.

38. **sanguínea,** Pall. Shrub or small tree, to 20 ft., with upright, spreading branches and short spines: lvs. ovate or broadly ovate, narrowed into the petiole, irregularly serrate and slightly lobed, more deeply lobed on vigorous shoots, at first hairy above and often also below, at maturity glabrous or nearly glabrous, 1½–3 in. long: corymbs pubescent or glabrous; fls. large; stamens 20, with purple anthers: fr. ½ in. diam. May; fr. in Aug., Sept. E. Siberia. Var. **chlorocárpa,** Schneid. (var. *xanthocárpa,* Regel). Fr. yellow, smaller: anthers whitish.



1102. Cratægus macracantha (×⅓). No. 35.

39. **dahùrica,** Koehne (*C. purpùrea,* Bosc. *C. sanguínea* var. *altàica,* Loud.). Shrub or small tree: spines to 1½ in. long: lvs. ovate or broadly elliptic-ovate, acute, broadly cuneate at the base, sharply serrate, those of the flowering branches very slightly or scarcely lobed, those of the shoots distinctly and acutely lobed, glabrous, ¾–2 in. long: corymbs glabrous; fls. ½in. across: fr. subglobose, ⅓in. across, orange-red. April, May; fr. Aug. E. Siberia.—The earliest leafing species of all hawthorns; very graceful; hardy.

18. Cordatæ.

40. **Phænopỳrum,** Medikus (*C. cordàta,* Ait. *C. acerifòlia,* Moench. *C. populifòlia,* Walt.). Washington Thorn. Tree, to 30 ft., with slender spines: lvs. slender, petioled, triangular or broadly ovate, usually truncate at the base, 3–5-lobed, sharply serrate, 1½–2½ in. long: corymbs many-fld., glabrous; styles 5: fr. depressed-globose, ¼in. across, shining, bright coral-red; calyx deciduous, leaving a circular scar; stones 3–5. May, June; fr. Sept., Oct. Va. to Ala. and Mo. S.S. 4:186. B.R. 14:1151. F.E. 28, p. 103 (habit).—A very desirable species, with beautiful fall-coloring and large clusters of bright red fr. remaining a long time on the branches. Formerly much used for hedges.

19. Apiifoliæ.

41. **apiifòlia,** Michx. (*C. Márshallii,* Eggleston). Shrub or small tree, rarely 20 ft., with stout spines and the branchlets pubescent when young: lvs. slender-petioled, broadly ovate, pinnately 5–7-cleft, serrate, glabrous or pubescent, ¾–1½ in. long: corymbs few-fld., villous; styles 1–3: fr. ovoid, ¼in. high, scarlet, with 1–3 stones; calyx often deciduous. April, May; fr. Oct. Va. to Fla., Ark. and Texas. S.S. 4:188.—A handsome species with graceful foliage and an abundance of white fls. in spring and small but bright-colored frs. in fall.

20. Brachyacanthæ.

42. **brachyacántha.** Sarg. & Engelm. Tree, to 50 ft., with stout spreading branches, armed with numerous short usually curved spines, ⅓–⅔in. long: lvs. obovate-oblong, oblong-lanceolate or elliptic, acute or sometimes obtuse, cuneate at the base, crenulate-serrate, rarely slightly lobed, glabrous at maturity, lustrous above, ¾–2 in. long: corymbs many-fld., glabrous; fls. ⅓in. across, turning orange in fading; stamens 15–20: fr. subglobose, ⅓–½in. across, bright blue and bloomy, with 3–5 stones. April, May; fr. Aug. La. and Texas. S.S. 4:177.—The only species with blue fr.; hardy only S.

21. Pentagynæ.

43. **nìgra,** Kit. (*C. carpáthica,* Lodd.). Shrub or small tree: branches pubescent or tomentose, with short spines: lvs. short-petioled, ovate or ovate-elliptic, deeply pinnately 5–9-lobed with serrate lobes, slightly pubescent above, densely pubescent beneath, 2–3 in. long: corymbs dense, 10–15-fld., tomentose; pedicels short; fls. white, becoming slightly red; anthers yellowish: fr. subglobose, ½in. across, black, lustrous, juicy, with 5 stones. May; fr. in Aug. S.E. Eu. L.B.C. 11: 1021. L.I. 30.

44. **pentágyna,** Waldst. & Kit. (*C. melanocárpa,* Bieb.). Shrub or small tree, to 15 ft.: young branchlets pubescent, with short spines: lvs. ovate to obovate, irregularly and usually sparingly serrate, pinnately 3–7-lobed, hairy above while young, finally nearly glabrous above, pubescent below, 1–2 in. long: corymbs villous; fls. ½in. across, anthers red: fr. ovoid or obovoid, purplish black, ½in. long, with 4–5 stones. May; fr. Sept., Oct. S. E. Eu., Caucasus. B.R. 22: 1874; 23:1933 (as *C. Oxyacantha Oliveriana*). R.H. 1901, p. 310.

22. Oxyacanthæ.

45. **Oxyacántha,** Linn. Hawthorn or May of English literature. Shrub or small tree, to 15 ft., with spreading glabrous branches and stout spines: lvs. short-petioled, cuneate or truncate at the base, roundish or broadly ovate, 3–5-lobed, with broad, serrulate lobes, 1–2 in. long: corymbs 5–10-fld., glabrous: fr. globular or roundish oval, ⅓–½in. high, scarlet; stones 2, with 2 furrows on the inner side. May. Eu., N. Afr. B.R. 13:1128 (as *C. oxyacanthoides*). Var. **bícolor,** Rehd. (*C. Oxyacántha* var. *Gúmpperi bícolor,* Hort. *C. Oxyacántha rùbra,* Schneid.). Fls. white in the center, edged red. F.S. 16:1651. Var. **Paùlii,** Rehd. (var. *coccínea,* Hort. Var. Paul's New Double Scarlet. *C. Oxyacántha* var. *spléndens,* Schneid.). Fig. 1103. With

double, bright scarlet fls.; one of the most showy. I.H. 14:536. F. 1867:117. Var. **aûrea**, Loud. (*C. Oxyacántha* var. *xanthocárpa*, Lange). With yellow fr. Var. **quercifòlia**, Loud. Lvs. with broad, rounded and crenate lobes.—Most of the garden forms usually listed as varieties of *C. Oxyacantha* belong to the following species. Even the varieties enumerated above are by some botanists not considered true *C. Oxyacantha*, but referred to *C. media*, Bechst., a hybrid between this and the following species; the existence of hybrid forms makes the distinction between the two species still more difficult.

46. **monógyna**, Jacq. (*C. Oxyacántha*, Hort.). Shrub or tree, to 20 ft., with stout spines: lvs. on rather slender petioles, ovate, 3–7-lobed, lobes with few teeth at the apex, 1–2 in. long: corymbs many-fld., with usually hairy pedicels: fr. oval, with usually 1 stone, ⅓–½in. high. May, June. Eu. and N. Afr. to Himalayas. Gn. 33, p. 465; 37, p. 467; 40, p. 500; 52, p. 266; 55, p. 452. R.H. 1900, p. 72 (all as *C. Oxyacantha*).—Many garden forms are cult.; some of the most distinct are the following: Var. **punícea**, Rehd. Fls. deep red, single. F.S. 15:1509, fig. 1. L.B.C. 14:1363. Var. **ròsea**, Hort. Fls. pink, petals with white claw. Var. **álbo-plèna**, Schneid. With white double fls. F.S. 15:1509, fig. 2. Var. **rùbro-plèna**, Schneid. With double red fls. F.S. 15:1509, fig. 3. Varieties differing in lvs. and habit: Var. **laciniàta**, Loud. Lvs. deeply pinnatifid with incised serrate lobes. Var. **pteridifòlia**, Rehd. (*C. Oxyacántha* var. *pteridifòlia*, Loud. Var. *filicifòlia*, Hort.). Similar, but lvs. longer, with narrower and more incised lobes. F.S. 20:2076. Var. **fèrox**, Schneid. (*C. Oxyacántha* var. *fèrox* Carr. *C. Oxyacántha* var. *hórrida*, Carr.) Branches with fascicles of numerous stout spines. F.S. 14:1468. G.C. III. 24:13. Var. **inérmis**, Rehd. (*C. Oxyacántha inérmis*, Dauthenay). A spineless form. R.H. 1900, pp. 72, 73. Var. **péndula**, Loud. With pendulous branches. Gn. 68, p. 288. G.M. 44:827. M.D.G. 1902:25, 26. Var. **ròseo-péndula**, Rehd. (*C. Oxyacántha* var. *péndula ròsea*, Hort.). A pendulous form, with pink fls. Var. **stricta**, Loud. (var. *pyramidàlis*, Hort.). Of fastigiate, upright habit. G.C. III. 41:184. M.D.G. 1906:390. Var. **semperflòrens**, Rehd. (var. *Brùantii*, Carr.). Low, graceful shrub, flowering until fall. R.H. 1883, p. 140. Gn. 29, p. 431; 33, p. 465. There are also some varieties with variegated lvs.

23. Orientales.

47. **tanacetifòlia**, Pers. Shrub or small tree: branches with short spines or unarmed, branchlets tomentose: lvs. cuneate, obovate, pinnately 5–7-cleft, with the lobes glandular-serrate, villous-pubescent, 1–2 in. long: corymb dense, 5–7-fld.; calyx-lobes large, deeply glandular-serrate; fls. large: fr. pubescent, yellow, 1 in. or more across, with laciniate bracts at the base. May, June. Asia Minor. B.R. 22:1884. Gt. 43, p. 215.

48. **orientàlis**, Pall. (*C. odoratíssima*, Lindl. *C. apiifòlia*, Hort.). Shrub or small tree, with spreading, almost unarmed branches and tomentose branchlets: lvs. short-petioled, cuneate, obovate or oblong, pinnately 3–5-cleft, with the lobes incisely serrate at the apex, tomentose pubescent, 1–2 in. long: corymb dense, tomentose; calyx-lobes entire: fr. depressed globose, brick- or orange-red, ¾–1 in. across, with 4–5 stones. June. S. E. Eu., Asia Minor. B.M. 2314. B.R. 22: 1885 (as *C. odoratissima*). Gn. 28:632 (as *C. tanacetifolia*), and p. 635. G.M. 40:824. Var. **sanguínea**, Rehd. (*C. sanguínea*, Schrad., not Pall. *C. Tournefórtii*, Griseb.). Lvs. more glabrescent: fr. dark red, with 2–4 stones. B.R. 22:1852.

49. **Azárolus**, Linn. (*C. Aròmia*, Ser. *C. maùra*, Linn. f.). Shrub or tree, to 25 ft., with pubescent branchlets: lvs. short-petioled, cuneate-obovate, deeply 3–5-lobed, with the lobes nearly entire or incised at the apex, grayish green, pubescent, 1½–2½ in. long: corymbs few-fld., densely tomentose: fr. orange-red or yellow, globular or ovoid, ¾–1 in. across. May. N. Afr., Asia Minor. B.R. 22:1897. (as *C. Aronia*). R.H. 1856:441. Var **sinàica**, Boiss. Lvs. glabrous: fr. smaller, reddish yellow. B.R. 22:1855 (as *C. maroccana*). Gn. 22, p. 146; 28, p. 634.

24. Pinnatifidæ.

50. **pinnatífida**, Bunge. Fig. 1104. Shrub or small tree, to 20 ft.: lvs. slender-petioled, cuneate, elliptic-ovate, pinnately 5–9-cleft, incisely serrate: corymbs many-fld., usually pubescent: fr. globular or pyriform, dark red, punctate, ½–¾in. high; stones 3–5. June. N. China, E. Siberia to Korea. R.H. 1901:308. Gt. 1862:366. Var. **màjor**, N. E. Br. (*C. Korolkòwii*, Schneid., not Henry. *C. Brettschnèideri*, Schneid. *C. califórnica*, Hort. *C. tatárica*, Hort.). Lvs. larger, less deeply lobed: fr. pyriform, 1 in. long. G.C. II. 26:620. R.H. 1901:308.

C. altàica, Lange = C. Wattiana.—*C. ambígua*, C. A. Mey. Related to C. monogyna. Lvs. deeply 4–7-lobed, sparingly hairy on both sides, 1–2 in. long: corymbs slightly hairy: fr. ovoid, usually with 2 stones. S. Russia.—*C. Báxteri*, Sarg.=C. fœtida.—*C. beàta*, Sarg. Allied to C. pruinosa. Shrub, to 15 ft.: lvs. oblong-ovate, villous above while young: anthers dark maroon-color: fr.



1103. Paul's thorn—Cratægus Oxyacantha var. Paulii. (×⅓)

crimson, pruinose, ripens end of Sept. N. Y.—*C. Béckwithæ*, Sarg. Allied to C. pastorum. Shrub or tree, to 18 ft.: lvs. ovate, usually truncate at the base, at maturity thin: calyx-lobes glandular-serrate: fr. subglobose, crimson, with 5 stones. N. Y.—*C. béllula*, Sarg. Related to C. pruinosa. Shrub, to 12 ft.; glabrous: lvs. ovate, bluish green and lustrous above, 2–3 in. long: stamens 8–10: fr. dull crimson, bloomy, ¾in. across, with usually 4 stones. Mich. S.T.S. 1:56.—*C. berberifòlia*, Torr. & Gray. Related to C. Crus-galli. Lvs. obovate or obovate-oblong, obtuse, pubescent below, lustrous and nearly glabrous above, 1½–2 in. long: corymbs pubescent; anthers yellow: fr. orange with red cheek. La. S.S. 4:179.—*C. Celsiàna*, Bosc. Shrub: lvs. pinnately lobed, slightly pubescent beneath: corymbs many-fld.: fr. ovoid, red. Origin unknown, probably hybrid of C. pentagyna.—*C. champlainénsis*, Sarg. Allied to C. mollis. Tree, to 20 ft., spiny: lvs. ovate, usually truncate at the base, lobed, glabrous above, pubescent on the veins below, 2–2½ in. long: corymbs villous, usually 4–5-fld.; stamens 10: fr. obovoid or ovoid, scarlet, ½in. long, in Sept. Que. and Ont. to Vt. and N. Y. S.S. 13:669.—*C. chlorosárca*, Maxim. Allied to C. sanguinea. Lvs. pinnately lobed, truncate at the base, with short lobes, glabrous at length: corymbs many-fld., nearly glabrous: fr. black, with green flesh. Japan.—*C. cognàta*, Sarg. Closely related to C. pruinosa. Shrub, to 10 ft., spiny: lvs. ovate, acute or acuminate, slightly lobed, dull bluish green, glabrous: corymbs 5–7-fld.; anthers yellow: fr. ovoid or pyriform, pruinose, dull crimson at maturity, over ½in. long, in Oct. Mass.—*C. cómpta*, Sarg. (C. silvicola var. compta, Eggleston). Allied to C. pruinosa. Shrub, spiny, glabrous: lvs. oblong-ovate, usually rounded at the base, slightly lobed, glabrous: corymbs many-fld.; stamens 7–10; anthers dark rose: fr. obovoid, light cherry-red, ½in. long, in Oct. W. N. Y. —*C. conspécta*, Sarg. Allied to C. pruinosa. Tree, to 20 ft., spiny: lvs. broadly ovate, rounded or subcordate at the base, lobed, yellow-green, pubescent on the midrib below: corymbs 5–6-fld., slightly hairy, compact; anthers white: fr. subglobose, crimson, over ½in. across, in Oct. Ont.—*C. crenulàta*, Roxbg.=Pyracantha crenulata. —*C. cunedta*, Sieb. & Zucc. Belongs to group Cuneatæ. Shrub: young branchlets villous: lvs. short-petioled, cuneate-obovate or cuneate-oblong, crenate-serrate, glabrous and lustrous above, sparingly hairy below: corymbs villous, 3–7-fld.; stamens 20; anthers red: fr. red, with 5 stones, plain inside. China and Japan. L. I. 5.—*C. cupulífera*, Sarg. Allied to C. rotundifolia. Shrub, to 20 ft.: lvs. obovate or rhombic, slightly lobed, lustrous and scabrate above: corymbs slightly villous; fls. cup-shaped; stamens 10, anthers pink: fr. scarlet, with 3–4 stones. N. Y.—*C. Dayàna*, Sarg. Allied to C.

pedicellata. Tree, to 15 ft., spiny: lvs. broadly ovate, acuminate, rounded or cuneate at the base, dark yellow-green, slightly hairy on the veins below while young: corymbs 10–14-fld.; fls. ¾in. across; stamens 20: fr. obovoid, crimson, in Sept., soon falling. W. N. Y.—*C. diffùsa*, Sarg. Allied to C. pruinosa. Intricately branched spiny shrub, to 15 ft., glabrous: lvs. ovate, acuminate, rounded or cuneate at the base, dark bluish green and slightly scabrate above: corymbs 6–12-fld.; stamens 10: fr. subglobose, scarlet, less than ½in. across, in Oct. W. N. Y.—*C. Dippeliàna*, Lange (C. tanacetifolia var. Leeana, Hort. C. tanacetifolia × C. punctata?). Small tree, spiny: lvs. rhombic-elliptic, lobed, sparingly pubescent above, densely beneath: corymbs densely villous; stamens 20: fr. subglobose, reddish yellow or dull red. Origin unknown. Gn. 33, p. 468.—*C. dissona*, Sarg. (C. pruinosa var. dissona, Eggleston). Allied to C. pruinosa. Slender spiny shrub, to 10 ft., glabrous: lvs. ovate to rhombic, cuneate at the base, dark bluish green: corymbs 5–7-fld.; stamens 10; anthers purple: fr. subglobose, crimson, in Oct. Mass.—*C. dsungàrica*, Zabel. Allied to C. sanguinea. Tree:



1104. Cratægus pinnatifida (×⅔). No. 50.

lvs. deeply lobed, sparingly pubescent or nearly glabrous: corymbs slightly pubescent: fr. black; stones without or with slight furrows. Of unknown origin.—*C. Dùnbari*, Sarg. Shrub, to 12 ft., spiny: lvs. ovate to suborbicular, usually rounded at the base, slightly lobed, glabrous or slightly rough above: corymbs 10–14-fld.: fr. subglobose, crimson, ½in. across, in Oct. W. N. Y. Belongs to group Anomalæ, allied to Tenuifoliæ.—*C. durobrivénsis*, Sarg. Allied to C. coccinioides. Shrub, to 20 ft., spiny: lvs. ovate, with 3–4 pairs of short lobes, glabrous: corymbs glabrous; stamens 20: fr. bright red, in Oct. N. Y. S.T.S. 1:2.—*C. elliptica*, Ait. (C. glandulosa, Moench. C. flava var. pubescens, Gray). Allied to C. flava. Lvs. broader, of firmer texture, more pubescent and glandular: fr. subglobose, red or yellow. Southern states. B.R. 22: 1890 (as C. spathulata).—*C. ellíptica*, Beadle, is C. senta, Beadle, a species allied to C. flava. S.S. 13:697.—*C. ellíptica*, Mohr, is C. signata, Beadle, a species allied to C. Crus-galli. S.S. 13:644.—*C. exornàta*, Sarg. Allied to C. pruinosa. Shrub, to 10 ft., spiny: lvs. ovate, usually rounded at the base, slightly lobed, dark yellow-green and rough above: corymbs 5–6-fld.; stamens 7–10; anthers pink: fr. subglobose, scarlet, less than ½in. across, in Sept. Ont.—*C. Fáxonii*, Sarg. Allied to C. rotundifolia. Shrub, to 10 ft., spiny: lvs. broadly ovate, with 4–5 pairs of short lobes, nearly glabrous at maturity: corymbs villous; stamens 5–10: fr. dark crimson, in Sept. N. H. S.T.S. 1:60.—*C. ferentària*, Sarg. Allied to C. macracantha. Intricately branched shrub, to 12 ft., with stout spines: lvs. rhombic or obovate, puberulous below on the veins: corymbs slightly villous; stamens 7–10; anthers white: fr. subglobose or ovoid, ½in. long, scarlet, with usually 2 stones, ripening in Oct. W. N. Y.—*C. flabellàta*, Spach (C. Grayana, Eggleston). Allied to C. pedicellata. Shrub, to 20 ft.: lvs. ovate, with short acute lobes, at first sparingly hairy above and villous at the veins beneath: corymbs slightly villous; calyx-lobes sparingly glandular-serrate; stamens 20: fr. ovoid, crimson, with 3–5 stones, in Sept. Que.—*C. florentìna*, Zuccagni=Pyrus cratægifolia.—*C. fœtida*, Ashe (C. Baxteri, Sarg.). Allied to C. intricata. Intricately branched, spiny shrub, to 12 ft., glabrous: lvs. ovate or oval: corymbs usually 5–6-fld.; calyx-lobes serrate: fr. subglobose, orange-red or red-brown, about ½in. thick, with 3–4 stones, in Oct. Mass. to Ont. and Va.—*C. Fontanesiàna*, Steud. Allied to C. Crus-galli. Lvs. elliptic or elliptic-lanceolate, almost glabrous, shining above: corymbs many-fld., pubescent: fr. red. Probably hybrid of C. Crus-galli.—*C. Fórbesæ*, Sarg. Allied to C. pastorum. Shrub, to 15 ft.: lvs. ovate to oval, cuneate or rounded at the base, slightly lobed: stamens 20; anthers dark rose-color: fr. globose or ovoid, scarlet, with thin and juicy flesh. Mass.—*C. formòsa*, Sarg. Allied to C. pruinosa. Shrub, to 15 ft.: lvs. oblong-ovate, rounded or cuneate at the base, slightly lobed, slightly hairy above while young: corymbs many-fld.: fr. ovoid or obovoid, scarlet, pruinose, with 4–5 stones. N. Y.—*C. gemmòsa*, Sarg. Allied to C. succulenta. Tree, to 30 ft., spiny: lvs. broadly obovate to broadly elliptic, doubly serrate and often slightly lobed, at maturity pubescent on the midrib beneath: corymbs villous: fr. scarlet, lustrous, in Oct. N. Y. to Mich. and Ont. S.S. 13:686.—*C. geneseénsis*, Sarg. Allied to C. Crus-galli. Small tree, to 12 ft., spiny, glabrous: lvs. obovate-oblong, pointed at the rounded or acute apex, with prominent veins: corymbs many-fld., lax; anthers pink: fr. ovoid, scarlet, ½in. long, with 1–3 nutlets, in Oct. W. N. Y. G.C. III. 53:115.—*C. glandulòsa*, Moench=C. elliptica.—*C. gloriòsa*, Sarg. Allied to C. pedicellata. Tree, to 25 ft., with few spines: lvs. ovate, cuneate or rounded at the base, rough above, slightly pubescent on the veins below, sometimes finally glabrous: corymbs 10–15-fld.; stamens 7–10: fr. ovoid, often unsymmetrical, deep crimson, in Sept. W. N. Y. —*C. grandiflòra*, Koch (C. lobata, Bosc. Cratæ-mespilus grandiflora, Camus). Small tree: lvs. elliptic, serrate, often slightly lobed toward the apex, pubescent: fls. 1–3, large: fr. brown, globose, large. Supposed to be a hybrid between Mespilus germanica and a Cratægus. G.F. 10:35. R.H. 1869, p. 80.—*C. Grayàna*, Eggleston=C. flabellata.—*C. Hárbisonii*, Beadle. Belongs to group Bracteatæ allied to Intricatæ. Tree, to 25 ft.: lvs. oval or broadly obovate, coarsely serrate; petioles glandular: corymbs many-fld., with conspicuous glandular bracts: fr. red or bright red, in Oct. S.S. 13:691.—*C. heterophýlla*, Fluegge. Allied to C. monogyna. Lvs. larger, usually trifid: fr. larger, bright red: corymbs many-fld. B.R. 14:1161; 22:1847.—*C. hiemàlis*, Lange. Possibly C. Crus-galli × C. pentagyna. Lvs. elliptic to ovate, densely serrate or slightly lobed, lustrous above, pubescent on the veins beneath: corymbs villous; stamens 15, with purple anthers: fr. purplish black. Origin unknown.—*C. Holmesiàna*, Sarg. Allied to C. pedicellata. Tree, to 30 ft.: lvs. oval or ovate, slightly lobed, at maturity yellowish green, glabrous: fls. ½–¾in. across; stamens usually 5, anthers purple: fr. ovoid, crimson, with usually 3 stones. Montreal to Pa., W. N. Y. and Ont. S.S. 13:676.—*C. integríloba*, Sarg. Allied to C. tomentosa. Tree, to 10 ft., spiny: lvs. broadly obovate or oval, broadly cuneate at the base, slightly lobed, glabrous: corymbs villous; calyx-lobes entire: fr. subglobose, ½–½in. across, scarlet, lustrous. Que. G.C. III. 47:60.—*C. irràsa*, Sarg. Allied to C. pedicellata. Shrub, to 12 ft.: lvs. ovate, cuneate or rounded at the base, slightly lobed, lustrous and glabrous above: stamens 20, anthers yellow: fr. ovoid, dark red, lustrous. Que.—*C. Korolkòwii*, Henry=C. Wattiana. See also No. 50.—*C. laùta*, Sarg. Allied to C. Ellwangeriana. Arborescent shrub, spiny: lvs. ovate, acuminate, scabrate above, sparingly pubescent on the veins below: corymbs 8–12-fld., compact: fr. ovoid, bright orange-red, ¾in. long, with 5 nutlets, in Sept. Origin unknown, much planted in Boston parks.—*C. leiophýlla*, Sarg. Allied to C. pruinosa. Slender intricate, spiny shrub, to 15 ft., glabrous: lvs. broadly ovate, usually rounded or truncate at the base, dark dull blue-green above: corymbs 5–7-fld., compact; anthers yellow: fr. obovoid, bright red, ½in. long, with usually 4 stones, in Nov. W. N. Y.—*C. livoniàna*, Sarg. Allied to C. Crus-galli. Tree, to 20 ft., spiny, glabrous: lvs. oblong-obovate, acute or rounded at the apex, finely and often doubly serrate: corymbs lax, 10–18-fld.; calyx-lobes glandular-serrate: fr. subglobose to ovoid, dark crimson, ½in. long, with 2–4 stones, in Oct. N. Y. S.T.S. 2:129.—*C. lobàta*, Bosc=C. grandiflora.—*C. lucòrum*, Sarg. Allied to C. pastorum. Tree to 25 ft., spiny: lvs. broadly ovate to obovate, slightly lobed, glabrous: corymbs villous, few-fld.; stamens 20, with purple anthers: fr. ovoid, crimson, in Sept. Ill. S.S. 13:679.—*C. maineàna*, Sarg. (C. leiophylla var. maineana, Eggleston). Allied to C. pruinosa. Tree-like shrub, to 15 ft., spiny, glabrous: lvs. ovate to deltoid, acuminate, hairy while young: corymbs many-fld.; stamens 10; anthers dark purple: fr. globose, scarlet, scarcely pruinose, about ½in. thick, in Oct. W. N. Y.—*C. matùra*, Sarg. Allied to C. pastorum. Shrub, to 10 ft., with few spines, glabrous: lvs. oval to ovate-oblong, usually cuneate at the base, dark green above, yellow-green below: corymbs many-fld.; stamens 5–10; anthers red: fr. ovoid, dark purplish crimson, ¾in. long, in Aug. Vt., Mass., N. Y.—*C. Maximowíczii*, Schneid. (C. sanguinea var. villosa, Maxim.). Allied to C. sanguinea. Small tree, to 20 ft: lvs. ovate, slightly lobed, pilose below: corymbs densely pilose: fr. pilose when young, finally glabrous. Amurland, Manchuria.—*C. microcárpa*, Lindl.=C. spathulata.—*C. ópulens*, Sarg. Allied to C. pruinosa. Shrub, to 15 ft., spiny, glabrous: lvs. oblong-ovate to oval, acuminate, hairy above while young: corymbs 5–8-

fld., compact: fr. subglobose, obscurely angled, crimson, slightly pruinose, ½in. long, in Oct. W. N. Y.—*C. Pálmeri*, Sarg. Allied to C. Crus-galli. Tree, to 25 ft.: lvs. broadly ovate to oblong, rounded or acute at the apex, coarsely serrate, glabrous: corymbs glabrous; stamens 10, with yellow anthers: fr. dull green, tinged with red, in Oct. S.M. 381.—*C. peregrina*, Sarg. Allied to C. mollis. Tree: lvs. ovate, broadly cuneate, with 5–6 pairs of narrow lobes, glabrous above, villous beneath: corymbs many-fld., villous: fr. ovate-globose, dark dull purple, pubescent at the base and apex, ½in. across. Origin unknown, probably S. W. Asia. S.T.S. 2:191.—*C. perjucúnda*, Sarg. Allied to C. pruinosa. Spiny shrub, glabrous: lvs. ovate, acuminate, dark green above: corymbs 8–10-fld.; anthers white: fr. ovoid, orange-red, finally crimson, slender-stalked, less than ½in. long, in Oct. Ont., N. Y.—*C. persímilis*, Sarg. Allied to C. Crus-galli. Shrub, to 8 ft.: lvs. oblong-obovate to oval, usually acute, veins prominent, slightly hairy while young: corymbs slightly villous; stamens 10–20: fr. subglobose or ovoid, crimson, lustrous, with 1–2 stones. N. Y.—*C. præcox*, Sarg. (C. præcoqua, Sarg.). Allied to C. rotundifolia. Shrub, to 10 ft., spiny: lvs. rhomboidal to oval, slightly hairy while young, glabrous at maturity and scabrous above: corymbs slightly villous, many-fld.; stamens 10: fr. subglobose, dark crimson, ⅔in. thick, in Aug. Vt., Que.—*C. promíssa*, Sarg. Allied to C. pruinosa. Shrub, to 12 ft., spiny, glabrous: lvs. oblong-ovate, acuminate, deeply lobed: corymbs lax, many-fld.; stamens 5–7; anthers pink: fr. ovoid, crimson, not pruinose, less than ½in. long, in Sept. W. N. Y.—*C. Pyracántha*, Pers.=Pyracantha coccinea.—*C. rivulàris*, Nutt. Allied to C. Douglasii. Shrub: lvs. ovate-lanceolate, serrate, glabrous at length. Wyo. to Colo. and Utah. S.S. 4:176.—*C. Sárgentii*, Beadle. Allied to C. intricata. Tree, to 20 ft.: lvs. elliptic to oblong-ovate, slightly lobed, glabrous at maturity: corymbs slightly villous or glabrous; stamens 20, with purple anthers: fr. yellow or orange-yellow, tinged with red, in Sept. Ga. to Tenn. and Ala.—*C. songárica*, Regel=C. Wattiana.—*C. spathulàta*, Michx. Shrub or tree, to 20 ft.: lvs. cuneate, oblanceolate, crenately serrate or 3-lobed at the apex: corymbs many-fld.: fr. scarlet, globular, ¼in. across. Southern states. S.S. 4:185. B.R. 22:1846 (as C. microcarpa). The only species of the group Microcarpæ allied to the Apiifoliæ.—*C. triflòra*, Chapm. Shrub or small tree, to 20 ft.: lvs. ovate or elliptic, serrate, often slightly lobed, pubescent, 1–2½ in. long: corymbs 3-fld., hirsute; fls. 1 in. across; stamens 20; anthers yellow: fr. globose, red. Ga., Ala. Belongs to the group Trifloræ, allied to Intricatæ.—Very distinct and handsome; has proved hardy at the Arnold Arboretum.—*C. verecúnda*, Sarg. Allied to C. intricata. Shrub, about 3 ft., spiny, glabrous: lvs. oblong-obovate or oval, acute or acuminate, light bluish green: corymbs 6–10-fld.; stamens 7; anthers white: fr. ovoid or obovoid, less than ½in. long, with 2–3 stones, in Sept. or Oct. W. N. Y.—*C. Wattiàna*, Hemsl. & Lace. (C. altaica, Lange. C. songarica, Regel). Allied to C. sanguinea. Lvs. smaller, truncate at the base, glabrous: corymbs glabrous: fr. yellow or reddish yellow, smaller. Cent. Asia. Var. *incísa*, Schneid. (C. Korolkowii, Henry. C. sanguinea var. incisa, Regel). Lvs. more deeply and acutely lobed. R.H. 1901:301.—*C. Wílsonii*, Sarg. Allied to C. tomentosa. Shrub, to 20 ft.: lvs. ovate or obovate, acute or obtuse, lustrous above, sparingly villous beneath: fr. ovoid, red, nearly ½in. long, with 1–3 stones. Cent. China.

ALFRED REHDER.

CRATÆVA (after Cratevas, an obscure writer on medicinal plants, not, as sometimes stated, at the time of Hippocrates, but at the beginning of the first century B. C., since he named a plant after Mithridates). *Capparidàceæ*. Tropical trees and shrubs, sometimes planted in the warm parts of the country.

Leaves 3-foliolate: fls. in corymbs, usually polygamous, with the odor of garlic; sepals and petals 4; stamens 8–20; torus elongated: berries ovate-globose, with a slender stripe.—Ten species, around the globe. The bark of the garlic pear, *C. gynandra*, blisters like cantharides. *C. religiosa*, from Malabar and the Society Isls. is a sacred tree, and is planted in native graveyards. The bitter, aromatic lvs. and bark are used by them in stomach troubles. The above and some other species are cult. in Eu. as ornamental greenhouse shrubs.

religiòsa, Forst. f. (*C. Nurvála*, Buch.-Ham.). A spreading unarmed deciduous tree of graceful proportions: lvs. long-petioled, the lfts. 2½–3 times as long as broad: fls. 2–3 in. across, showy, yellow, or purplish yellow, the petals long-clawed.—Once cult. by Franceschi, Santa Barbara, Calif., but reported by him as no longer in cult. there. Excellent greenhouse plant N.

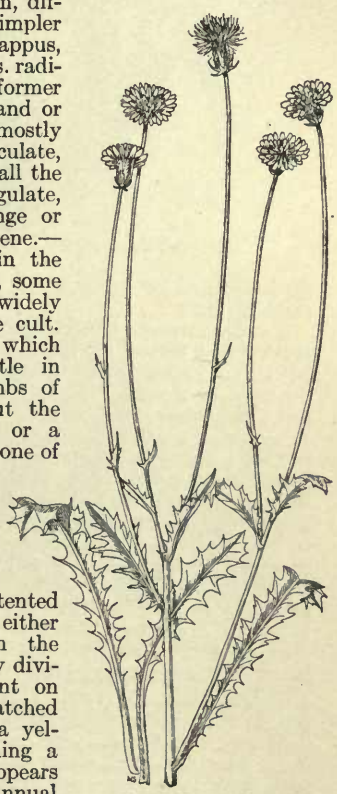
N. TAYLOR.†

CRATEROSTÍGMA (Greek, referring to character of stigma). *Scrophulariàceæ*. Torenia-like perennial low nearly stemless herbs of E. and S. Afr., sometimes grown under glass. Lvs. radical, plantago-like, many-nerved, entire: fls. lilac and purple, spicate, racemose or even solitary; calyx tubular, 5-ribbed and narrowly 5-toothed; corolla tubular, 5-ribbed and 5-toothed, the tube enlarged toward the top, the limb 2-lipped, the dorsal lip concave and entire or emarginate, the other large and spreading and 3-lobed; stamens 4 and perfect, in unequal pairs; style filiform, 2-lobed and dilated at apex: fr. an oblong caps. included in the calyx. Differs from Torenia in technical floral characters and in being nearly or quite stemless and with only radical lvs.—About 4 species. **C. pùmilum**, Hochst. (*Torènia auriculæfòlia*, Dombr.) has fls. on slender pedicels ½–1¼ in. long, the corolla-lobes pale lilac blotched with purple and veined with white: lvs. sessile, ovate, in a basal rosette, pubescent beneath and nearly glabrous above. E. Africa. F.M. 10:534.—A stemless perennial.

L. H. B.

CRÈPIS (Greek for *Sandal;* application obscure). *Compósitæ*. A large group of annual, biennial and perennial herbs, a few of which are now and then grown in outdoor gardens for the showy flowers.

Much like Hieracium, differing mostly in the simpler involucre, white soft pappus, and beaked achene: lvs. radical and cauline, the former mostly runcinate, repand or pinnatisect, the latter mostly clasping: heads pedunculate, solitary or paniculate, all the florets perfect and ligulate, the rays yellow, orange or red: fr. a smooth achene.—Perhaps 250 species in the north temperate zone, some of them weedy and widely dispersed. Among the cult. kinds is *C. sibírica*, which resembles a sow-thistle in habit, and has corymbs of reddish blue fls. about the size of a hawkweed, or a small dandelion. It is one of the coarser border plants, and rare. Rather light, sandy soil, and full exposure to the sun are essentials to the welfare of this plant. It is contented in a rather dry position, either in the rockery, or in the border. It is prop. by division. A common plant on the moss of English thatched cottages is *C. virens*, a yellow-fld. plant, resembling a dandelion. *C. rubra* appears to be the commonest annual species cult. abroad.



1105. Crepis rubra. (×¼)

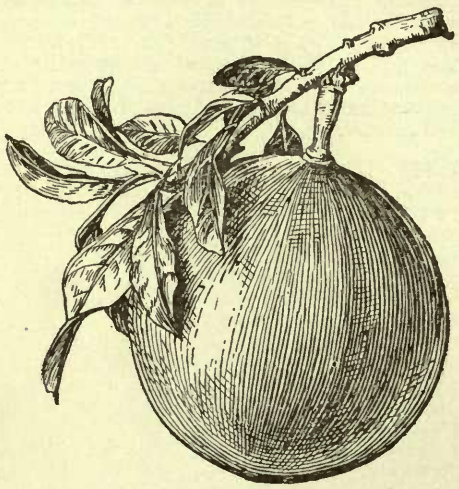
sibírica, Linn. Perennial, 2–3 ft. high, and at least as wide when in bloom: plant covered with short rough hairs: root large, fleshy: lvs. rough, wrinkled, the lower coarsely dentate, the upper often somewhat cordate, 12 in. long, including a petiole half as long: fls. bright yellow in a strictly terminal corymb; involucre loose, hairy. July. Eu., Asia Minor, Himalayas. Gn. 53, p. 493.—The tallest and largest-fld. of the genus. Its white plumy masses of seeds are also attractive.

aùrea, Reichb. Black-hairy: height 1 ft. or less: fls. orange, mostly solitary: lower lvs. spatulate-oblong, toothed, shining. June. Alps.—One of the commonest perennial species of the genus abroad. Repays rich soil.

rùbra, Linn. Fig. 1105. Annual: height ½–1½ ft.: fls. red, usually solitary, the involucre being hispid. An attractive little flower-garden plant. Var. **álba**, Hort., has flesh-colored or whitish fls. Italy, Greece.

C. barbàta, Linn.=Tolpis.—*C. montàna*, Reich. 12–18 in.: lvs. unequally dentate: fls. yellow in a large head. High mts., Switzerland, etc. Mentioned as grown in this country, but apparently not in the trade. L. H. B.†

CRESCÉNTIA (after Crescenzi, thirteenth century Italian agricultural writer). *Bignoniàceæ*. This genus is chiefly interesting for the calabash tree, which has



1106. Crescentia Cujete.—The calabash. (×⅛)

no near allies of horticultural importance; yields the calabash fruit.

Tropical trees, glabrous: lvs. alternate, solitary or clustered at nodes: fls. large, tubular, with a fluted 5-cut limb, yellowish, with red or purple veins; calyx 2-parted or deeply 5-cut.—About 5 species, in Mex. and Cent. Amer. The calabash tree is a native of Trop. Amer., is especially familiar in the W. Indies, and can be grown outdoors in extreme S. Fla. and S. Calif. The outer skin of the fr. is removed and the seeds and pulp from within, and the hard woody shell is used for water-gourds and for all sorts of domestic vessels, according to size and shape. The growing fr. can be made to assume various forms by skilful tying. It is a tree 20–40 ft. high, and readily distinguished from all others by its peculiar habit of growth, as it bears large, horizontal, scarcely divided branches, which bear clusters of lvs. at intervals. The tree is becoming important in the manufacture of tobacco-pipes.

Cujète, Linn. Fig. 1106. A handsome tree when growing in the open, with wide-spreading well-foliated branches: lvs. 4–6 in. long, broadly lanceolate, tapering at the base, dark glossy green: fls. solitary, pendulous; calyx 2-parted; corolla constricted below the middle, and then swollen above, malodorous when decaying; stamens 4, sometimes 5: fr. frequently 18–20 in. through. The growing tree has somewhat the habit of a Burbank plum tree. B.M. 3430. N. Taylor.†

CRESS. A name applied to the pungent herbage of several species of the Cruciferæ, used as salad.

The leaves of the ordinary garden cress (*Lepidium sativum*), sometimes called peppergrass, have a pleasant pungency, somewhat like that of the water-cress, which makes the plant well adapted to be used as a popular condiment, served with salads, especially lettuce, and also for garnishing purposes. The quick sprouting habit of the seed is proverbial. Often the plants show above ground the third day after seed is sown. But if cress is wanted in its prime continuously, new sowings must be made every few days. Sow seed rather thickly in rows a foot apart, selecting any good garden loam. The reason that this useful plant is seldom seen in the average home garden is probably its liability to be attacked by hordes of flea-beetles which seem to have a particular fondness for cress pungency. But it is easily grown under glass, in flower pots, flats, or on a bench, in any light and fairly warm place and in any good soil. Grown thus it is usually free from flea-beetle injury, and goes well with forced lettuce. Seed is easily grown, either in the open or under glass. The plants are allowed to mature their seeds, are then pulled and the seed rubbed or thrashed out and cleaned. There are slight variations in the form of the leaves, some of which are more or less curled, others more of the broad-leaved type.

Water-cress (*Nasturtium officinale* of the older books, but known as *Radicula Nasturtium-aquaticum* and *Roripa Nasturtium* in recent books), Fig. 1107, is a hardy perennial, and finds a congenial place in small, running streams, shallow pools or ditches, wintering well when covered with water. It is usually found freely, bunched, in most of our markets and at green grocers'. It grows readily from seed as well as from freshly cut pieces of branches, and soon spreads over a large area. The best product comes from clear running water.

Similar to water-cress in pungency is the upland cress (*Barbarea præcox*), a hardy biennial. It also grows easily from seed sown in the open or under glass in ordinary soils and situations. The root-leaves are used for garnishing and seasoning, but they are not of the highest quality. See p. 454, Vol. I.

Other plants sometimes grown under the name of cress are *Cardamine pratensis* (p. 661) and *Spilanthes oleracea* (which see). The very pungent root-leaves of the former are said to be eaten, but apparently the plant is not cultivated for this purpose.

T. Greiner.

CRÌNUM (Greek name for a lily). *Amaryllidàceæ*. Large and showy flowering bulbs, mostly tender, closely allied to Amaryllis and distinguished by the longer perianth-tube; flowers usually white or in shades of red; largely summer bloomers, but differing widely in this respect.

Stems arising from a tunicated bulb with a more or less elongated neck: lvs. mostly persistent, usually broad, sometimes several feet long: fls. few or many in a 2-bracted umbel, often very fragrant and with 3 types of coloring, pure white, banded red or purplish down the center, or flushed with the same colors; perianth salver-form or funnel-shaped, the tube straight or curved, long-cylindrical; segms. linear, lanceolate or oblong, nearly or quite equal; stamens 6, attached on the throat of the corolla, with long filiform filaments and very narrow versatile anthers; ovary 3-celled, the ovules few in each cell, the style long and filiform, somewhat bent



1107. Water-cress—Radicula Nasturtium-aquaticum.

downward, the stigma not lobed: fr. a roundish or irregular caps., at length dehiscing; seeds large, green, thick.—Probably 100 species in warm and tropical regions around the world, in moist or wet places. The crinums are amaryllis-like plants of great beauty. They are widely grown, often under the name of "lilies," some of them as warmhouse plants, some as

coolhouse subjects, and a few as hardy border plants. The bulbs are often very large, sometimes as much as 2 or 3 feet long, neck and all, the leek-like neck gradually tapering from the bulb proper. In some species the bulb is short and onion-like. Fig. 1108 shows forms of crinum bulbs. In some species the flowers are 1 foot long and half as broad; and sometimes the leaves reach the length of 6 feet and a width of 5 or 6 inches. The flower-stalk is solid, leafless, usually arising from the side of the bulb-neck. The genus might be roughly divided into the evergreen kinds, mostly with leek-like bulbs and symmetrical star-like straight-tubed usually erect flowers; and the deciduous-leaved kinds, mostly with roundish bulbs and nodding bell-shaped more or less irregular flowers.

The crinums require so much room that they are not often seen in commercial collections in this country. They are particularly adapted to mild and warm climates, and therefore full notes on such handling of them are given here. They are not much grown in American greenhouses. The species cross freely, and many fine hybrids are known, some of them under Latin species-names.

Hardy crinums.

The species of Crinum require widely different culture, and their geographical distribution furnishes an important clue as to the degree of warmth required. There are two species hardy in the northern states, *C. longifolium* and *C. Moorei*, the latter being less reliable than the former but with finer flowers. These two species differ from others in blooming all summer instead of during a short period, and in the more lasting qualities of their flowers. An interesting hybrid between the two, *C. Powellii*, is hardier than *C. Moorei*, and the flower, though better than *C. longifolium*, is not quite so showy as that of *C. Moorei*. The hybrid has three well-marked colors, white, rosy and purplish. A single bulb of the white variety has given fifty flowering bulbs in four years. It is excellent for placing in conspicuous positions on terraces or lawns, or in corners where flowers are wanted to combine with architecture or statuary for summer effect. The Agapanthus is frequently grown also for such purposes. Of course large specimens are needed for this use, but they are easily secured and they last from year to year. The bulbs of crinums are mostly grown in Holland and in Florida. The only native species, *C. americanum*, the "swamp lily of Florida," makes a brilliant and striking spectacle when seen in places far from cultivation, as in the Everglades.

The most reliable of the hardy crinums in the North is probably *C. Powellii*. If the bulbs are planted 2½ to 3 feet deep (to the bottom of the bulb) in well-drained soil, the plant stands without protection in the neighborhood of New York City. Let them stand 2 to 3 feet apart. This crinum makes a very ornamental summer plant, even the strong foliage producing a tropical effect. It produces offsets very freely, but they are deep in the ground. It seems not to produce seed in the North. *C. longifolium* is also hardy, but is better with a covering in winter; and it is inferior to *C. Powellii* in leaf and flower. *C. Moorei* is equally hardy except that the bulbs grow near the surface and are therefore so much exposed as often to be ruined by frost. It is a very desirable summer species. It often seeds in the latitude of New York City; and these fleshy seeds germinate readily if placed on the surface of moist soil. It produces offsets freely, which are used in propagation. It has very strong fleshy roots; and when grown in pots or tubs (which is a desirable practice) it should be given plenty of room. This species has a long columnar neck with a spreading cap or crown of leaves, and large white or pink flowers. *C. variabile* (*C. capense*) is hardy south of the Ohio. There are a number of half-hardy species; and most of the greenhouse kinds make very desirable lawn or porch plants when well established in large pots or tubs.

Tender crinums.

There are more than fifty species of greenhouse crinums, all of them worth growing because of their handsome flowers; some of them have very ornamental foliage. Most of the species are seldom seen in this country, possibly because they occupy too much space and give a comparatively small number of flowers to recompense the grower for their upkeep. It is not necessary to keep the evergreen species growing all the time after the flowers have been produced. The plants may be put out-of-doors under a lath-house for four or five months. The soil should be of a lasting nature with good drainage so that frequent repotting will not be necessary. When the plants are in a growing state, frequent applications of manure water will be found to be beneficial. In the warmer parts of the country,



1108. Crinum bulbs as named in the trade. Left to right, C. Moorei, C. giganteum, C. Kirkii, C. Powellii.

many of the tropical species should be plunged or planted out in the open border, where they often give a satisfactory quantity of flowers. In winter, the plants may be carried over under the bench of a temperate house. They should be given water occasionally during April and the first half of May to encourage new root-growth. When planted out in rich soil, nearly all of them will produce their gorgeous flowers out-of-doors; and during winter they are best treated as dormant bulbs with a little more heat than given such plants as cannas and richardias, planting them out as soon as the weather is favorable. A few of the tropical crinums are grown for their foliage principally, and are often seen in public conservatories and palm-houses where they suffer but little from dense shade. The flowers of most species are exceedingly handsome but only for a comparatively short time; during the remainder of the year when out of bloom there are hosts of things that are much more ornamental. Tropical crinums should be grown in this country nearly altogether for outdoor work; we then get the best out of them because our hot summers are favorable to their growth and for the production of bloom. Those species not amenable to this treatment do not give results at all in keeping with the space and time devoted to them. (G. W. Oliver.)

Crinums in Florida and the South.

The various species of Crinum belong to the most important, the most beautiful and the most popular of Florida garden plants. No plants grow so easily, with so little attention, and no plants are so floriferous and so deliciously fragrant. Some of the species, as *C. zeylanicum*, *C. erubescens* and *C. Sanderianum*, are so common in gardens, that they are little appreciated by people in general. Planted together in masses or in borders and in front of shrubbery, they look extremely beautiful. They grow best in rich, somewhat moist soil, but they are also perfectly at home in the high pineland ridges when well fertilized and cultivated. There is great confusion in the nomenclature of these plants, scarcely half a dozen being correctly named in the various catalogues. The following notes are based on many years' experience with crinums in Florida, and the names represent plants that the author considers to be proper representatives of the species.

C. abyssinicum has white flowers and is attractive, but it does not grow well in the sandy soils of Florida.

C. amabile. Very much like *C. augustum* in growth and the flowers also much the same, but it is considerably smaller and multiplies rapidly by offsets. Every three or four years it must be replanted in fresh rich ground, and the offsets must then be removed. It is a very beautiful plant, and much more floriferus than the *C. augustum*, flowering in every month of the year. The perfume of the masses of flowers in spring and summer is so strong that it pervades the entire garden. It does not bear seeds in Florida, but the pollen is fertile and can be used in cross-breeding.

C. americanum. Common along muddy banks of lakes and rivers. A very beautiful pure white, intensely fragrant species and very valuable in hybridizing work. Flower-stem usually 3 feet high, bearing mostly four flowers. Grows well in gardens, particularly in rich moist soil.

C. amœnum. A rather small-growing Asiatic species with long slender bulbs and white flowers tinged red on the outside. Rare.

C. asiaticum. The columnar stem-like bulb, about 12 to 15 inches long, grows mostly above the ground. In planting it should never be set deep in the ground; a few inches is sufficient. The leaves are arranged in a rosette. They are about 3 feet long, very broad near the bulb, gradually narrowing to a sharp point at the end. The color is light bluish green. Flowers almost all the year round, even in winter when the weather is warm, usually 20 flowers in an umbel being borne always a little above the foliage on a strong stem. The flowers are pure white, with linear narrow segments; filaments and stigma purplish red, yellowish white in the lower third. Strangely and deliciously fragrant. A real gem among our garden flowers. Hardy all over the Gulf Coast region, where it forms in time large and impressive clumps of tropical foliage. Bears large pea-green fleshy seeds abundantly. Excellent for raising hybrids.

C. augustum. "Great Mogul" of Barbados. The largest-growing of all our crinums, specimens 4 feet high and 6 to 8 feet in diameter being not uncommon. It needs rich moist soil and a fair amount of good fertilizer. Leaves are very broad, 4 to 5 feet long, narrowing gradually to a sharp point, deeply channeled. It blooms continually for months. Flower-stem an inch in diameter, purplish-red, 4 feet high, bearing a large umbel of glossy purplish crimson flower-buds which are pink inside after opening. Nearly twenty flowers to each umbel, giving a large mass of very beautiful and deliciously fragrant blossoms. This umbel is so large and heavy that it soon bends over and finally lies on the ground. For this reason, it is necessary to tie it to a strong bamboo stake. It is difficult to propagate, as offsets are formed slowly. A plant five years old has formed only two side-shoots. Although it affords good pollen for hybridizing purposes, it does not seed. Hardy in New Orleans.

C. campanulatum (*C. caffrum*). Very distinct, with beautiful glaucous green leaves and umbels of six to eight rosy red campanulate flowers. The flowers are much recurved at their edges. It blooms several times each year. One plant, although eighteen years old, never made a side-shoot. It grows wild in ponds in southern Africa and very likely needs moist soil.

C. Careyanum (offered in the trade as *C. virgineum* which is really a white-flowering species from Brazil). It also goes under the name of *C. grandum.* This is a doubtful plant, being perhaps an old English hybrid. It is very distinct from all other crinums, very beautiful and deliciously fragrant and a night-bloomer. Flower-stem 3 feet high, with an umbel of six to eight pure white flowers with a faint red band in the center. The buds are reddish and the stem is purplish grayish green. Bears no seed.

C. caribæum. Reminds one of *C. americanum*, but flower-stem grayish purple on a green ground. Flowers pure white, very fragrant. Rare.

C. crassipes. Bulbs conical, very large, 8 to 10 inches in diameter. Forms offsets tardily, if at all. Flower-stem short. Flowers fifteen to twenty in an umbel, white, bell-shaped, faintly keeled with pink.

C. erubescens (usually advertised as *C. fimbriatulum*). One of the most common species in Florida gardens. Increases rapidly by offsets. Leaves long, thin and narrow, 2 to 3 feet long: flower-stem 2 to 3 feet tall, purplish green, carrying usually four to six very beautiful fragrant flowers, pure white with a faint pink keel, outside purplish red. Does not bear seeds, and pollen, and is useless for cross-breeding. Found everywhere in gardens.

C. fimbriatulum. Extremely rare, and not in the trade. Flowers pure white, with a soft red band in the center of each petal. One plant formed only five offsets in the course of eight years.

C. giganteum. Perhaps the most beautiful species, the leaves being as ornamental as an aspidistra or a dracena. Evergreen like *C. pedunculatum*, *C. amabile*, *C. augustum*, and *C. asiaticum.* The leaves are about 3 feet long, rich deep green with a slight bluish tint. It forms large clumps in the course of a few years. Flowers six to eight in an umbel, bell-shaped, creamy white in the bud, pure white when fully expanded, exhaling a very strong vanilla-like perfume. They appear six or eight times during the year, even in winter when the weather is warm. Needs rich moist soil and does not thrive satisfactorily on high dry land. An excellent species for hybridization.

C. imbricatum. Allied to *C. giganteum*, but bulbs much larger and leaves rather glaucous green, strongly nerved, with serrated edges. Flowers similar, but creamy white. Flowers usually two or three times during the year. This is as beautiful as *C. giganteum*, but it does not form such large clumps in the course of a few years. Seeds freely.

C. Kunthianum. A large-growing species, with a fine rosette of bright green spreading leaves and large umbels of pure white flowers. Its variety *nicaraguense* is a still larger-growing plant. The flower-stem is quite short, about a foot high, bearing five or six very large white flowers with a faint pink band in the center, purplish on the outside. The flowers of both are strongly fragrant.

C. longifolium. An excellent plant for hybridizing. The leaves are glaucous green, flowers eight to twelve in an umbel, pink, flushed with deeper red on the outside. A fine foliage plant, though flowers not very showy. The white variety, *C. longifolium album*, with very beautiful pure white bell-shaped flowers, is a very showy plant and much superior to the type.

C. Macowanii. Forms very large bulbs with long slender necks. A beautiful species with pink flowers, but very difficult to grow in light soils. It does not flower regularly each year.

C. Moorei. Bulb very large, 6 to 8 inches in diameter, with a very long slender, stem-like neck about 10 to 12 inches long. The leaves are very beautiful, long and thin and very wavy. It usually flowers in March in central Florida. Flowers four to ten in an umbel, bell-shaped, rosy or pinkish red and deliciously fragrant. There is a beautiful white form of this extremely beautiful species. Var. *Schmidtii*, which usually flowers also in March or April. Both kinds bear seeds if hand-pollinated with their own pollen or crossed with different other species. This crinum will not thrive well in the light sandy soils. It requires a heavier soil with some clay in it, and it grows well only in a lath-house.

C. pedunculatum. Very rare in Florida gardens. Reminds one of *C. asiaticum*, but the bulb is shorter, more massive and the leaves thinner and of a brighter green. Flowers twenty to twenty-five in an umbel, pure white and strongly fragrant. This plant needs rich mucky soil to do its best. It does not thrive on dry ground. It is a much shyer bloomer than *C. asiaticum*, with which it is often confounded.

C. podophyllum. This is another evergreen species, almost a miniature *C. imbricatum.* Leaves glaucuous green, strongly nerved, with serrated edges. Bulb only a few inches in diameter and very short. Flower-stem about 10 inches high bearing only a few pure white strongly fragrant flowers. Flowers only once during the summer.

C. pratense. Bulb 5 to 6 inches in diameter. Flowers white. Requires moist rich soil. Rare.

C. purpurascens. This small species, with linear undulated leaves about a foot long, forms large clumps in rich moist soil, thriving with caladiums, marantas, ferns, and other shade-loving plants. Flowers five to six in an umbel, slightly red in bud and pink when expanded. Flower-stem purplish, only about 6 to 8 inches high.

C. Sanderianum (Milk-and-Wine Lily). Common in Florida gardens. Flowers white, keeled with bright red, deeper red on the outside. Flower-stems 3 feet high, carrying five or six flowers in the umbel. Bears no seed.

C. scabrum. One of the showiest. Flowers large, amaryllis-like, pure white, banded crimson, reminding one of *Hippeastrum vittatum.* Very fragrant, but flowers of short duration. Flowers three or four times during spring and summer. Bears seed abundantly and can be easily cross-fertilized with other species. Grows well on high dry pine land, but, like all crinums, requires rich soil.

C. variabile. When in bloom, this is the showiest of all the species. Bulbs very large, conical. Flower-umbels consist of fifteen to twenty large pure white bell-shaped flowers, being borne well above the foliage, standing upright. The flowers are faintly striped with pink. Three or four stems are usually pushed up at the same time from one large bulb, and beds consisting of twenty-five or fifty bulbs are a magnificent sight, as almost all the buds open at the same time. This crinum is strictly a night-bloomer, the flowers begining to open in the dusk of evening, remaining in perfect condition until sunrise. A clump or a bed of this species in full bloom during a moonlight night has a wonderful effect. It looks particularly beautiful under palms. This species is hardy as far north as southern Missouri and Kentucky, with a little protection in the form of stable manure or dry leaves. It has been received under the names *C. Kirkii*, *C. ornatum* and *C. latifolium.* Does not bear seeds.

C. yemense. Flowers pure white, bell-shaped and somewhat fragrant. Bears seeds. Excellent for cross-breeding purposes.

C. zeylanicum (often sold as *C. Kirkii*). Perhaps the most common of all the crinums, being found in almost every garden, even in the backwoods. The flowers which are intensely fragrant are borne on tall purplish stems. They are deep crimson in the bud

state, white with a red stripe, when fully expanded. They usually flower in June and July after the rainy season has set in. Bears large grayish green fleshy seeds abundantly and is a fine plant to be used in hybridizing.

H. NEHRLING

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A. *Perianth erect, salver-shaped, with linear segms.; stamens spreading.* (*Stenaster.*)

B. *Color of perianth white; tube greenish.*

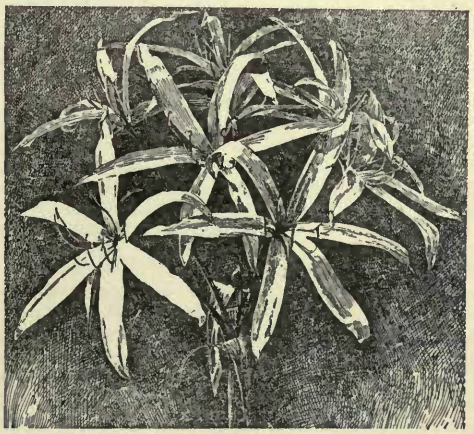
1. **asiáticum,** Linn. (*C. toxicàrium,* Roxbg.). Bulb 4–5 in. thick; neck 6–9 in. long: lvs. 20–30 to a bulb, 3–4 ft. long, 3–4 in. broad: peduncle 1½–2 ft. long, 1 in. thick; fls. 20–50 in an umbel; spathe-valves 2–4 in. long; pedicels ½–1 in. long; perianth white; tube erect, tinged with green, 3–4 in. long; segms. 2½–3 in. long; filaments tinged red, 2 in. long: ovule 1 in a cell. Trop. Asia. B.M. 1073. G.F. 4:283. Baker gives 5 botanical varieties, of which the most important in the American trade is probably var. **sínicum,** Baker (*C. sínicum,* Roxbg. *C. pedunculàtum,* Hort., not R. Br.). ST. JOHN'S LILY. Bulb 6 in. thick, 18 in. long: lvs. 5 in. broad, with undulated edges, forming a massive crown 4–5 ft. high: peduncle 2–3 ft. long; fls. 20 or more, the tube and segms. longer than in the type; perianth white. China. The bulb usually divides into 2 of equal size; small offsets are rarely produced. Seedlings flower in 5 years. Var. **declinàtum,** Baker (*C. declinàtum,* Herb.), has a declined instead of erect bud; perianth-segms. tinged red at tip. B.M. 2231. Var. **prŏcerum,** Baker (*C. pròcerum,* Carey), is larger than the type with lvs. 5 ft. long, 6 in. wide: perianth-tube and limb 5 in. long, the latter tinged red outside. Rangoon. B.M. 2684. Var. **anŏmalum,** Baker, is freakish-looking, its lvs. being expanded into a broad, membranous, striated and plaited wing. B.M. 2908 (as *C. plicatum*). **C. ebŏraci,** Herb. (*C. hýbridum Todòræ,* Hort.). Similar to the variety next mentioned, but half the size. Garden hybrid between a small form of *C. asiaticum* and *C. longifolium.* **C. ebòraci** var. **cáppedum,** Reasoner (*C. cáppedum,* Reasoner). Habit much like *C. asiaticum,* but lvs. tapering to a slender point, semi-erect, 4 ft. high: fls. about 20, segms. 4 in. long, ½in. broad, spreading, white, sometimes changing to pink. Garden hybrid between *C. asiaticum* var. *sinicum* and *C. longifolium.* Increases both by offsets and splitting of the bulb into two. **C. sínico-scàbrum,** Hort., hybrid of *C. asiaticum* var. crossed with *C. scabrum,* and intermediate in aspect and fl.—*C. asiaticum* is the largest of the cult. species, good specimens standing 5 ft. high and having a greater spread. The evergreen reticulated lvs. are ornamental. It blooms several times each year in good warmhouse or greenhouse conditions.

2. **pedunculàtum,** R. Br. (*C. austràle,* and *C. exaltàtum,* Herb. *C. canaliculàtum,* Roxbg.). Bulb 4 in. thick; neck 6 in. long. lvs. 25–30 to a bulb: fls. 20–30 in an umbel; spathe-valves 3–4 in. long; pedicels 1–1½ in.; perianth greenish white, not tinged with red outside, the segms. linear and spreading and shorter than the tube; filaments short, bright red; style shorter than the filaments: ovules 3 in a cell. Austral. B.R. 52.—The bulb grows above ground on a large rootstock; summer; coolhouse.

3. **caribæum,** Baker (*C. floridànum,* Griseb., not Fraser). Lvs. lorate-oblong, 1 ft. or less, 3–4 in. broad, narrowed to the base: umbels 3–4-fld.; perianth-tube 3–4 in. long, nearly straight; segms. white, linear, spreading, nearly as long as tube. W. Indies.

BB. *Color of perianth purplish red outside; tube purplish red.*

4. **amábile,** Donn. Bulb small; neck 1 ft. or more long: lvs. 25–30 to a bulb, 3–4 ft. long, strap-shaped, tapering to the point, the margin entire: peduncle 2–3 ft. long; fls. 20–30 in an umbel, very fragrant; spathe-valves 4–5 in. long; pedicels ½–1 in. long; perianth with a crimson center band, tinged outside bright purplish red; tube bright red; segms. 4–5 in. long; stamens an inch shorter than the segms. Sumatra. B.M. 1605. R.H. 1856:241.—Summer; warmhouse. Supposed by Herbert to be a spontaneous hybrid between *C. asiaticum*



1109. Crinum americanum. (×⅓)

var. *procerum* and *C. zeylanicum:* fls. sterile; bulb increases by small offsets; has been sold under the name of *C. augustum* (Hort., not Roxbg.), which is a similar but smaller natural hybrid presumably between *C. bracteatum* and *C. zeylanicum,* and has more obtuse lvs. than *C. amabile.*

AA. *Perianth erect, salver-shaped, with lanceolate segms.: stamens spreading.* (*Platyaster.*)

B. *Lvs. few, 6–12 to a bulb.*

5. **americànum,** Linn. Fig. 1109. FLORIDA SWAMP LILY. Bulb stoloniferous, ovoid, 3–4 in. thick; neck short: lvs. 1½–2 in. broad and 2–4 ft. long, curved, denticulate: fls. 3–6, usually 4 on an erect scape 20–30 in. high; pedicels 0 or very short; perianth creamy white, the lobes linear or lance-linear; tube greenish, equaling or exceeding the lobes. Native in river swamps Ga. and Fla. and westward. B.M. 1034.—Blooms in spring and summer, but some fls. may occur in winter far S.

6. **praténse,** Herb. Bulb ovoid, 4–5 in. thick; neck short: lvs. 6–8, linear, suberect, 1½–2 ft. long, 1½–2 in. wide, channeled, narrowed to point, margin entire: fls. 6–12 on a lateral compressed peduncle 1 ft. or more high; perianth white, the tube greenish and 3–4 in. long, the segms. nearly or quite as long, ½in. broad, lanceolate; filaments shorter than segms., bright red. Low grounds, India. Summer. Var. **élegans,** Carey, has a longer-necked bulb, decumbent, peduncle, and tube an

inch shorter than the segms. B.M. 2592. Var. **venûstum,** Carey, has about 30 fls. in an umbel. India.

7. **amœ̀num,** Roxbg. Bulb globose, 2–3 in. diam., with a very short neck: lvs. 10–12, suberect, linear, 2 ft. or less long, rough-edged, tapering to the apex: fls. 6–12, the peduncle standing 1–2 ft. high; perianth-tube greenish, 3–4 in. long; segms. white tinged red outside, 2–3 in. long, lanceolate; filaments bright red, shorter than segms. India. Summer; warmhouse. Var. **Mèarsii,** Bedd. (*C. Mèarsii,* Bedd.). Very small: lvs. 1 ft. or more long, 1 in. wide, very smooth: peduncle 3–5 in. long, 6–10-fld.; fls. white, the tube slender and 5 in. long; segms. lanceolate, 2½ in. long and ½in. broad. Upper Burma. G.C. III. 42:62.—Whole plant not more than 2 or 3 in. high when not in bloom; blooms well in a 3-in. pot.



1110.
A young plant of Crinum Moorei.

BB. *Lvs. numerous, 20 or more to a bulb.*

8. **augústum,** Roxbg. (*C. amábile* var. *augústum,* Gawl). Bulb conical, 6 in. thick; neck long: lvs. 20–30, strap-shaped, 2–3 ft. long, 3–4 in. broad: fls. 12–30, on a lateral much-compressed peduncle 2–3 ft. high; pedicels sometimes an inch long; color strong purplish red outside, banded within; tube purplish; segms. lanceolate, 4–5 in. long; filaments half length of segms., red. Mauritius, Seychelles. B.M. 2397. B.R. 679.—Warmhouse; effective.

9. **erubéscens,** Ait. Bulb ovoid, 3–4 in. thick, the neck short: lvs. many, curved, strap-shaped, thin, 2–3 ft. long and 2–3 in. broad, slightly rough on edges: fls. 4–12, on peduncle 2 ft. or more high, the pedicels 0 or very short; color reddish outside, white within; tube bright red, 5–6 in. long; segms. half as long as tube, lanceolate, reflexing. Trop. Amer. B.M. 1232. L.B.C. 1:31.—Summer; warmhouse.

10. **Kunthiànum,** Roem. (*C. erubéscens,* HBK., not Ait.). Bulb ovoid, 3 in. diam., with a short neck: lvs. about 20, strap-shaped, spreading, 2–3 in. broad, undulate but entire: fls. 4–5 in an umbel, the peduncle 1 ft. high, the pedicels 0 or very short, pure white; tube 7–8 in. long; segms. lanceolate, 2½ in. long; filaments less than 2 in. long, bright red. Colombia. Var. **nicaraguénse,** Baker, is purple outside, the segms. a little longer and lvs. longer and narrower.

11. **purpurâscens,** Herb. Bulb ovoid, short-necked, 2 in. diam., stoloniferous: lvs. 20 or more, linear, thin, 3 ft. or less, prominently undulate: fls. 5–9, on a peduncle 1 ft. or less long; tube very slender, 5–6 in. long; segms. lanceolate, half as long as tube, pink or purplish; filaments bright red. Upper and Lower Guinea, in streams and lakes, the lvs. often floating. B.M. 6525. G.C. III. 47:114.—Amphibious. Summer; warmhouse.

AAA. *Perianth funnel-shaped; tube permanently curved; segms. oblong ascending; stamens and style contiguous and declined.* (*Codonocrinum.*)

B. *Bulbs long-necked* (*No. 30 omitted*).

C. *Margin of lvs. not ciliate, but often scabrous.*

12. **longifòlium,** Thunb. (*Amarýllis longifòlia,* Linn. *C. ripàrium,* Herb. *C. capénse,* Herb.). Bulb ovoid, 3–4 in. diam.: lvs. 12 or more, strap-shaped, 2–3 ft. long, 2–3 in. wide, margins rough: fls. 6–12, pedicels 1–2 in. long; perianth tinged red on the back, and sometimes on the face, with a white variety; tube cylindrical, 3–4 in. long, about equaling the limb; segms. oblong, acute, 1 in. or less broad; stamens nearly as long as segms.; filaments red. Cape. Natal. B.M. 661. Var. **álbum,** Hort. Gn. 52, p. 123.—Probably the hardiest pure species of crinum, enduring the winter of the Middle States, if protected with litter during cold weather. Prop. by offsets or seed, which latter is produced abundantly. **C. grandiflòrum,** Hort., is a hybrid with *C. Careyanum,* said to partake of the hardiness of *C. longifolium.* Sometimes described as having a short-necked bulb.

13. **Macòwanii,** Baker. Bulb globular, 9–10 in. diam., with neck 6–9 in. long: lvs. 12–15, strap-shaped, thin, 2–3 ft. long, 4 in. or less broad: fls. 10–15, on a stout green peduncle 2–3 ft. high; tube curved, green, 3–4 in. long; segms. about equaling the tube, pink, oblong, acute, 1–1½ in. broad. Natal.—Late autumn; greenhouse, or half-hardy.

14. **Moòrei,** Hook. f. (*C. Makoyànum,* Carr. *C. Colénsoi, C. Máckenii* and *C. natalénse,* Hort.). Fig. 1110. Bulb ovoid, neck 12–18 in. long: lvs. 12–15, strap-shaped, 2–3 ft. long, 3–4 in. wide, margin entire, veins rather distant, distinct: fls. 6–12, on peduncle 2–3 ft. high, the pedicels 1½–3 in. long; tube greenish, about 3 in. long and with a funnel-shaped pinkish limb of equal length, the segms. oblong, nearly acute, connivent; filaments pink, an inch shorter than segms. Natal and Kaffraria. B.M. 6113. G.C. III. 2:499; 48:59. R.H. 1887:300 and p. 417. R.B. 22, p. 196; 23:61. Var. **álbum,** Hort. Gt. 31:1072. Gn. 52, p. 122, and var. **platypétalum,** Hort., are cult. *C. Colensoi* has a longer tube, smaller fl., with a paler and narrower limb. *C. Schmidtii,* Regel, is probably a pure white-fld. form of this species.

15. **Pòwellii,** Hort. Fig. 1111. Bulb about 3 in. diam., with a long slender neck: lvs. about 20, spreading, ensiform, acuminate, 3–4 ft. long, 3–4 in. broad near the base, margin smooth: fls. about 8; perianth dark rose-color; pedicels 1–1½ in. long.—Garden hybrid of *C. longifolium* and *C. Moorei.*—A valuable outdoor crinum. Var. **álbum,** Hort., white. Var. **intermèdium,** Hort., light rose-color.

CC. *Margin of lvs. ciliated.*

16. **Kírkii,** Baker. Bulb globose, 6–8 in. thick, neck 6 in. long: lvs. 12 or more, 3½–4 ft. long, 4–4½ in. wide and long-tapering to a point; margin rough, veins close: fls. 12–15 on a stout compressed peduncle 1–1½ ft. high; pedicels 0 or very short; color white, with a very distinct bright red band down the center of each oblong acute segm.; tube greenish, 4 in., about equaled by the segms. E. Afr. B.M. 6512.—Probably not in commerce. See No. 17. Sept.; warmhouse.

BB. *Bulbs short-necked* (*not considering No. 30*).

C. *Fls. numerous, usually more than 8 in an umbel.*

17. **zeylânicum,** Linn. Bulb globose, 5–6 in. thick: lvs. 6–10, thin, sword-shaped, 2–3 ft. long, 3–4 in. wide, wavy, margin roughish; peduncle long and not very stout, often tinged red; fls. 10–20 on very short pedicels; tube 3–4 in. long, curved; segms. oblong, acute, 3–4 in. long, 1 in. broad, white with a broad red keel; stamens an inch shorter than segms. Spring to midsummer; warmhouse. Trop. Asia and Afr. B.M. 1171 (as *Amaryllis ornata*).—A warmhouse species. Usually sold as *C. Kirkii,* which is an allied species from E. Afr., probably not known outside of botanic gardens.

18. **variábile,** Herb. (*C. crassifòlium,* Herb.). Bulb ovoid, 3–4 in. thick, without distinct neck: lvs. 10–12, linear, glabrous and entire, the outer ones 2 ft. and more long, 2 in. wide, weak: fls. 10–12, on a compressed erect peduncle 1–1½ ft. high, the pedicels ½–1 in. long; tube greenish, 1½ in. long; segms. white with red tinge down the keel, oblong, acute, 2½–3½ in. long; filaments red, an inch shorter than segms. Cape region. Spring.

19. **latifòlium,** Linn. (*C. ornàtum* var. *latifòlium,* Herb. *C. Línnæi,* Roem. *C. jeménse, C. jeménicum* and *C. yeménse,* Hort.). Bulb nearly globose, 6–8 in. diam., with a short neck: lvs. many, strap-shaped, thin,

2–3 ft. long and 3–4 in. broad, slightly scabrous on the margins: fls. 10–20, on a peduncle 2 ft. or less high; tube curved, 3–4 in. long, greenish; segms. about as long as the tube, oblong-lanceolate and acute, 1 in. broad at middle, whitish tinged red. Trop. Asia.—An excellent species; summer; warmhouse.

20. **Jóhnstonii,** Baker. Bulb globose, 3–4 in. diam., without neck: lvs. about 20, long-pointed, the outer ones 5–6 ft. long and sword-shaped, the inner linear: fls. about 20 on a peduncle 2 ft. high; tube slightly curved, tinged green, 4 in.; limb shorter than tube, the segms. ovate or oblong, acute, white and tinged pink on the back; stamens nearly as long as limb. Mts. British Cent. Afr. B.M. 7812. G.C. III. 50:170—Closely allied to *C. longifolium.* Fls. fragrant, 8 in. long.

21. **crássipes,** Baker. Bulb very large, conical, without neck: lvs. sword-shaped, 3–4 ft. long, 4 in. broad and long-tapering to the apex, entire: fls. 15–20, in a stout compressed peduncle less than 1 ft. long, the pedicels 1–1½ in. long; tube about 3 in. long, slightly curved, green; segms. oblanceolate, ½in. broad, equaling the tube, ascending, white tinged red on the back; filaments purple, nearly equaling the segms. Probably Trop. Afr.

CC. *Fls. fewer, usually less than 8 in an umbel.*

D. *Segms. of perianth red, striped or tinted with red.*

E. *Tube of perianth usually 3 in. or more long.*

22. **Sanderiànum,** Baker (*C. ornàtum,* Bury). Bulb globose, 2 in. thick; neck short, 2–3 in. long: lvs. 10–12, thin, 1½–2 ft. long, 1½ in. broad, margin denticulate, tapering to a long point: fls. 3–6, nearly sessile, white, keeled with red; tube 5–6 in. long, curved; segms. oblong, acute, ascending, 3–4 in. long and 1 in. or less broad; stamens much shorter than segms. Upper Guinea. Gn. 52:122.—Closely allied to *C. scabrum.* Intermediate house; blooms at intervals.

23. **scàbrum,** Herb. Bulb globose, 5–6 in. diam., with short neck: lvs. 12 or more, 2–3 ft. long, 1½–2 in. wide, closely veined, margin scabrous: fls. 4–8, the peduncle 1–2 ft. high; pedicels 0 or very short; tube greenish, 4–5 in. long; segms. white with distinct red keel, oblong, acute, 3 in. or less long; filaments rather shorter than segms. Apr. May. Trop. Afr. B.M. 2180. F.S. 21:2216. A very showy and easily cult. species; spring or early summer; warmhouse. **C. Hérbertii,** Sweet (*C. scàbro-capénse,* Hort. *C. Kunthiànum,* Hort., not Roem.). Fls. similar to *C. scabrum,* but color lighter, the plant taller and larger. Garden hybrid between *C. scabrum* and *C. longifolium.* This is a doubtful name. *C. Herbertianum,* Wall. = *C. zeylanicum.* *C. Herbertianum,* Roem. & Schulte = *C. strictum.* **C. virgínicum,** garden hybrid, resembles *C. Herbertii,* but the plant is smaller and the fls. larger and brighter in color. See also No. 32.

24. **Careyànum,** Herb. (*C. ornàtum* var. *Careyànum,* Herb.). Regarded by Baker as "scarcely more than a variety of *C. latifolium;*" confused in cult.: fls. only 4–6 in the umbel, on a subterete green peduncle about 1 ft. high: bulb globose, 3–4 in. diam., short-necked, with brown coverings: lvs. 8–10, strap-shaped, undulate, thin, 2 ft. or less long, 2–3 in. broad, the margin entire: perianth-tube curved, greenish, 3–4 in. long; segms. (or limb) about as long as the tube, oblong-acute, 1 in. broad, lightly red-tinged at center; stamens a little shorter than segms. Mauritius and Seychelles. B.M. 2466.—Autumn; greenhouse.

25. **fimbriátulum,** Baker. Lvs. linear, 4–5 ft. long, 2 in. broad toward base but long-pointed, glaucous green, margins ciliated with small membranous scales: fls. 3–7, nearly sessile, on peduncle 2 ft. high; tube curved, 4–5 in. long; segms. white with distinct red keel, oblong, acute, ascending, 3 in. long and 1 in. broad; stamens an inch shorter than segms. Lower Guinea. Gn. 55: 92. Allied to *C. scabrum.*—A different plant is passing in the trade under this name.

EE. *Tube short,—3 in. or less.*

26. **campanulàtum,** Herb. (*C. aquáticum,* Herb. *C. cáffrum,* Herb.). Bulb small and ovoid: lvs. linear, deeply channeled, 3–4 ft.: fls. 6–8, on a slender peduncle 1 ft. or more long, the pedicels ½–1 in. long; tube slender, 3 in. or less long, about as long as the campanulate limb; segms. bright rose-red, oblong, obtuse, much exceeding the filaments. Cape region. B.M. 2352.—A very distinct species; warmhouse.

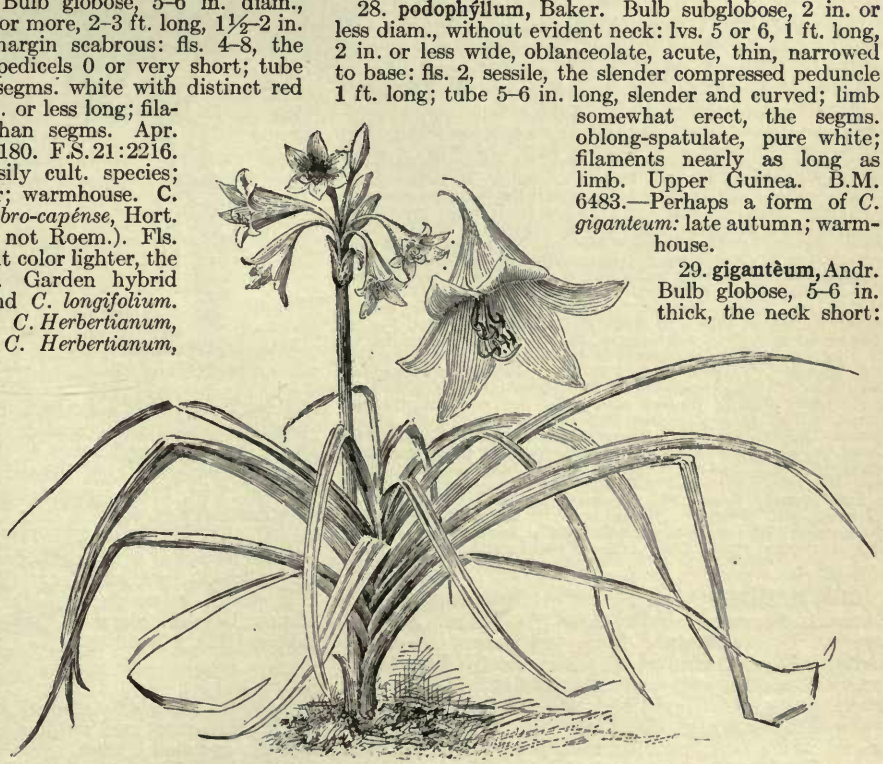
27. **lineàre,** Linn. f. Bulb small, ovoid: lvs. linear, 1½–2 ft. long, ½in. broad, glaucous, channeled on the face, the margin entire: fls. 5–6, the peduncle slender and about 1 ft. long, the pedicels ¾in. or less long; tube slender, 2½ in. or less long; segms. 2–3 in. long, white tinged with red in center, oblong or oblanceolate, acute; stamens much shorter than segms. Cape region. B.M. 915 (as *Amaryllis revoluta*). B.R. 623 (as *A. revoluta* var. *gracilior*).

DD. *Segms. of perianth pure white (exception in one form of No. 29).*

E. *Pedicels very short or 0.*

28. **podophýllum,** Baker. Bulb subglobose, 2 in. or less diam., without evident neck: lvs. 5 or 6, 1 ft. long, 2 in. or less wide, oblanceolate, acute, thin, narrowed to base: fls. 2, sessile, the slender compressed peduncle 1 ft. long; tube 5–6 in. long, slender and curved; limb somewhat erect, the segms. oblong-spatulate, pure white; filaments nearly as long as limb. Upper Guinea. B.M. 6483.—Perhaps a form of *C. giganteum:* late autumn; warmhouse.

29. **gigantèum,** Andr. Bulb globose, 5–6 in. thick, the neck short:



1111. Crinum Powellii.

lvs. 12 or more, lanceolate, narrowed both ways, 2–3 ft. long, 3–4 in. broad, veins distant, with distinct cross veinlets: fls. 4–6, rarely 8–12 on a stout compressed peduncle 2–3 ft. long; tube 5–7 in. long; segms. pure white, much imbricated, oblong; filaments pure white, an inch shorter than segms. Trop. Afr. B.M. 5205. F.S. 23:2443. G.F. 4:223. I.H. 33:617. —A very fragrant species. Var. **nóbile**, Baker (*C. nóbile*, Bull), has the peduncle and fl. suffused with tinge of red.—*C. giganteum* is large or gigantic only in its fls.; summer; warmhouse.

30. **Râttrayii**, Hort. Excellent stove plant, 20 in.: lvs. ascending, strap-shaped, acute, entire, dark green: fls. pure white, with a spread of 6 in., in few-fld. umbels; segms. ovate-elliptic, acute or sometimes erose; stamens strongly declined, nearly equaling the segms. Uganda. G.C. III. 38:11 and suppl.

31. **abyssínicum**, Hochst. Bulb ovoid, 3 in. thick, the neck short: lvs. about 6, linear, 1–1½ ft. long, ½–1 in. wide, veins close, margin rough, narrowed to a point: fls. 4–6, on a peduncle 1–2 ft. high, the pedicels very short or 0; perianth white, the tube slender, 2 in. or less long, the segms. oblong, acute, 2–3 in. long and ¾in. or less broad; filaments less than 1 in. long. Mts. of Abyssinia. Greenhouse.

32. **virgíneum**, Mart. Bulb large and brown: foliage as in *C. giganteum*, the lvs. 2–3 ft. long and 3–4 in. broad at the middle, narrowed both ways, pointed: fls. about 6, sessile or very nearly so; tube 3–4 in. long; segms. pure white, connivent, acute, as long as the tube; filaments much shorter than the segms. S. Brazil. See also *C. virginicum* under No. 23.

EE. *Pedicels 1 in. long.*

33. **imbricàtum**, Baker. Bulb very large, globose: lvs. strap-shaped, very thin, 3 ft. long, 3 in. broad at middle and narrower toward base, distinctly veined: fls. 5–6, on a stout peduncle 1 ft. or more long; tube slender and curved, 3 in. long, the campanulate limb of equal length; segms. imbricated, oblong-obtuse; filaments 1 in. shorter than segms. S. Afr.—Allied to *C. giganteum*.

Crinums hybridize so freely, and the progeny is so likely to be interesting, that many mongrel forms have been recorded under Latin names. It is not feasible to account for all such names here. Many of the forms are soon lost.—*C. Lugárdæ*, N. E. Br. Bulb small: lvs. long and narrow, rough-edged: fls. 2–6, the peduncle 1 ft. or less high; tube nearly or quite 4 in. long; segms. lanceolate, about or nearly as long as tube, white with light pink median stripe. Trop. Afr.—*C. nàtans*, Baker. Allied to C. purpurascens, but aquatic, the 20 or so strap-shaped undulate lvs. submerged: bulb small, narrow-ovoid, with many long fibrous roots: fls. few, white, the narrow segms. recurved. Upper Guinea. B.M. 7862.—*C. rhoddnthum*, Baker. Lvs. lorate, exceeding 1 ft., thick, ciliate-edged: fls. many; tube 3 in. long; segms. red, lanceolate, 2½ in. long, erect-spreading and curved in upper part; stamens as long as segms., the filaments red. Cent. Afr. G.C. III. 33:315. —*C. Sámuelii*, Worsley. Bulb 3 in. diam. and 2½ in. long: lvs. sometimes 4 ft. long, rough-edged: fls. 2, sessile, on peduncle 1 ft. high, white slightly flushed with pink, not fragrant, 4½ in. across. Cent. Afr.—*C. Vásseï*, Boiss. Bulb ovoid, 4 in. across, without distinct neck: lvs. linear-lorate, 2 ft. or less long, 2 in. broad, rough-edged: fls. about 15, on peduncle 1 ft. or less high, white with red median stripes; perianth funnel-shaped, 8 in. long, the tube curved and red, the segms. linear-lanceolate, and a little shorter than tube. Mozambique. R.H. 1908: 132.—*C. Wimbushii*, Worsley. Differs from C. Samuelii in lvs. not rough-edged, fls. on short pedicels, faintly fragrant, less lasting and with longer style. Cent. Afr.—*C. zanzibarénse*, Hort.=(?).

L. H. B.†

CRÍTHMUM (Greek for barley, from some resemblance in the seed). *Umbelliferæ*. Samphire. A single species, **C. marítimum**, Linn., on shores in Great Britain, W. Continental Eu., and the Medit. region, rarely planted in wild gardens or borders. It is a fleshy glabrous perennial herb, seldom more than 1 ft. high, somewhat woody at the base: lvs. 2–3-ternate, the segms. thick and linear: umbels compound, of 15–20 rays, involucrate, the umbellules with involucels; petals very minute, entire, fugacious: fr. ovoid, not compressed, about ¼in. long. Thrives well in a sunny situation, and will grow at considerable distance from the sea. Prop. by division, and by seeds sown as soon as ripe.

CROCÓSMIA (Greek, *odor of saffron*, which is perceivable when the dried flowers are placed in warm water). *Iridàceæ*. Gladiolus-like garden plant.

This genus has but one species, and is not clearly distinguished from the closely allied Tritonia, but it differs in the stamens being separated at equal distances instead of grouped at one side, the form of the limb, the tube not swollen at the top, and the fr. 3-seeded, sometimes 5-seeded, instead of many-seeded. The name of this genus is spelled Crocosma by Baker, but it was first spelled Crocosmia. The fls. with coppery tips shading into orange-yellow are very distinct and attractive. Pax, in Engler & Prantl, combines the genus with Tritonia.



1112. Crocosmia aurea var. imperialis. (×½)

Crocosmia aurea is a showy bulbous autumn-blooming plant, which is hardy south of Washington, D. C., with slight protection, and in the North is treated like gladioli, the bulbs being set out in the spring, after danger of frost, and lifted in the fall for winter storage. It is of easy culture, and is propagated by offsets or by seeds which should be sown in pots, under glass, as soon as ripe. Corms should be stored in peat or sphagnum to prevent them from becoming too dry.

aùrea, Planch. (*Tritònia aùrea*, Pappe.). Height 2 ft.: corm globose, emitting offsets from clefts in the side: scape 1½–2 ft. high, leafy below, naked or only bracted above, compressed, 2-winged: lvs. distichous, shorter than the scape, linear, ensiform, striated, but with a distinct midrib: fls. sessile in the panicle, perhaps 25 scattered over a long season, with buds, fls. and seeds at the same time; perianth bright orange-yellow toward center; tube slender, curved, 1 in. long; segms. longer than the tube: caps. 3-celled. Trop. and S. Afr. July–Oct. F.S. 7:702. B.M. 4335. B.R. 33:61 (Tritonia). Also interesting as one parent of a bigeneric cross resulting in *Tritonia (Montbretia) crocosmæflora*. Var. imperiàlis, Hort., Fig. 1112, grows about 4 ft. high. Var. **maculàta**, Baker, has dark blotches above the base of the 3 inner segms. J.H. III. 33:567.

J. N. Gerard.
Wilhelm Miller.

CRÒCUS (Greek name of saffron). *Iridàceæ*. Low spring-flowering and autumn-flowering garden bulbs; showy, and well known.

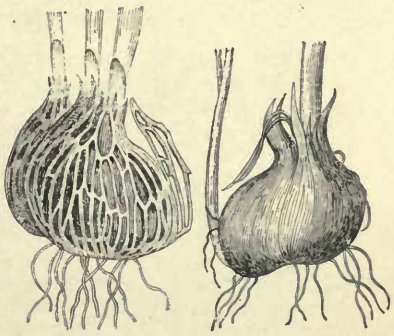
Stemless plants (the grass-like lvs. rising from the

ground or corm), with solid bulbs or corms: fls. showy, in many colors, funnel-shaped and erect, with a very long tube and 6 nearly or quite equal segms.; stamens 3, attached in the throat of the perianth and shorter than the segms.; style 3-cleft, the branches entire or forked or much fimbriated; ovary 3-loculed: seeds many, nearly globular: fr. an oblong 3-valved caps.—Probably 75 species, many of them variable, in the Medit. region and extending into S. W. Asia. The fls. open in sunshine. They come in fall or spring, but the best-known species are spring-flowering, which are amongst the earliest and brightest of spring bloom. Crocuses force easily (see *Bulb*). A half-dozen corms may be planted in a 4-in. pot for this purpose. Crocuses are scarcely known in the American trade under their species names. Inasmuch as the flowers of the common crocus close when taken out of the sun, they are not popular as window-garden or house subjects. Crocuses have been much hybridized and varied. There are many color-forms. The common crocuses of the trade have descended from *C. vernus* chiefly, but *C. susianus, C. mœsiacus, C. stellaris, C. biflorus* and *C. sativus* are frequent. The Dutch bulb-growers cult. many species, and these are offered for sale in their American lists; the species are therefore included in the following synopsis. In this account, the treatment by Baker is followed (Handbook of the Irideæ).

Botanically, the genus divides itself into three groups on the characters of the style-branches: the branches entire, once-forked or fimbriated at the apex, or cut into several capillary divisions. Horticulturally, the species fall into two groups,—the spring-flowering and the autumn-flowering. These groups are not so definitely separated as it would seem, however. Some of the species bloom in winter in regions in which the ground does not freeze hard; others begin to bloom in July or August; some may continue to bloom till winter closes in. Yet these two flowering periods mark very important differences in the utilization of the plants and the primary division in the following treatment is made on this basis. The colors are now much varied by cultivation and hybridizing, but they are well marked in the specific types as a rule. They run largely in yellow, white and purple.

The covering or tunic of the bulbs may be uniformly membranaceous, or it may be composed of strongly reticulated or parallel fibers. Fig. 1113. The flowers appear usually just in advance of the grass-like foliage-leaves. The floral leaves are small and more or less dry or scarious and arise directly from the corm and may be seen as a spathe-like structure inside the leaf-tuft; this is usually known as the basal spathe. The real spathe subtends the bloom, and it is always one-flowered; this floral spathe may be one-leaved or two-leaved.

Culture.—Many forms of crocus are well known, where they are justly valued as among the showiest and brightest of winter and spring flowers. They thrive in any ordinary soil. About two-thirds of the species are classed as vernal and the remainder as autumnal flowering; but the various members of the tribe would furnish nearly continuous bloom from August to May were the season open. While there are numerous species interesting to a botanist or a collector, practically the best for general cultivation are *Crocus Imperati, C. susianus* (Cloth of Gold crocus) and the Dutch hybrids, mostly of *C. mœsiacus*. These bloom in about the order named. The rosy flowers of *C. Imperati* may be expected with the earliest snowdrops. The named species, having shorter flower-tubes than the Dutch hybrids, are not so liable to injury by the severe weather of the early year. The autumnal species are not satisfactory garden plants, the flowers mostly appearing before the leaves, and being easily injured. *C. speciosus* and *C. sativus* are probably the most satisfactory. The latter species has been cultivated from time immemorial, the stamens having a medicinal reputation, and being a source of color (saffron). The cultivation of this species is a small industry in France, Spain and Italy.—The corms of crocuses should be planted about 3 or 4 inches deep, in a well-worked and perfectly drained soil which is free from clay or the decaying humus of manure. They should be set only 2 or 3 inches apart if mass effects are desired. They may be planted in September or October for bloom in the spring or the following autumn; or the autumn kinds may be planted early in spring. The corms should be carefully examined and all bruised and imperfect ones rejected, as they are very susceptible to attacks of fungi, which, gaining a footing on decrepit corms, will spread to others.—The careful gardener will examine all exotic small bulbs annually, or at least biennally, until they show by the perfection of their new bulbs that they have become naturalized, or are suited to their new environment. In this case they may be allowed to remain until crowding requires their division. This examination should take place after the leaves are matured and dried up. Inasmuch as new corms form on top of the old ones, the plants tend to get out of the ground; it is well therefore to replant the strongest ones every two or three years. Increase may be had from new corms which are produced more or less freely in different species on top or on the sides of old corms.—Seeds are often produced freely, but are likely to be overlooked, as they are formed at the surface of the soil. These germinate readily and most freely at the growing time of the plant. They should preferably be germinated in seed-pans, which should be exposed to freezing before the natural germinating time. Seedlings usually flower the third season.—The dutch hybrid crocus is often useful for naturalizing in the lawn, although the grass may run out the plants in a few years, if the bulbs are not replaced by strong ones; they will not last more than a year or two if the foliage is mown off, but if the foliage is allowed to remain until ripe and if the lawn is fertile, the plants may remain in fair condition three or four years or more. (J. N. Gerard.)



1113. Reticulated and membranaceous tunics. Crocus susianus (left) and C. sativus (right).

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A. *Blooming in spring (sometimes in midwinter and continuing toward spring).*

B. *Style-branches entire or merely toothed.*

C. *Fls. yellow, at least inside (varying to whitish forms): basal spathe absent.*

D. *Outer segms. striped or feathered outside.*

1. **susiànus,** Ker. CLOTH-OF-GOLD CROCUS. Fig. 1114. Corm ¾in. diam.: lvs. 6–8 in a tuft, reaching to the fl., narrow-linear, with revolute edges and a central band of white: upper spathe 2-lvd.: perianth-segms. 1½ in. or less long, orange-yellow, becoming reflexed, the outer ones brownish or striped on the outside; anthers orange, longer than the filaments; style-branches long and spreading. Crimea. B.M. 652 (adapted in Fig. 1114).—Blooms very early, Feb., Mar.



1114. Crocus susianus. (×½)

2. **chrysánthus,** Herb. (not B.R. 33:4, fig. 1, which=*C. Olivieri* var. *Suterianus*). Corm small: lvs. as high as the fl., very narrow: upper spathe 2-lvd., nearly as long as perianth-tube: perianth-tube 2–3 times as long as the segms., the latter 1¼ in. or less long, and plain orange-yellow (varying tinted or striped on the outside, or even nearly white); throat glabrous; anthers orange, twice as long as the roughened filaments; style-branches red-orange. Macedonia and Asia Minor. Gn. 74, p. 140. Var. **álbidus,** Hort. Fls. whitish. Gn.W. 25:229.

3. **stellàris,** Haw. Supposed to be a hybrid between *C. mœsiacus* and *C. susianus,* and known only in cult.: blooms with *C. mœsiacus:* lvs. only 4–6, narrow-linear, reflexed edges, white-banded: upper spathe 2-lvd.: perianth-tube short, the segms. 1–1½ in. long, bright orange, the outer ones striped and feathered with brown on the back; anthers pale orange, a little longer than the filaments; style-branches somewhat overtopping the anthers. Mar.

DD. *Outer segms. not striped (at least not in the specific types).*

4. **mœsìacus,** Ker (*C. aùreus,* Sibth. & Smith). DUTCH CROCUS. Later: corm larger: lvs. 6–8 in a tuft, overtopping the fl., narrow-linear, with reflexed edges and white central band: upper spathe 2-lvd., inner valve very narrow or obsolete; segms. very obtuse, bright yellow, 1½ in. long, one-half to a third the length of the tube: anthers pale yellow, hastate at the base, somewhat longer than the filaments; style-branches overtopped by the anthers. Transylvania to Asia Minor. B.M. 2986.—Variable. A sulfur-yellow form is *C. sulphùreus,* Ker. B.M. 1384. There is a striped form. B.M. 938. A cream-white form is *C. lácteus,* Sabine.

5. **ancyrénsis,** Maw. Corm ¾in. diam.: lvs. 3–4, as tall as the fl., very narrow: upper spathe 2-lvd.: perianth-tube exserted; segms. bright orange-yellow, 1 in. or less long, not striped nor colored outside; anthers orange-yellow, much longer than the filaments; style-branches red-orange. Asia Minor.—Blooms early.

6. **Korolkòwii,** Maw & Regel. Corm globose, 1 in. diam. with matted fibers: lvs. 8–12, very narrow, with reflexed edges and a central white band: upper spathe of 1 or 2 membranous valves: perianth-tube shortly exserted; segms. about 1 in. long, bright orange-yellow and not striped, the outer ones grayish brown on the outside; anthers orange-yellow; style-branches entire and orange-yellow. Turkestan, etc. Var. **dytíscus,** Bowles, has the outer segms. deep brown outside and with narrower margins of yellow.

CC. *Fls. lilac, purple or white.*

D. *Basal spathe (rising directly from the corm inside the lvs.) absent.*

7. **biflòrus,** Mill. SCOTCH CROCUS. Corm ¾in. or less in diam.: lvs. 4–6, overtopping the fls., very narrow, with deflexed edges and a white central band: upper spathe 2-lvd.: perianth-tube exserted, the segms. 1½ in. long, purple-tinged, the outer ones 3-striped down the back, the throat bearded and yellowish; anthers orange, exceeding the filaments; style-branches orange-red. S. and S. W. Eu. B.M. 845.—Runs into many forms, some of them almost white. Some of the named botanical forms are: Var. **argénteus,** Baker (*C. argénteus,* Sabine. *C. præcox,* Haw. *C. lineàtus,* Jan). Less robust and with only 3 or 4 lvs. to a tuft and smaller fls. more tinged with purple and the outer segms. dark-striped outside. Italy. B.M. 2991 (as *C. minimus.* Var. **pusíllus,** Baker (*C. pusíllus,* Tenore). Fls. smaller than in var. *argenteus,* paler, the 3 outer segms. striped with dark purple. Italy. B.R. 1987 (var. *estriatus,* with petals pale purple and not striped). Var. **Wéldenii,** Baker (*C. Wéldenii,* Hoppe), with uniform slaty purple limb. Dalmatia. B.M. 6211. Var. **Ádamii,** Baker (*C. Ádamii,* Gay). Limb pale purple, the outer segms. 1-colored or with 3 pale purple stripes. Caucasus. B.M. 3868 (as *C. annulatus* var. *Adamicus*). Var. **nubígenus,** Herb. Segms. very small and nearly white, the outer ones with a broad band of purple on the back. Asia Minor. Var. **Pestalózzæ** (*C. Pestalózzæ,* Boiss.). Small-fld., with 1-colored whitish segms. Asia Minor. Var. **Alexándri,** Hort. (*C. Alexándri,* Velen. Fls. larger than in *C. biflorus* type; outer segms. flushed all over the back with bright lilac and with a narrow margin of white, or often with only feather-like stripes on white grounds. B.M. 7740.

8. **èrius,** Herb. (*C. Sibthorpiànus* var. *staùricus,* Herb.). Corm globose, ¾in. or less diam., the tunic bristle-ringed at top: lvs. 3–6 in the tuft, as high as the fl., very narrow, with reflexed margins and a white band: upper spathe 2-lvd.: perianth-tube little exserted; segms. 1 in. or less long, unstriped, pale or dark lilac, the throat yellow and glabrous; anthers orange, twice the length of the slightly papillose filaments. Armenia, Kurdistan. B.M. 6852B. Gn. 74, p. 212. Early.

DD. *Basal spathe present.*

E. *Throat of perianth glabrous.*

9. **versícolor,** Ker (*C. fràgrans,* Haw. *C. Reìnwardtii,* Reichb.). Corm ¾in. or less in diam., with tunics of matted parallel fibers: lvs. 4–5, as high as the fls., otherwise like the last: upper spathe 1- or 2-lvd.: perianth-tube exserted; segms. 1½ in. long, pale or dark purple, often striped and feathered with dark purple; throats glabrous, whitish or yellowish; anthers yellow, twice as long as the filament; style-branches, orange-yellow, equaling or overtopping the anthers. S. France. B.M. 1110.

10. **banáticus,** Heuff. Corm globular, ½in. diam.: lvs. usually 2, thin and flattish, and becoming ¼in. broad, glaucous beneath: upper spathe 1-lvd.: perianth-tube scarcely exserted; segms. 1½ in. or less long, bright purple, and never striped, but often dark-blotched toward the tip; throat glabrous; anthers orange, a little longer than the white filaments; style-branches short, orange-yellow, somewhat fringed at the tip. Hungary.

11. **Tommasinianus,** Herb. Corm globular, ½in. diam.: lvs. appearing with the fls., narrow (⅛in. broad): upper spathe 1-lvd.: perianth-tube little exserted; segms. 1½ in. or less long, pale red-bluish, sometimes dark-blotched at the tip; throat glabrous; anthers pale orange, a little longer than the white glandular filaments; style-branches short, orange-yellow. Dalmatia and Servia.—Distinguished from *C. vernus* by its glabrous throat.



1115. Crocus vernus. (×⅓)

12. **Sièberi,** Gay. Corm globular, ¾in. diam.: lvs. 4–6, as high as the fl., glaucous beneath, ⅛in. broad: upper spathe 2-lvd.: perianth-tube short-exserted; segms. 1–1½ in. long, color of *C. vernus;* throat yellow and glabrous; anthers orange, twice as long as filaments; style-branches nearly entire, orange-red. Greece, Crete. Gn. W. 22:287. G.M. 49:54. Var. **purpùreus,** Hort. Fls. darker purple than the type. Var. **versícolor,** Hort. Outer perianth-segms. white feathered with purple or dark violet; inner segms. white, yellow at base inside. Gn. 73, p. 201.

13. **reticulàtus,** Bieb. Corm ¾in. diam., covered with honeycombed fibers: lvs. 3–5, as high as the fl., very narrow, with reflexed edge and a white band: upper spathe 2-lvd.: perianth-tube much exserted; segms. 1–1½ in. long, white to purple, the 3 outer ones striped; throat glabrous; anthers orange, twice the length of the orange filaments; style-branches scarlet, overtopping the anthers. S. E. Eu.—Varies to white.

EE. *Throat of perianth pubescent or bearded.*

14. **vérnus,** All. Fig. 1115. Corm 1 in. or less diam.: lvs. 2–4, as high as the fl., often ¼in. broad, glaucous beneath, but green above, with reflexed edges, and a central white band: upper spathe 1-lvd., about as long as perianth-tube: perianth-segms. 1–1½ in. long, lilac, white or purple-striped; throat pubescent, never yellow; anthers lemon-yellow, exceeding the filaments; style-branches orange-yellow. S. Eu. B.M. 860, 2240. R.H. 1869, p. 331. Gn. 54, p. 79.—The commonest garden crocus.

15. **etrúscus,** Parl. Corm 1 in. or less in diam.: lvs. about 3, very narrow, as tall as the fl.: upper spathe 1-lvd.: perianth-tube short exserted; segms. 1–1½in. long, lilac, or the outer ones cream-colored and sometimes purple-feathered outside; throat yellow, slightly pubescent; anthers orange, twice as long as the glabrous filaments; style-branches nearly entire, orange. Italy.

16. **Màlyi,** Vis. Corm depressed-globose, 1 in. or less diam., with fine parallel fibers in the tunic which is slightly reticulated upward: lvs. narrow-linear, not so tall as the fl., with reflexed margins and white central band: upper spathe 2-lvd., foliaceous: perianth-tube yellow, scarcely exserted; segms. white, 1¾in. long; throat orange-yellow and bearded; anthers orange, twice as long as the filaments; style-branches orange, slightly divided at tip. Dalmatia. G.C. III. 37:163. G. M. 51:455.

BB. *Style-branches fimbriate at the top, or once-forked.*

17. **Imperàti,** Tenore. Fig. 1116. Corm nearly or quite 1 in. diam.: basal spathe present: lvs. 4–6, exceeding the fls., very narrow: upper spathe 1- or 2-lvd.: perianth-tube little exserted; segms. 1–1½ in. long, lilac or even white, the outer ones buff and 3-striped on the outside; anthers yellow, exceeding the filaments; style-branches fimbriate. Italy. B.R. 1993. Gn. 54, p. 79. Very early.

18. **Ólivieri,** Gay. Corm nearly globose, ½–¾in. diam.: basal spathe absent: lvs. 4–5, as tall as the fl., becoming ¼in. broad: upper spathe 2-lvd.: perianth-tube little exserted; segms. bright orange-yellow and never striped, 1½ in. or less long; throat glabrous; anthers orange, twice the length of the roughish filaments; style-branches orange, slender-forked. Var. **Suteriànus,** Baker (*C. chrysánthus,* Bot. Reg.) has narrower and more rolled lvs. Greece to Asia Minor. No. 2.

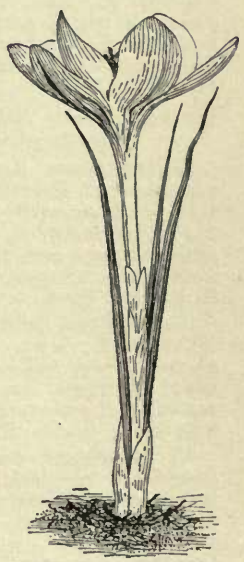
BBB. *Style-branches cut into capillary divisions: basal spathe absent: upper spathe 2-lvd.*

19. **vitellìnus,** Wahl. (*C. syrìacus,* Boiss. & Gaill.). Corm ¾in. or less diam.: lvs. 4–6, as high as the fls., narrow-linear: perianth-tube short, exserted; segms. 1 in. or less long, orange-yellow, the outer brown-tinged outside; style-branches divided into many capillary parts. Asia Minor. B.M. 6416.—Rare in cult. Var. **gravèolens,** Baker (*C. gravèolens,* Boiss. & Reut. *C. syrìacus,* Baker). Lvs. narrower: outer segms. flushed with black or bearing 3 distinct stripes of black down the back.

20. **Fleischeri,** Gay (*C. Fleischerìanus,* Herb. *C. smyrnénsis,* Poech). Corm ¾in. or less diam., the tunics a dense mass of regularly interlacing fibers: lvs. about 6 to a tuft, as high as the fls., very narrow and having reflexed edges and a white band: perianth-tube not exserted; segms. 1–1¼ in. long, white, acute, the outer with 3 slender lilac lines on the back; throat yellow and glabrous; anthers small, orange, about as long as the filaments; style-branches brick-red. Asia Minor, on limestone hills.

21. **cándidus,** Clarke (*C. Kìrkii,* Maw). Corm globose, ¾in. diam.; tunics of matted parallel fibers: lvs. as high as the fl., becoming ¼in. broad, the margin ciliated and the keel very narrow: perianth-tube little exserted; segms. 1–1¼ in. long, white tinged yellow towards throat (which is glabrous), the outer ones tinged or feathered with purple on back; anthers orange, about as long as the filaments; style-branches cream-white. Asia Minor. G. 31:17. Var. **lùteus,** Hort. Fls. yellow, more deeply colored at the base, 3 outer segms. veined and mottled with purple.

22. **hyemàlis,** Boiss. & Blanche. Corm globose, ¾in. or less diam., the tunic membranous: lvs. about 4 to the tuft, as high as the fl., with reflexed margins and a white band: perianth-tube little exserted; segms. 1–1½ in. long, white, with a long central purple line and three shorter lines; throat yellow, glabrous; anthers orange, twice as long as filaments; style-branches red. Palestine. Var. **Fóxii,** Maw, has nearly black anthers. Gn. 74, p. 188.



1116. Crocus Imperati. (×½)

AA. *Blooming in autumn (sometimes in late summer and continuing toward autumn).*

B. *Style-branches entire or very nearly so.*

C. *Fls. white or lilac: basal spathe present (except in No. 26); upper spathe 2-lvd.*

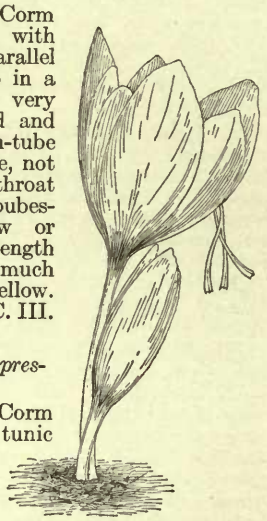
23. **satìvus,** Linn. SAFFRON CROCUS. Fig. 1117. Corm 1 in.

or more diam.: lvs. 6–10, as tall as the fl., very narrow, ciliate-edged: perianth-tube little exserted; segms. oblong and obtuse, bright lilac or even white; throat pubescent; anthers yellow, longer than filaments; style-branches 1 in. or more long, bright red (the source of saffron). Asia Minor. R.H. 1895, p. 573.—The commonest fall-blooming species.

24. **hadriáticus,** Herb. Much like *C. sativus:* usually smaller-fld., pure white, the segms. pubescent at base: anthers bright orange, more than twice longer than the white or purple filaments. Greece, etc.—Runs into several forms. Var. **melitênsis,** Hort. Fls. feathered with purple and brown. Malta. Var. **Wilhelmii,** Hort. Fls. pale, with purple markings outside near the throat.

25. **zonâtus,** Gay. Corm somewhat flattened or deflexed, ½–¾in. diam.: lvs. appearing after the fls., narrow-linear: perianth-tube exserted, 2–3 in.; segms. 1–2 in. long, rose-lilac, purple-veined and orange-spotted within; throat yellow, pubescent; anthers white, 2–3 times longer than the yellow filaments; style-branches short and yellow. Cilicia. G.C. III. 23:85.

26. **cáspius,** Fisch. & Mey. Corm ovoid, ¾in. or less diam., with rigid tunic that has matted parallel fibers toward base: lvs. 4–5 in a tuft, not reaching the fl., very narrow, with a white band and reflexed margins: perianth-tube much exserted; segms. white, not striped, 1–1¼ in. long; throat yellow, glabrous or slightly pubescent; anthers pale yellow or cream-colored, twice the length of filament, style-branches much exceeding anthers, slender, yellow. Near Caspian Sea. Oct. G.C. III. 34:443.



1117. Crocus sativus (×⅔)

CC. *Fls. yellow: basal spathe present; upper spathe 1-lvd.*

27. **Scharojânii,** Rupr. Corm globose and very small, the tunic membranous: lvs. developed in spring and remaining till the fl. appears; perianth-tube much exserted; segms. bright yellow, 1-colored, 1½–1¾ in. long; throat yellowish white; anthers pale yellow; style-branches nearly entire, orange-red, shorter than the stamens. Caucasus, Armenia, blooming end of July and in Aug. G.C. III. 32:321.

BB. *Style-branches fimbriated or forked at the top: basal spathe present; upper spathe 1-lvd.*

28. **longiflòrus,** Raf. Corm ½in. diam.: lvs. 3–4, very short at flowering time, very narrow: perianth-tube much exserted; segms. oblong and bright lilac, 1½ in., never striped; throat slightly pubescent, yellow; anthers orange, more than twice as long as the filaments; style-branches scarlet, slightly compound. S. Eu. B.R. 30:3.—Not frequent.

29. **serôtinus,** Salisb. Corm 1 in. or less: lvs. 4–6, as high as the fl., very narrow: perianth-tube little exserted; segms. oblong, 1½ in., lilac or purple, indistinctly or not at all striped; throat glabrous; anthers yellow, much exceeding the filaments; style-branches orange-yellow, fimbriated. Spain. B.M. 1267.—Not frequent.

30. **Sâlzmannii,** Gay (*C. tingitànus,* Herb.). Corm somewhat depressed, 1 in. diam.: lvs. about 6, not prominent at flowering time, very narrow: perianth-tube much exserted; segms. 1½ in. long, plain lilac; throat pubescent, yellowish; anthers orange, longer than the filaments; style-branches slender, orange. Morocco. B.M. 6000.

BBB. *Style-branches capillary-divided.*

C. *Fls. white.*

D. *Basal spathe present.*

31. **níveus,** Bowles. Very robust and vigorous: corm globose, ¾–1 in. diam., the tunic of fine reticulated fibers; lvs. 6 in the tuft, equaling the fls.: basal spathe 2½ in. long; spathe 2-lvd., 4 in. long, leafy at top: perianth-tube 5½ in. long, the segms. white but with an orange glabrous throat; anthers yellow, 3 times as long as the filament. Probably Greece.—Differs from *C. Boryi,* to which it is closely related, by the basal spathe being present, yellow anthers, naked filaments, and reticulated tunic.

DD. *Basal spathe absent.*

32. **lævigâtus,** Bory & Chaub. Corm ovoid, ¾in. or less diam., with rigid tunic broken into many small imbricated parts: lvs. 3–4 in a tuft, as high as the fl., very narrow, with reflexed margins and a white band: upper spathe 2-lvd., very short: perianth much exserted; segms. about 1 in. long, white and 1-colored or with 3–5 stripes of lilac on the back of outer segms.; throat yellow, glabrous; anthers white, about as long as the papillose filaments; style-branches bright yellow, exceeding the anthers. Greece. Var. **Fontenâyi,** Bowles, is very late-blooming, and the fl. has a buff tint, outside finely feathered with purple, and clear lilac inside. Gn. 74, p. 176.



1118. Crocus speciosus var. Aitchisonii. (×½)

33. **Bôryi,** Gay. Corm globular, ¾in. or less diam.: lvs. 3–6, narrow-linear, as high as the fls.: upper spathe 2-lvd.: perianth-tube short-exserted; segms. 1–1½ in. long, white, sometimes lilac-lined at the base outside; throat yellow, glabrous; anthers white, somewhat longer than the orange filaments; style-branches scarlet, divided into many capillary segms. and exceeding the anthers. Greece. Var. **Tournefôrtii,** Baker (*C. Orphanìdis,* Hook. f. B.M. 5776), has lilac fls. Var. **marathoníseus,** Baker (*C. marathoníseus,* Heldr.), has style-branches less divided than in the type, shorter and not overtopping the anthers. G.C. III. 40:335. Gn. 70, p. 273. G.M. 49:767.

CC. *Fls. lilac (varying to white in No. 39).*

D. *Basal spathe present; upper spathe 1-lvd.*

34. **mèdius,** Balb. Corm globular, 1 in. or less diam.: lvs. 2–3, appearing in spring, narrow, becoming a foot or more high: perianth-tube much exserted; segms. 1½–2 in. long, bright lilac; throat glabrous, whitish; anthers pale orange, twice the length of the yellow filaments; style-branches scarlet, with many capillary divisions. S. France, Italy.

35. **nudiflòrus,** Smith. Corm very small, stoloniferous: lvs. 3–4, appearing after the fls., very narrow: perianth-tube much exserted; segms. 1½–2 in., lilac; throat glabrous; anthers large and yellow, twice as long as the filaments. Mts. S. France and Spain.—Long known in cult., but not common.

36. **astùricus,** Herb. Corm globular, ¾in. or less in diam.: lvs. about 3, appearing in fall but not maturing till spring: perianth-tube short-protruded; segms. 1½ in. long, lilac; throat pubescent; anthers bright yellow, longer than the white filaments; style-branches orange, with many capillary divisions. Spain.



XXXI. The White Spine cucumber.

37. **byzantìnus**, Ker (*C. iridiflòrus*, Heuff.). Corm ½in. diam.: lvs. 2–4, developing after the fls.: perianth-tube much exserted; segms. 2 in. or less long, the outer ones dark lilac and acute, the inner ones shorter and pale lilac or white; anthers orange, longer than the filaments. S. E. Eu. B.M. 6141. B.R. 33:4.—An old garden plant, but rarely seen in this country.

DD. *Basal spathe absent; upper spathe 2-lvd.*

38. **pulchéllus**, Herb. Corm small, somewhat depressed: lvs. produced after flowering, maturing in spring: perianth-tube much exserted; segms. 1–1½ in. long, bright lilac, more or less indistinctly striped; throat glabrous, bright yellow; anthers white, longer than the pubescent yellow filaments; style-branches orange, with many capillary branches. Greece to Asia Minor. B.R. 30:3.

39. **speciòsus**, Bieb. Corm not stoloniferous, 1 in. or less: lvs. usually 3, developing after the fls., thin, very narrow, becoming 1 ft. long: perianth-tube much exserted; segms. 1½–2 in., lilac and feathered with darker color; anthers very large, bright orange, much exceeding the filaments. S. E. Eu. and Asia. B.M. 3861. Gn. 62, p. 265; 71, p. 613. B.R. 25:40.—Handsome and variable. Var. **álbus**, Hort. Fls. white. Var. **Aìtchisonii**, Foster (*C. Aìtchisonii*, Hort.). Fig. 1118. More graceful than the type and larger, fls. paler in color, the segms. more pointed, divisions of stigma more numerous and more spreading or even drooping: fls. very pale bluish lilac. Asia. G. 28:415. Gn. M. 8:228.

L. H. B.

CROP. The product secured from an area of cultivated plants; as, a crop of wheat, a crop of mushrooms, a crop of violets. The word is used generically for classes of products, as grain crop, root crop, forest or timber crop, fiber crop, flower crop, seed crop, salad crop. It is employed also as a verb,—the cropping of the land, to crop to fruit.

Other limitations of the word refer to duration and inter-relations: *catch-crop*, a secondary crop grown between the succession of other crops, as in the time between a crop of radishes and a crop of cabbages; or between the rows or stands of other plants; *companion-crop*, a catch-crop grown between other growing plants, as lettuce between rows or hills of beans; *succession-crop*, a catch-crop succeeding another crop as late celery following early potatoes; *cover-crop*, a catch-crop grown usually late in the season, or in winter, to protect the land and to afford green-manure. Rotation-cropping is a form of succession-cropping. Double-cropping may be either companion-cropping or succession-cropping, or both.

L. H. B.

CROSSÁNDRA (Greek, *fringed anthers*). *Acanthàceæ*. Warmhouse evergreen shrubs of minor importance.

Upright, with entire or somewhat toothed, often verticillate lvs., glabrous, or the infl. hairy: fls. in dense sessile spikes, red or yellow, with prominent bracts; corolla cylindrical, more or less curved, somewhat enlarged at the throat, with a flat or spreading oblique limb; stamens 4, in pairs.—Perhaps 20–25 species from India, Trop. Afr., and Madagascar. The one commonly in the trade has handsome 4-sided spikes of scarlet-orange fls.; perianth has 5 segms., the 2 upper ones being smaller; stamens 4, of 2 lengths: caps. oblong, acute, 4-seeded. It is cult. S. outdoors to a slight extent, and also rarely in northern greenhouses. Should be grown in rich loam, peat or leaf-mold, and sand. Prop. by cuttings in sand over bottom heat, preferably under a bell-jar.

undulæfòlia, Salisb. (*C. infundibulifórmis*, Nees). Height 1 ft., rarely 3 ft.: lvs. opposite, ovate-acuminate, stalked: fls. scarlet-orange, overlapping one another in dense closely bracted, æchmea-like spikes, 3–5 in. long. India. B.M. 2186. R.H. 1891:156. B.R. 69.

C. flàva, Hook. Unbranched shrub, 6–8 in. high: st. green, glabrous: lvs. opposite, close together, large for the size of the plant, 6 in. long, obovate-lanceolate, dark green above, paler beneath, wavy, more obtuse than in the above; lower lvs. stalked, upper ones sessile: spike 4-sided, spiny; fls. yellow; tube much exserted, jointed. Trop. W. Afr. B.M. 4710.—*C. guineénsis*, Nees. Height 2–6 in.: st. light red, rusty pubescent: lvs. 2–4 pairs, 3–5 in. long, elliptic, green above, with golden netted nerves, reddish beneath: spike solitary, terminal, slender, 3–5 in. high; fls. numerous, small, pale lilac, with 2 darker spots on the 2 smallest segms. and a white eye. Guinea. B.M. 6346.—A handsome foliage plant.

N. Taylor.†

CROSSOSÒMA (Greek, referring to a fringe-like body on the seeds). *Ranunculàceæ;* by Bentham & Hooker referred to *Dilleniàceæ*, and by Engler made the type of the family *Crossosomatàceæ*. Four much-branched woody plants of Mex., Ariz. and S. Calif.: very glabrous, with grayish bark and whitish wood: lvs. oblong or narrower, entire, alternate, nearly or quite sessile, some of them fascicled: fls. mostly white, solitary and short-stalked at the ends of the branchlets. *C. californìcum*, Nutt., has been mentioned in gardening literature abroad: 3–15 ft. high: lvs. 1–3 in. long, not much fascicled: fls. large, with nearly orbicular white petals more than ½in. long, the anthers long-oblong: follicles ¾in. or more long, many-seeded. Isl. of Santa Catalina. *C. Bigelovii*, Wats., is lower, the lvs. mostly fascicled and fls. only half as large, the petals white or purplish. Ariz. to S. E. Calif.

CROTALÀRIA (Greek, *rattle, castanet;* from the rattling of the seeds in the pod). *Leguminòsæ*. Rattle-Box. Annual outside herbs, and shrubs grown in greenhouses or in the open far South.

Herbs or shrubs of various habit: lvs. simple (actually unifoliolate) or compound: fls. in terminal racemes or rarely the racemes opposite the lvs.; calyx-tube short, the teeth narrow, as long as or a little shorter than the pea-like corolla.—A cosmopolitan genus of perhaps 250 species, in tropics and subtropics mostly. For best results, the seed should be started early indoors, after being soaked in warm water. The name is sometimes misspelled Crotolaria. Greenhouse kinds are subject to red spider. *C. juncea* yields the Sunn hemp of India. Our common rattle-box, *C. sagittalis*, is often a troublesome weed.

A. *Lvs. apparently simple.*

retùsa, Linn. Annual, 1½ ft. high: branches few, short: lvs. entire, very various in shape, but typically obovate with a short mucro, clothed beneath with short appressed hairs: fls. about 12 in a raceme, yellow, streaked or blotched with purple; standard roundish, notched. Cosmopolitan. June–Aug.—Intro. 1896, as a novelty and called "dwarf golden yellow-flowering pea," "golden yellow sweet pea," etc. The fls. are much less fragrant than the true sweet pea.

verrucòsa, Linn. Annual, erect and nearly glabrous, the branches and fl.-stalks 4-angled: lvs. ovate, shortly petioled, blunt: fls. racemose, numerous, their variegated blue corollas making a magnificent show in early spring. Cosmopolitan in the tropics. B.M. 3034. B.R. 1137. P.M. 13:223.

AA. *Lvs. foliolate (compound).*

B. *Fls. striped with brown or red.*

longirostràta, Hook. & Arn. Greenhouse plant, herbaceous or somewhat shrubby, much branched, 3 ft. high: branches long, slender, glabrous: petioles 1½ in. long; lfts. 3, oblong, with a minute mucro, glabrous above, hoary beneath, with very short, appressed, silky hairs: racemes erect; calyx with 2 upper lobes ovate, the 3 lower ones lanceolate; fls. as many as 25 in a raceme, yellow with reddish or reddish brown stripe along the back of the unopened fls.; standard wider than long, reflexed, notched. W. Mex., Guatemala. B.M. 7306. F.R. 1:809.—Flowering from Dec. to March. Intro. into Kew through the U. S. Dept. Agric. in 1891.

BB. *Fls. not striped, pure yellow.*

incàna, Linn. A woody perennial, 2–4 ft., with stout round branches, the whole plant silky-hairy: lfts. 1½–2 in. long, obtuse, cuneate below, membranous: fls. 12–20 in a raceme, yellow, at least ½in. long: pod nearly sessile, loosely hairy. Common throughout the tropics. B.R. 377.

capénsis, Jacq. Stout, much-branched shrub, 4–5 ft. high: branches terete, appressedly silky; stipules when present petiolulate, obovate and lf.-like, obsolete or wanting on many petioles: lfts. broadly obovate, obtuse or mucronulate, glabrous or minutely pubescent on one or both sides: racemes terminal or opposite the lvs., loose, many-fld., the fls. usually more than 1 in. long; calyx and pod pubescent; wings transversely wrinkled and pitted. S. Afr.—Cult. in S. Fla.

C. Trópeæ, Mattei. An erect or prostrate annual: racemes lateral, often 20-fld. or more; fls. small, yellowish. Italian Somaliland.

WILHELM MILLER.
N. TAYLOR.†

CRÒTON (Greek name, probably of the castor bean). *Euphorbiàceæ.* Herbs, shrubs or trees of no special horticultural value; some cultivated for economic products which they yield.

Pubescence stellate or scaly: lvs. usually alternate: fls. mostly in terminal spikes or racemes, usually monœcious, sometimes dioœcious; sepals usually 5–10, small, petals present at least in the staminate fls.; stamens 5 to many, incurved in the bud; ovary 3-celled, 1 ovule in each cell.—Five hundred or more species in the warmer parts of the world, chiefly in Amer. Several herbaceous species native in S. and W. U. S.



1119. Croton alabamensis.

For *Croton tinctorius,* see *Chrozophora;* for *C. sebiferus,* see *Sapium.* See also *Codiæum* for the commonly cultivated crotons of florists.

Tíglium, Linn. CROTON-OIL PLANT. PHYSIC-NUT. PURGING CROTON. Small tree: lvs. ovate, acuminate, serrate, petiolate, varying from metallic green to bronze and orange: pistillate fls. apetalous. S. E. Asia. Blanco. Fl. Fil. 383.—The powerful purgative, croton oil, is obtained from the seeds. Offered in S. Calif. as an ornamental and curious plant.

Elutèria, Benn. CASCARILLA. SEASIDE BALSAM. SWEETWOOD. Petals in both staminate and pistillate fls.: lvs. ovate-lanceolate, acuminate subcordate. Bahamas. B.M. 7515.—This species and *C. Cascarilla,* Benn., Bahamas and Fla., yield the cascarilla bark.

alabaménsis, E. A. Smith. Fig. 1119. Shrub, 6–9 ft. high: lvs. evergreen, nearly entire, oblong-lanceolate, upper side nearly smooth, lower side densely silvery scaly: both staminate and pistillate fls. with petals. Local in Ala., rarely cult. G.F. 2:594 (see Fig. 1119).

J. B. S. NORTON.

CROWFOOT: *Ranunculus.*

CROWN IMPERIAL: *Fritillaria Imperialis.*

CRUCIANÉLLA (Latin, *a little cross;* from the arrangement of the leaves). *Rubiàceæ.* CROSSWORT. Hardy rock plants of minor importance.

Herbs, often woody at the base: branches usually long, slender, 4-cornered: upper lvs. opposite, without stipules; lower lvs. or all in whorls of 3 or more, linear or lanceolate, rarely ovate or obovate: fls. small, white, rosy or blue.—About 30 species, natives of the Medit. region and W. Asia. The genus is closely related to Asperula, and is distinguished by the fls. having bracts, not an involucre, and the style-branches distinctly unequal instead of nearly equal. The first species below has lately been referred to Asperula. It is of easy cult., preferring light, moderate loam and partial shade. A delicate plant for the front of borders, and capital for the rockery. Prop. chiefly by division, and also by seeds.

stylòsa, Trin. (*Aspérula ciliàta,* Rochel). Annual, prostrate, 6–9 in. high: lvs. in whorls of 8 or 9, lanceolate, hispid: fls. small, crimson-pink, in round terminal heads ½in. diam.; floral parts in 5's; style club-shaped, long exserted, very shortly twice cut at the top. June–Aug. Persia.—Grown, and often acting in England, as a perennial.

angustifòlia, Linn. Annual: lower lvs. 6 to a whorl, linear, on an erect or sometimes branching, smooth st.: fls. white, in spike-like clusters, small, the petals sometimes short mucronate. Medit. region. July.

C. chloróstachys, Fisch. & Mey. Annual, rough and spreading, but the whole plant only 4–6 in. high: fls. small, in spike-like clusters.—*C. glomeràta,* Bieb. (Asperula glomerata, Griseb.), has yellowish green fls. in many interrupted spikes. Palestine to Persia. Properly an Asperula.

N. TAYLOR.†

CRYPTÁNTHE (Greek, for *hidden flower*). *Boraginàceæ.* NIEVITAS. This genus includes many species referred by some writers to Eritrichium and Krynitzkia, but probably none of them is in cult. They are mostly annuals, with white fls., which are usually sessile: calyx 5-parted to the base, as long as the corolla-tube; segms. more or less hispid or with hooked bristles, in fr. closely embracing the nutlets, eventually deciduous: nutlets 4, sometimes 3, 2 or 1, smooth, papillate, or muriculate, never rugose.—Over 60 species, in Pacific N. Amer., southward, into N. Mex. and Chile. **C. glomeràta,** Lehm. (*Krynítzkia glomeràta,* Gray), is a coarse biennial, 1–3 ft. high: lvs. spatulate or linear-spatulate. Plains, along eastern base of Rocky Mts. **C. barbígera,** Greene (*K. barbígera,* Gray. *Eritrichium barbígerum,* Gray). Nine to 12 in. high: lvs. linear. S. Calif.

CRYPTÁNTHUS (Greek, for *hidden flower*). *Bromeliàceæ.* Brazilian epiphytal bromeliads, differing from Æchmea and Billbergia (which see for culture) in the tubular calyx and the dense heads of flowers nearly sessile amongst the leaves.

Leaves crowded in a rosette, recurved-spreading, spinulose-serrate: fls. in a terminal head, nearly buried beneath the bracts; petals oblong, joined at the base; stamens attached to corolla-tube.—Monogr. by Mez (who recognizes 8 species) in DC. Monogr. Phaner. 9 (1896); by some, all are considered to be forms of one species.

A. *Lvs. not narrowed or petiolate above the sheath.*

acaùlis, Beer (*Tillándsia acaùlis*, Lindl. *C. undulàtus*, Otto & Dietr.). A few inches high, suckering freely: lvs. sea-green, long-pointed and spreading, weak-spiny: fls. white, nestling deep in the foliage. B.R. 1157.—A very variable plant, of which Mez recognizes the following leading types:

Var. **genuìnus**, Mez. Stemless or very nearly so: lvs. sub-elliptic-lanceolate, strongly undulate, gray-scurfy beneath, scurfy above.

Var. **díscolor**, Mez (*C. díscolor*, Otto & Dietr.). Stemless or nearly so: lvs. elongated, scarcely undulate, silvery-scurfy below, glabrous or nearly so above.

Var. **rùber**, Mez (*C. rùber*, Beer). Produces a branching st. or trunk: lvs. short, strongly undulate, reddish.

Var. **bromelioìdes**, Mez (*C. bromelioìdes*, Otto & Dietr.). St. tall: lvs. much elongated, scarcely undulate, remotely spinulose.

Var. **diversifòlius**, Mez (*C. diversifòlius*, Beer). St.-bearing: lvs. elongate-lingulate, deep green above, silvery-scurfy beneath.

zonàtus, Beer. Fig. 1120. Lvs. oblong-lanceolate, the margin undulate and densely serrate-spinulose, marked with transverse bands of white: fls. white.

bivittàtus, Regel (*Billbérgia bivittàta*, Hook. *B. vittàta*, Hort.). Nearly or quite stemless: lvs. long-oblong, curving, long-pointed, somewhat undulate, spiny, dull brown beneath, green above and with 2 narrow buff or reddish bars extending the length of the lf.: fls. white. B.M. 5270.

AA. *Lvs. narrowed or petiolate above the sheath.*

Beùckeri, Morr. Lvs. 10–20, oblong, pointed, canaliculate at base, very finely spiny, brownish green or rosy and spotted or striped with light green: fls. white.

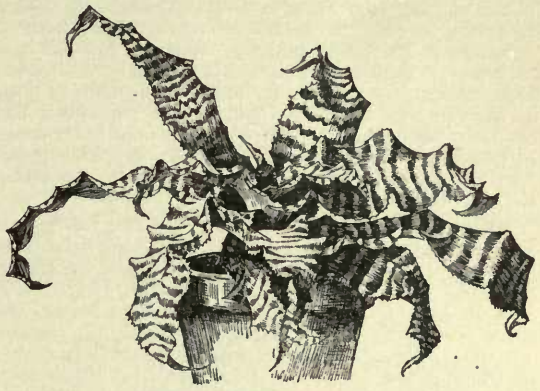
C. nítidus, Bull. A recent importation from Brazil, described as a stemless species with sessile dark olive-green lvs., marked with a band of cream-color each side of the midrib.

L. H. B.
GEORGE V. NASH.†

CRYPTOCORÝNE (Greek-made name, referring to the spadix being inclosed or hidden in the spathe). Syn. *Myrioblástus*. *Aràceæ*. Aquatic or paludose herbs of 20–30 species in Trop. Asia and the Malayan Archipelago, rarely seen in choice collections but apparently not in the trade. They have creeping and stoloniferous rhizomes, strongly ribbed oblong or linear or ovate lvs., monœcious fls. without perianth, the upper ones on the spadix staminate and the lower pistillate: spathe closed, the infl. wholly included. The species require the treatment given tender arums. *C. ciliàta*, Fisch., 1 ft., lvs. narrow, stalked: fls. fragrant in a long tubular peduncled spathe which is fringed at the top. *C. retrospiràlis*, Fisch., plant slender with very narrow almost grass-like lvs., and small spathe terminating in a spiral or twist. *C. Griffithii*, Schott, with lvs. ovate or orbicular-oblong marked with fine red lines; spathe purple. B.M. 7719.

CRYPTOGAMS are flowerless plants, producing not seeds but spores. The whole vegetable kingdom was formerly thrown into two classes, the flowering plants or phanerogams and the flowerless or cryptogams. Cryptogam means "concealed nuptials," and phanerogam "visible nuptials." These names were given when it was thought that the sexual parts of the flowerless plants were very obscure or even wanting. The word is now falling into disfavor with botanists. Cryptogams are of less horticultural interest than the flowering plants, although they include the ferns, and some interesting smaller groups, as selaginellas, lycopods or club mosses. The word cryptogam is now mostly given up by botanists as representing a taxonomic group, as the name is founded on imperfect or false analogies. The plants covered by this name are now distributed in the great divisions of thallophytes, bryophytes and pteridophytes; and the phenogams or phanerogams are spoken of as spermatophytes (see the categories on p. 2, Vol. I.).

CRYPTOGRÁMMA (Greek, *a concealed line*, alluding to the sub-marginal sori). *Polypodiàceæ*. Hardy subalpine ferns of both hemispheres of interest mainly to the collector.



1120. Cryptanthus zonatus.

Leaves of 2 sorts, the fertile lvs. contracted and the sori covered by the infolded margin of the segms., forming pod-like bodies. Besides our native species, a third one, *C. crispa*, is found in Eu., and a fourth in the Himalayas. Name often incorrectly written Cryptogramme. Cult. simple.

acrostichoìdes, R. Br. ROCK-BRAKE. Height about 8 in.: lvs. numerous, 4–6 in. long, on tufted straw-colored stalks, tri-quadripinnatifid, with toothed or incised segms., the sporophylls with longer stalks, less divided and with pod-like segms. Canada to Colo., Calif., and northward.

Stélleri, Prantl (*Pellæa gràcilis*, Hook. *P. Stélleri*, Baker). SLENDER ROCK-BRAKE. Lvs. 4–10 in. long, very delicate in texture, withering by Aug., few to a plant, about 2 pinnate.—Grown best in loose well-drained leaf-mold. A rather rare rock fern of the eastern states, offered by some dealers in hardy ferns. Grows in crevices of cliffs, or in moss.

R. C. BENEDICT.†

CRYPTÓLEPIS (Greek, *hidden scale*). *Asclepiadàceæ*. Shrubs, erect or twining, of Trop. Asia and Afr. Lvs. opposite: fls. in a loosely forking, few-fld. cyme; calyx deeply 5-parted, with 5 scales at base; corolla with spreading limb, the tube short-cylindrical or campanulate, the lobes 5 and linear, spreading or deflexed and twisted; corona of 5 scales attached at or near the middle of the tube: follicles terete and smooth, spreading.—Species 20. Cult. only in S. Calif. and S. Fla. **C. Buchânanii**, Roem. & Schult. A twining shrub with yellow fls., resembling those of an echites: lvs. 3–6 in. long, leathery, shining above: cymes very short-stalked, paniculate. India. **C. longiflòra**, Regel. Dwarf and compact growing, with long lvs. tinted with red; tubular white fls., as in *Bouvardia jasminiflora*. Native country unknown.

CRYPTOMÈRIA (Greek, *kryptos*, hidden, *meros*, part; meaning doubtful). *Pinàceæ*. Ornamental evergreen cultivated for its handsome habit and foliage.

Large pyramidal tree, with a straight slender trunk, covered with reddish brown bark and with verticillate spreading branches, ascending at the extremities: lvs. spirally arranged, linear-subulate, acute, slightly curved, decurrent at the base: fls. monœcious; stami-

nate oblong, yellow, forming short racemes at the end of the branches, pistillate globular, solitary, at the end of short branchlets: cone globular, with thick, wedge-shaped scales, furnished with a recurved point on the back and with pointed lobes at the apex, each scale with 3–5 narrow-winged, erect seeds.—One species in China and Japan, extensively planted for avenues, and as timber trees in the latter country, where the light and easily worked but durable wood is much used.

It is hardy as far north as New York, and thrives in sheltered positions even in New England. It seems, however, in cultivation, not to assume the beauty it possesses in its native country. With us, it looks best as a young plant, when it much resembles the *Araucaria excelsa*. It is therefore sometimes grown in pots. It thrives best in a rich, loamy and moist soil and sheltered position. Propagated by seeds or by cuttings of growing wood, especially var. *elegans*, which grows very readily. The horticultural varieties are also sometimes increased by grafting.

japónica, Don. Tree, attaining 125 ft.: lvs. linear-subulate, compressed and slightly 4- or 3-angled, bluish green, ½–1 in. long: cone brownish red, ¾–1 in. across. S.Z. 124. H.I. 7:668. R.H. 1887, p. 392. Gng. 4:197. F.E. 10:510. G.F. 6:446.—Of the garden forms, the most desirable is var. **élegans,** Beissn. (*C. élegans,* Veitch). Low, dense tree, with horizontal branches and pendulous branchlets: lvs. linear, flattened, soft, spreading, longer than in the type, bright green, changing to bronzy red in fall and winter. Very handsome when young, but short-lived. Var. **araucaroìdes,** Carr. Of regular pyramidal habit, with short, thick falcate lvs., resembling *Araucaria excelsa*. Var. **compácta,** Beissn. Of very compact habit, with bluish green foliage. Var. **pyramidàlis,** Carr. Of narrow pyramidal compact habit, dark bluish green, not changing to reddish brown during winter. Var. **Lóbbii,** Carr. Of compact habit, with shorter and more appressed bright and deep green lvs. Var. **nàna,** Knight. Dwarf and procumbent, densely branched form; adapted for rockeries. Var. **spiràlis,** Veitch. Slender shrub, with strongly falcate lvs., twisted spirally around the branchlets. S.Z. 124, fig. 4. ALFRED REHDER.

CRYPTOPHORÁNTHUS (Greek, meaning to *bear hidden flowers*). *Orchidàceæ*. A few Trop. American orchids closely allied to Masdevallia and Pleurothallis, remarkable for the almost closed fl. within which is hidden the lip: sepals united at the base into a short tube and joined also at the apex, the petals being inside; there are openings or "windows" on either side where the sepals spread apart at their middles. The species require the cult. given Pleurothallis. Apparently none is in the American trade. *C. maculàtus,* Rolfe (*Pleurothállis maculàta,* Rolfe), is a little plant with numerous yellow densely crimson-spotted fls. *C. Dayànus,* Rolfe (*Masdevállia Dayànus,* Reichb. f.). and *C. atropurpùreus,* Rodr. (*Pleurothállis* and *Masdevállia fenestràta,* Hort.), may be expected; the former has upper sepal yellowish white and purple-spotted keels, and inferior sepals (joined) orange with brown spots; the latter has dark purple solitary fls. *C. Moòrei,* Rolfe, has small dull red-purple fls. with darker lines, the lateral openings about ½in. long: lvs. broadly elliptic, purple beneath, about 1½ in. long.

CRYPTOPÝRUM: *Triticum.*

CRYPTOSTÈGIA (Greek, *krupto,* conceal, and *stego,* cover; referring to the 5-scaled crown in the corolla-tube, which is not exposed to view). *Asclepiadàceæ*. Tropical climbers.

Leaves opposite: fls. large and showy in a terminal trichotomous cyme; corolla funnel-shaped, the tube short.—Only 2 species, 1 from Trop. Afr., and 1 from Madagascar. The juice of *C. grandiflora,* when exposed to the sunshine, produces caoutchouc. See Dict. Economic Products India 2:625. The plant is cult. in India for this purpose. It is rarely cult. in Old World greenhouses for ornament. It is said to be of easy cult. in a warmhouse and prop. by cuttings.

grandiflòra, R. Br. (*Nèrium grandiflòrum,* Roxbg.). St. erect, woody: branches twining: lvs. opposite, short-stalked, oblong, entire, 3 in. long, 1½ in. wide: fls. in a short spreading cyme, reddish purple, becoming lilac or pale pink, about 2 in. across, twisted in the bud: fr. a follicle. Old World, probably Indian origin, but established in the African Isls. of the Indian Ocean, especially Reunion. Hooker, however, thinks that it was originally a Trop. African plant. B.R. 435.—Once cult. at Oneco, Fla., by Reasoner, and not uncommon in botanic gardens under glass. Called pulay or palay in India where it is widely cult. as an ornamental. Not important as a rubber plant.

madagascariénsis, Hemsl. A climbing glabrous shrub: lvs. short-petioled, leathery, variable in outline, 2–4 in. long: fls. 2½–3 in. across, pink or whitish, not lilac as in many specimens of *C. grandiflora;* corolla-lobes longer than the tube. Madagascar.—A very showy greenhouse climber with cymose infl.

N. TAYLOR.†

CRYPTOSTÉMMA (Greek, *hidden crown*). *Compósitæ*. Two or 3 hoary herbs, by some united with Arctotis, apparently not in the trade, but sometimes mentioned in gardening literature: diffuse or creeping, with basal or alternate lvs. that are dentate or lyrate-pinnatisect, villous above and white-tomentose or woolly beneath: heads radiate, yellow or more or less purplish, rather large, pedunculed, or solitary on leafless scapes, the rays sterile: achene densely villous, 5-ribbed, the pappus paleaceous and in 1 series. *C. calendulàceum,* R. Br. (*C. lusitánicum,* Hort.), is a free-blooming annual with pale yellow rays and a dark brown disk, the heads on 1-fld. peduncles: lvs. pinnatifid, 3-nerved. Cape and Austral. B.M. 2252. G.C. III. 28:390, desc. *C. Forbesiànum,* Harv., and *C. níveum,* Nichols. (*Microstèphium níveum,* Less.), of S. Afr., may be more or less in cult. Both have yellow rays, in the latter the heads being solitary and the plant decumbent or creeping and the lvs. ovate, cordate or orbicular; in the former the lvs. are mostly pinnatisect, the margins revolute.

CRYPTÓSTYLIS (*hidden style,* Greek). Syn. *Zosteróstylis. Orchidàceæ*. Eight or 10 terrestrial orchids of the E. Indies, Malaya and Austral., allied to Pogonia. Lvs. solitary or few, narrow and membranaceous, on stiff petioles: fls. rather large, racemose or spicate on simple sheathed scapes, the sepals and petals very slender or even awl-like and nearly or quite equal; lip large, sessile, the broad base inclosing the column and then expanding into a broad blade. *C. arachnìtes,* Blume. Rootstock fleshy: lvs. erect, green, lanceolate: fls. on a scape 18 in. or less high, many and spider-like, the sepals and petals green and the fleshy lip purple and mottled, pubescent and grooved. India (Ceylon, Khasia). B.M. 5381. A curious indoor orchid.

CTENÁNTHE (Greek, *comb-flower*). *Marantàceæ*. About a dozen Brazilian plants closely allied to Calathea and Maranta, differing from the former in belonging to the 1-seeded section of the family and from the latter in having a shorter corolla-tube and different shaped fls. Sepals 3, free and equal, somewhat parchment-like; corolla-tube short but wide, the lobes 3 and nearly equal and hooded at the apex; staminal tube very short; 2 exterior staminodia petal-like, short, obovate and hooded, with lateral deflexed lobes. The ctenanthes are perennial herbs with basal and cauline lvs. that are more or less petiolate, and crowded fls. in terminal spikes or racemes. They are glasshouse plants requir-

ing the treatment of calathea; apparently little known in American collections. The species fall into two groups, those with variegated and those with green lvs. Of the former group are **C. Kummeriàna,** Eichl., and **C. Oppenheimiàna,** Schum., the former being 20 in. or less tall and with villous ovary and raceme, the latter robust and 3 ft. or more tall and ovary glabrous. Of the plain-lvd. kinds, **C. Luschnathiàna,** Eichl. (*C. compréssa* var. *Luschnathiàna,* Schum.), and **C. setòsa,** Eichl., may be found in choice collections; both species grow about 3 ft. high, the former having ovate-acute bracts and the latter long-acuminate brown-villous bracts.

CUCKOO FLOWER: *Cardamine pratensis.*

CUCKOO-PINT: *Arum.*

CUCUMBER. Plate XXXI. The common cucumbers are derived from an Asian species, *Cucumis sativus* (see *Cucumis*), which has long been known in cultivation. The so-called West India gherkin, which is commonly classed with the cucumbers, is *Cucumis Anguria.* The snake, or serpent cucumber is more properly a muskmelon, and should be designated botanically as *Cucumis Melo* var. *flexuosus* (cf. A. G. 14:206). The "musk cucumber" is *Cucumis moschata,* Hort., which is probably identical with concombre musqué, referred to *Sicana odorifera* by Le Potager d'un Curieux, known in this country as cassabanana. The Mandéra cucumber is *Cucumis Sacleuxii,* Paill. et Bois. (Pot. d'un Curieux), but it is not in cultivation in this country. None of these is of any particular importance except the common types of *Cucumis sativus.* These are extensively cultivated in all civilized countries as field and as garden crops. They come into commerce as pickles packed in bottles and barrels, and are very extensively used in this form. Of late, the forcing of cucumbers under glass has come to be an important industry in the eastern states.

Field culture.

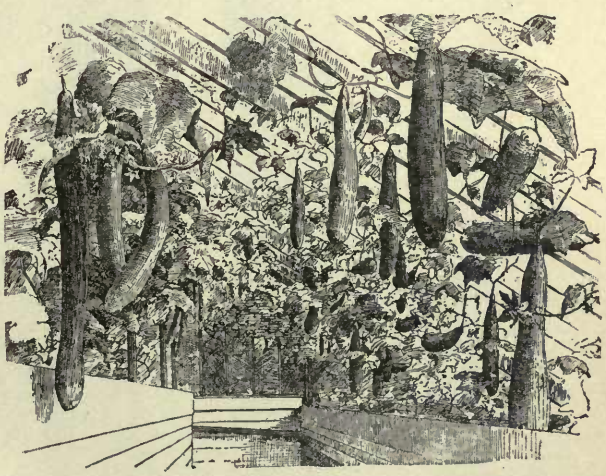
The common cucumber is an important field and garden crop and may be classed as one of the standard crops of the vegetable-garden. The fruit is used as a table salad, eaten raw, with the usual salad seasonings, and is pickled in large quantities. The cucumber is pickled in both large and small sizes, both by the housewife and commercially on a large scale. The small fruit, of not more than a day or two's growth and measuring from 1 to 2 inches in length, makes the most desirable and delicate of pickles. These are packed in bottles for the commercial trade and bring fancy prices. Larger sizes are pickled and sold by the keg or barrel.

The cucumber is a native of the tropics and tender of frost. It should be planted in a warm location, after danger from frost is past. For the early crop—and earliness is of prime importance to the commercial vegetable-grower—a sandy soil is preferable, supplied with an abundance of well-rotted stable manure. The seed may be sown in hills 3 feet apart with rows 6 feet apart, or may be planted by machine (the common seed-drill) in drills 6 feet apart. In either case, an abundance of seed should be used, for severe injury by insect pests often occurs in the early stages of the cucumber's life. Plants may be started under glass to hasten maturity. The seed is sometimes sown in pots or baskets or in inverted sods and these protected and so managed that the cucumber plant receives those conditions most suitable to its rapid and healthy growth. These conditions are: a temperature between 60° and 65° at night, which may be allowed to rise to 100° in bright sunshine; an ample supply of moisture; sufficient ventilation, without draft, to prevent a soft brittle growth. It is almost impossible to transplant cucumber seedlings and secure satisfactory results if the roots are disturbed. A glass-covered frame may be used over seed planted in the field, and yields good returns on labor and equipment. Any method whereby marketable cucumbers may be obtained a few days earlier, if not extravagant of time and labor, will pay handsomely.

The cucumber, in the field, should yield marketable fruits in seven to eight weeks from seed and continue in profitable bearing until frost. It is customary among commercial growers to allow two or three plants to the hill, and when grown in drills, one plant is left every 18 to 24 inches.

During the height of the growing season, which is usually in August when the days are hot and nights moist and warm, the cucumbers need to be picked every day. The fruit is ready to harvest when it is well filled out, nearly cylindrical in shape. When immature it is somewhat furrowed. When allowed to remain too long, it becomes swollen in its middle portion and cannot be sold as first quality. Cucumbers are marketed by the dozen, the field crop often bringing as much as 60 cents a dozen at the first and selling as low as 5 cents a dozen at the glut of the market.

The cucumber plant is affected by serious insect pests and fungous diseases. Of the insect pests, the striped cucumber beetle is the most serious and difficult to combat. It feeds on the leaves, usually on the

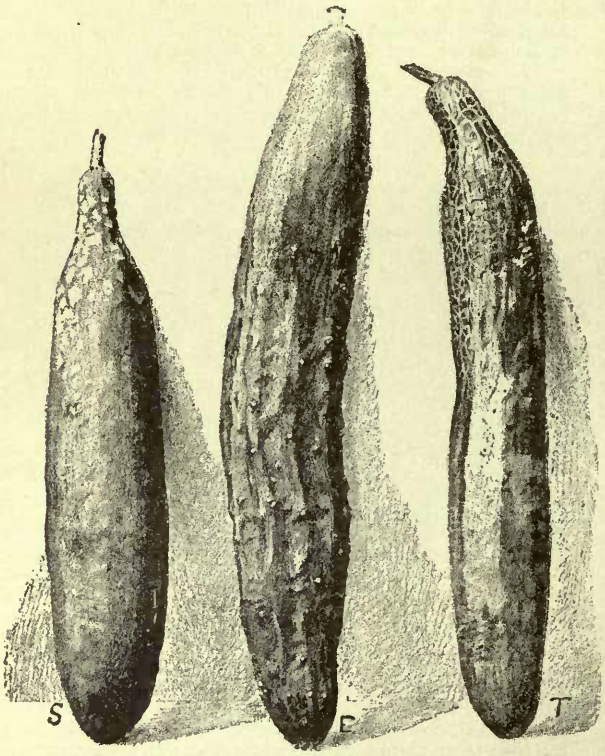


1121. House of English cucumbers.

under sides, and appears soon after the cucumber seedlings break ground. This cucumber beetle seems to be little affected by the common remedies for chewing insects. This is probably largely due to its activity, the beetle moving to unpoisoned parts of the plant, and also to the fact that rarely, in commercial practice, is the under side of the leaves thoroughly poisoned. Arsenate of lead applied in more than ordinary strength is the most satisfactory remedy. Hammond's Slug Shot, dusted lightly over the plants, will drive the bugs away, while a teaspoonful of paris green mixed with two pounds of flour makes also an excellent mixture with which to fight the bugs. Or cover the young plants with small wire or hoop frames, over which fine netting is stretched. If the plants are kept quite free from attack till these protectors are outgrown, they will usually suffer little damage. Plants started in hotbeds or greenhouses may usually be kept free at first, and this is the chief advantage of such practices. The cucumber beetles are kept away somewhat at times by strewing tobacco stems thickly under the plants; and kerosene emulsion will sometimes discommode the young squash bugs without killing the vines, but usually not. What is known as the cucumber blight (*Pseudoperonospora cubensis*) has done much to discourage the growth of cucumbers. This fungus may be repulsed by thorough spraying with bordeaux and the plants should

be kept covered with bordeaux throughout their growth. This will require at least three or four sprayings. The growth of the vines, which usually completely covers the ground, prevents late sprayings, which are often necessary to maintain healthy growth and insure maximum returns.

The common field varieties most popular in the United States grown for a slicing cucumber are of the White Spine type. Many of the so-called White Spine varieties now on the market are not typical of the original White Spine cucumber, which is a fruit averaging about 6 inches in length, rather blunt on both ends, with white prickles appearing at frequent intervals over the surface. The seed end is light-colored, in mature specimens almost white with whitish stripes extending toward the stem end from one-third to one-half the length of the cucumber. What is often cata-



1122. Three prominent varieties of English or Forcing cucumber. S. Sion House; E. Duke of Edinburgh; T. Telegraph. (×⅙)

logued as the Improved White Spine has become more popular among growers within recent years. This type possesses some of the characteristics of the popular English type of cucumber known as the Telegraph. The improved type has been obtained by crossing the White Spine with the Telegraph or some closely related variety. This cross has resulted in an increased length and darker green color, with a fewer number of spines and seeds and a more common tapering of the ends. All of these changes have apparently been beneficial and have been well fixed by careful selection. This is well illustrated by the cucumber of the White Spine type sold as Woodruff Hybrid.

The English type of cucumbers is raised on a small scale in this country but infrequently for market purposes.

Forcing of cucumbers.

The commercial production of cucumbers under glass has assumed large proportions. This crop ranks second in commercial importance among greenhouse-grown vegetable crops, lettuce only exceeding it in importance. The cucumber crop is ordinarily grown in the spring of the year after two or three crops of lettuce have been removed, and it continues to occupy the ground until the vines cease bearing, due either to poor management, pests or some similar trouble. The cucumber should come into bearing six to eight weeks after setting in the houses. It is the customary plan to plant the seed in 4- to 6-inch clay pots about two weeks before the house to be used is ready for setting. These pots are often placed over manure heat and should always be in a warm house separate from the lettuce. Two weeks should be sufficient to allow the plant a good start, two or three pairs of leaves being all the development desired before setting in the permanent location. Careful management is essential to a healthy growth, for many pests prove more serious in the glasshouse than in the field. A night temperature not below 60° F. is very essential, while the day temperature may go to 90° F. without danger in bright sunshine. The appearance of the plants will immediately indicate, to the experienced observer, the conditions under which the crop has been grown. A short stocky growth between joints with dark green foliage is desirable. There are localities in which growers make cucumbers the all-the-year-round crop in the glasshouse, usually growing crops from two seedings during the entire season. It requires more skill to produce good cucumbers during the fall and winter months than from February on, and the yield is much lighter in the late fall and early winter than for the spring crop. All cucumbers require an abundance of moisture and food. It has become a common practice in certain sections to mulch the cucumber vines in the greenhouse with good quality strawy manure to the depth of 3 or 4 inches and apply the water directly on the manure. This practice eliminates the packing and puddling of the soil often caused by direct heavy watering, increases the supply of readily available plant-food and gives the roots a good opportunity to grow near the surface where air is available and still be protected from the drying out which occurs when the soil is directly exposed to the sun.

The pruning and training of the cucumbers in the greenhouse is of much importance. A number of methods are in common use, one of the most common and practical of which is: Stretch a wire tightly the length of the house at the base of the plants which may be set in rows 3 feet apart and 18 inches to 2 feet apart in the rows; fasten at the base of each plant a soft but strong twine known in tobacco-growing sections as tobacco twine, securing this single twine to an overhead wire running parallel and directly over the ground wire, but not stretching the string tight. As the cucumber plant grows, it is twined about this string to which it clings by tendrils. When the plant reaches the upper wire it is either allowed to grow at will over wires provided for an overhead support and from which the cucumbers usually hang down where they can be easily picked, or it is pruned and the encouragement of fruiting along the upright stem continued. In the meantime more or less fruit has been harvested and at each joint a lateral branch has appeared. It is necessary to cut these off. Some growers prefer to take them off back to the main stem, while others, if a cucumber is obtainable on the first joint of the lateral, nip the lateral just beyond this point.

"In the greenhouse, cucumbers are liable to damage from mite, aphis, root-gall and mildew. For the mite, syringe the plant and pick off the infested lvs.; for aphis, use tobacco fumigation and pick infested lvs.; for root-gall, use soil which has been thoroughly frozen; for mildew, improve the sanitary conditions, and then use sulfur."—Bailey, "Forcing-Book."

Yields of twenty-five to one hundred and twenty-five cucumbers have been secured from single plants. The expert growers, under normally good circumstances,

may expect to obtain a yield of six to seven dozen marketable cucumbers from a plant.

Varieties of cucumber.

There are a great many varieties of cucumbers in cultivation. This means that the group is variable, the varieties comparatively unstable, and varietal distinctions somewhat uncertain. Nevertheless, there are certain dominant types which may be separated, and around which most of the varieties may be conveniently classified. The principal types are the following:

Common cucumber, *Cucumis sativus.*

I. English forcing type (var. *anglicus*): Fig. 1122. Large-lvd., strong-growing, slow-maturing plants, not suited to outdoor cult.: fr. large, long, smooth, usually green, with few or early-deciduous black spines. Telegraph, Sion House, Tailby Hybrid, Kenyon, Lorne, Edinburgh, Blue Gown.

II. Field varieties (hill or ridge cucumbers).

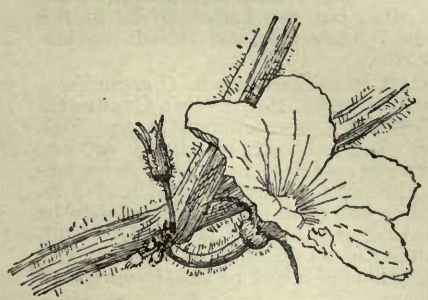
a. Black Spine varieties.

1. Netted Russian type: Small, short-jointed vines, bearing more or less in clusters, small, ellipsoidal fr. covered with many small, black, deciduous spines: fr. green, ripening to dark reddish yellow, on a cracking, chartaceous skin. Early-maturing and prolific. Netted Russian, Everbearing, New Siberian, Parisian Prolific Pickle.
2. Early Cluster type: Small or medium vines: fr. small, usually less than twice as long as thick, indistinctly ribbed, green, ripening yellow, with scattered, large, black spines. Early Cluster, Early Frame.
3. Medium Green type: Intermediate in size of vine and fr. between the last and next: fr. about twice as long as thick, green, ripening yellow, with scattering, large black spines. Nichols Medium. Green, Chicago Pickle.
4. Long Green type: One of the best fixed types, representing, perhaps, one of the more primitive stages in the evolution of the group. Vines large, long and free-growing: fr. large and long, green, ripening yellow, with scattered, large, black spines. Long Green, Japanese Climbing.

b. White Spine varieties.

5. White Spine type: A strong and important type: plants medium large, vigorous: fr. medium large, about thrice as long as thick, green, ripening white, with scattering, large, white spines. There are many selected strains of White Spine. Cool and Crisp, Davis Perfect and Fordhook Famous belong here.
6. Giant Pera type: Mostly poorly fixed varieties, having large rather unthrifty vines, bearing large frs. tardily and sparsely, which are white or whitish, smooth or with scattering, deciduous, usually white spines. Chicago Giant, Goliath, Giant Pera, White Wonder, Long Green China.

Sikkim cucumber, *Cucumis sativus* var. *sikkimensis.* Plant small and stocky, much like the common cucumber: fr. large, reddish brown marked with yellow. (The Egyptian hair cucumber, of Haage & Schmidt, as we have grown it, is apparently an odd form of *Cucumis sativus*, and may belong here. It has a medium-sized white fr., densely covered with soft, white hair. The plant resembles the Sikkim cucumber.) Not in general cult.



1123. Staminate flower of Cucumis Melo. (Nat. size)

Snake or Serpent cucumber, *Cucumis Melo* var. *flexuosus.* Vines resembling those of muskmelon: fr. very long, twisted, ribbed-cylindrical, green, tardily yellowing, covered with dense, woolly hairs.

West India gherkin, *Cucumis Anguria.* Figs. 1127, 1128. Vines small and slender, somewhat resembling a slender watermelon plant: fr. very abundant, small, ellipsoid, covered with warts and spines, green, tardily whitening. Good for pickles.

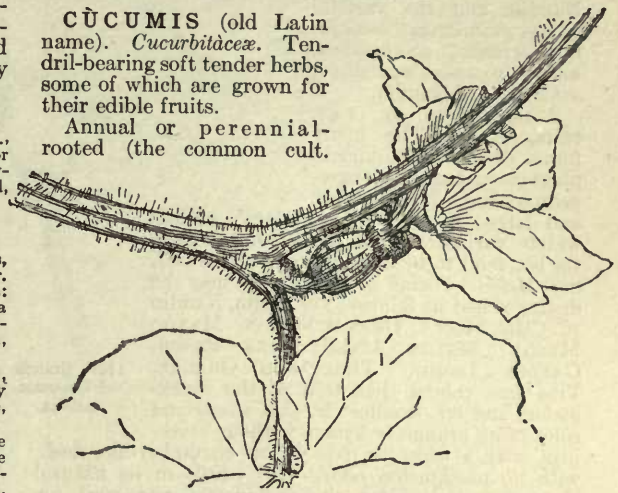
These varieties are mostly all good for one purpose or another. The small sorts are naturally preferred for pickling, the medium sorts for slicing, and the large, late varieties for ripe fruits. The White Spine varieties are great favorites for slicing, and only less so for pickling.

F. A. Waugh.
H. F. Tompson.

CUCUMBER TREE: *Averrhoa* and *Magnolia.*

CÙCUMIS (old Latin name). *Cucurbitàceæ.* Tendril-bearing soft tender herbs, some of which are grown for their edible fruits.

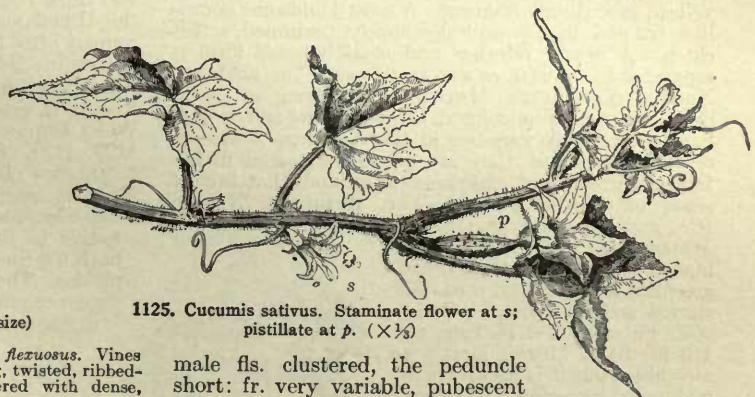
Annual or perennial-rooted (the common cult. species annual), with large alternate entire or palmately lobed or dissected lvs.: monœcious (rarely diœcious); sterile fls. in clusters, not long-stalked, the fertile ones solitary and mostly short-stalked in the axils; corolla of 5 deep acute lobes; stamens not united; stigmas 3, obtuse: tendrils simple: fr. a pepo, mostly 3-celled, usually indehiscent, fleshy or thick, globular, oblong or cylindrical, sometimes echinate, many-seeded.—About 30 species of villous or spinescent climbers and trailers with annual sts., in warm parts of the globe, most abundant in Afr. Monogr. by Cogniaux, DC. Monogr. Phaner. 3. See, also, Naudin, Ann. Sci. Nat. (Bot.) IV. 11:9; 12:108.



1124. Pistillate flower of Cucumis Melo. (Natural size.)

A. *The melon group: fr. smooth at maturity or only pubescent (not spiny or tuberculate).*

Mèlo, Linn. Melon. Muskmelon. Figs. 1123, 1124. Long-running, hairy or villous annual: lvs. large, soft-hairy, round-heart-shaped or reniform, sometimes rounded-lobed and more or less denticulate:



1125. Cucumis sativus. Staminate flower at *s*; pistillate at *p*. (×⅓)

male fls. clustered, the peduncle short: fr. very variable, pubescent or becoming glabrous. S. Asia and Trop. Afr.—Very variable, and widely cult.

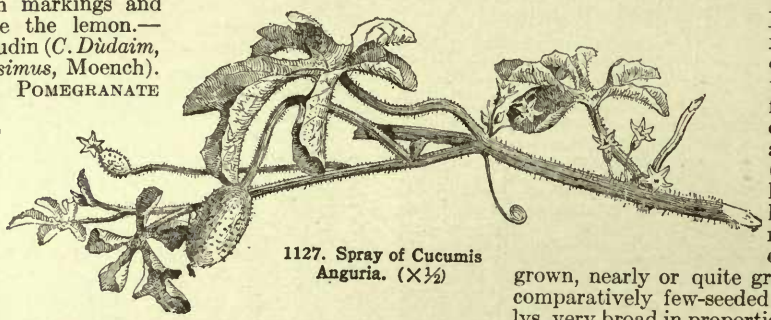
1. Subspecies or var. **agrèstis,** Naudin. The wild or run-wild or spontaneous plant: slender: fls. small, short-peduncled, often in 2's or 3's: fr. oblong or turbinate, size of a plum, not edible.—To this subspecies

Cogniaux refers such names as *C. Chate*, Linn., *C. pubescens*, Willd., *C. maculatus*, Willd., *C. campechianus* Kunth, *C. Gurmia* and *C. Chaeta*, Wall., *C. maderaspatanus*, Roxbg., *C. eriocarpus*, Boiss., *C. picrocarpus* and *C. jucundus*, Muell., *C. trigonus*, Benth. (not Roxbg.), *C. Pancherianus*, Naudin, and the varietal names *maculatus*, *Cossonianus*, *texanus*, *cantonianus*, *saharunporensis*, *anatolicus*, *æthiopicus* of Naudin.



1126. Branch of Cucumis sativus.

2. Subspecies or var. **cúlta,** Kurz. The many forms of the cult. melon: plant very robust: fls. longer-pedunculate, 3–5 together and large: fr. large to very large, edible: widely variable; when forced under glass the lvs. tend to be more prominently lobed. See *Melon*. Forms of this group may be distinguished as follows: Var. **Chìto,** Naudin (*C. Chìto*, Morr.). Orange Melon. Mango Melon. Melon Apple. Vine Peach. Garden Lemon. Vegetable Orange. Vine less robust than that of the muskmelon, and lvs. smaller: fr. size, shape and color of an orange or lemon, without markings, with a white or pale yellow cucumber-like flesh, with no muskmelon odor. Not edible in its natural state, but useful for the making of preserves (or "mangoes") and pickles. Name pronounced *keeto*. Cf. Bull. 15, Cornell Exp. Sta.; A.G. 14:206.—The "Lemon cucumber" offered by dealers is apparently a form of *C. sativus*, the fruit being nearly round with yellow and green markings and smooth skin, like the lemon.—Var. **Dùdaim,** Naudin (*C. Dùdaim*, Linn. *C. odoratissimus*, Moench). Dudaim Melon. Pomegranate Melon. Queen Anne's Pocket Melon. Vine small, as in the last: fr. size and shape of an orange, somewhat flattened at the ends, very regular and smooth, marbled with longitudinal markings of cinnamon-brown overlying yellow, exceedingly fragrant. A most handsome gourd-like fr. and highly and deliciously perfumed. Not eaten. A nearly odorless and scarlet-rinded form is separated by Naudin as var. *erythræus*.—Var. **acídulus,** Naudin. Cucumber Melon. Frs. oblong or cylindrical, mottled or unicolored, the flesh white and cucumber-flavored. No varieties in the American trade are of this group, but they are occasionally seen in botanical gardens and experimental grounds that import seeds of oriental plants.—Var. **flexuòsus,** Naudin (*C. flexuòsus*, Linn.). Snake Melon. Snake Cucumber. Fr. many times longer than broad, greenish at maturity, variously curved and furrowed. A.G. 14: 203. Fr. often 2–3 ft. long, and 1–3 in. diam. Grown mostly as an oddity, but it is useful for the making of conserves. The hard-shelled snake gourd is a Lagenaria (which see).—Var. **inodòrus,** Naudin. Winter Melon. Lvs. lighter colored, less hairy, narrower: frs. possessing little or none of the common muskmelon odor, and keeping long. The winter muskmelons are little known in this country, although they are worthy of popularity. Much cult. in parts of the Medit. region.—Var. **saccharìnus,** Naudin. Pineapple Melon. Comprising varieties of oblong shape and very sweet flesh. Not sufficiently distinct from the next.—Var. **reticulàtus,** Naudin. Nutmeg or Netted Melons. Frs. softer rinded, more or less netted, or sometimes almost plain or smooth. Comprises the common muskmelons, aside from cantaloupes.—Var. **cantalupénsis,** Naudin. Cantaloupe. Rock Melons. Frs. mostly hard-rinded, more or less warty, scaly or rough, often deeply furrowed or grooved. Name derived from Cantaluppi, near Rome, a former country seat of the Pope, whither this type of melons was brought from Armenia. In the U. S. the word cantaloupe is often used as a generic name for muskmelon, but it is properly a name of only one group of muskmelons—the hard and scaly-rinded (see Waugh, G.F. 8:183).

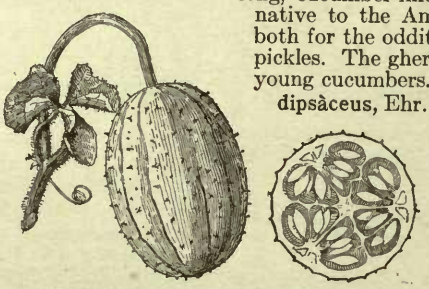


1127. Spray of Cucumis Anguria. (×½)

aa. *The cucumber group: fr. spiny or tuberculate (nearly unarmed in C. Sacleuxii).*

satîvus, Linn. Cucumber. Figs. 1125, 1126. Long-running, prickly: lvs. usually 3-lobed (or strongly angled), the middle lobe most prominent and often pointed: fr. prickly or muricate, at least when young, but in some varieties becoming smooth, mostly oblong, the flesh white. S. Asia. See *Cucumber*. Runs into many fr.-forms in cult., but not so widely polymorphous as *C. Melo*.—Var. **ânglicus,** Bailey. Figs. 1121, 1122. English or Forcing Cucumber. A product of cult. and selection, distinguished from the common or field cucumbers as follows: frs. (and ovaries) very long and slender, little if any furrowed, spineless or nearly so when grown, nearly or quite green at maturity, comparatively few-seeded: fls. very large: lvs. very broad in proportion to their length, with shallower sinuses: vines very vigorous, with long and thick tendrils.—Var. **sikkiménsis,** Hook. f., cult. in the Himalayan Mts., but not known to be in this country; has large 7–9-lobed lvs. and cylindrical-club-shaped fr. B.M. 6206.

Angùria, Linn. (*C. echinàtus*, Moench. *C. anguriòides*, Roem. *C. grossulariæfórmis*, Hort.). Bur Cucumber. West Indian Gherkin. Gooseberry Gourd. Figs. 1127, 1128. Sts. slender, hispid: lvs. deeply cut into 3–5 narrow obovate or spatulate divisions, watermelon-like: fls. small, the pistillate long-stalked: fr. 1–3 in. long, cucumber-like but more spiny. Supposed to be native to the American tropics. B.M. 5817.—Cult. both for the oddity of its frs. and for the making of pickles. The gherkins of mixed pickles, however, are young cucumbers.

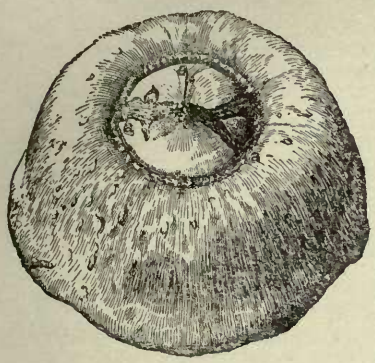


1128. Fruit of Cucumis Anguria. (×½)

dipsàceus, Ehr. (*C. bcrdàna* and *C. ambígua*, Fenzl. *C. erinàceus*, Hort.). Dipsaceous Gourd. Ostrich-Egg Gourd. Hedgehog Gourd. Plant and foliage like that of *C. Melo:* fls. long-stalked: fr. 1–2 in. long, oblong or nearly spherical, becoming hard and dry, densely beset with long scales or hairs, and looking like a bur. Arabia,

Afr. R.H. 1860, p. 210.—Cult. as an ornamental gourd.

Sacleùxii, Paill. & Bois. MANDERA CUCUMBER. Slender, hairy, whitish: lvs. roundish-reniform, obscurely lobed and irregularly dentate, scabrous on both surfaces and grayish green: fls. solitary; males on long-filiform peduncles, the females on shorter but slender peduncles and with hairy ovary: fr. ovoid, 3–4 in. long and half as thick at the middle, somewhat scabrous, with longitudinal stripes of lighter green; seeds brown, ⅕in. long. Zanzibar.—Said to be ornamental and the fruits useful for pickles.



1129. Young Turban squash, on which the remains of the corolla still persist. The central part of the fruit is the ovary.

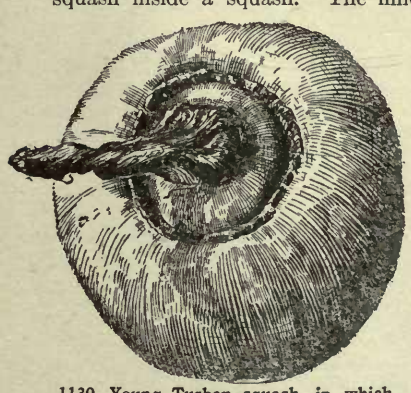
C. acutángulus, Hort.=Luffa.—*C. Citrúllus*, Ser.=Citrullus vulgaris.—*C. Colocýnthis*, Linn.=Citrullus Colocynthis.—*C. metuliferus*, Mey. Hispid annual, with palmately somewhat 3-lobed cordate petiolate lvs., and oblong-obtuse spiny fr., about 4 in. long. S. Afr.—*C. perênnis*, James=Cucurbita.—*C. prophetàrum*, Linn. Slender perennial with ashy scabrous long-stalked mostly 3–5-lobed lvs., and longitudinally white-striped softly spinose fr. 1–1¾ in. long. Afr.—*C. Vilmòrinii*, Hort. A plant of unrecorded origin, with cut lvs. and abundance of canary-yellow soft-spined frs.

L. H. B.

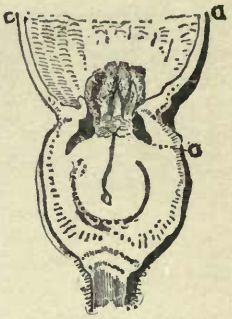
CUCURBIT: A plant of the genus *Cucurbita*. Sometimes shortened to *Cucurb*.

CUCÚRBITA (classical name). *Cucurbitàceæ*. GOURD. PUMPKIN. SQUASH. Vine-like tender herbs, tendril-bearing, grown for their edible and ornamental fruits.

Annual, or the root perennial-rhizomatous, rough-hairy and scabrous, with large often palmately lobed lvs., the tendrils bifid or multifid: fls. monœcious, large, yellow, solitary in the axils, the staminate long-stalked, the pistillate short-stalked; corolla 5-lobed; stamens 3, arising from the bottom of the fl., and united in a column; stigmas 3, but 2-lobed; ovary inferior, inclosed in a hollow receptacle; tendrils 2–3-forked.—About 10 species in warm parts of Asia, Afr., Amer. The morphology of the pepo or gourd-fruit may be illustrated by the Turban squash. Figs. 1129–31. In this fr., there is a "squash inside a squash." The inner part bears the corolla and the styles. It is the ovary. The corolla is attached about the edge of the inner squash, as the withered remains in Fig. 1129 show. Sometimes the withered corolla becomes detached, but hangs to the withered remains of the stigmas, as in Fig. 1130. The longitudinal section of the flower (Fig. 1131) explains the structure. The corolla is shown at *c*, *d*. The top of the ovary is at *o*. The stigmas are on the ovary. The part encircling the ovary (outside of *o*) is the hollowed receptacle. Ordinarily the receptacle is closed at the top, completely confining the ovary; but in the Turban squashes the receptacle does not extend over the top of the ovary, and the ovary therefore protrudes. The older morphologists held this outer part of the squash to be adnate calyx, rather than receptacle. The cucurbits are monographed by Cogniaux, DC. Monogr. Phaner. 3. Also by Naudin, Ann. Sci. Nat. (Bot.) IV, vol. 6. See *Pumpkin* and *Squash*.

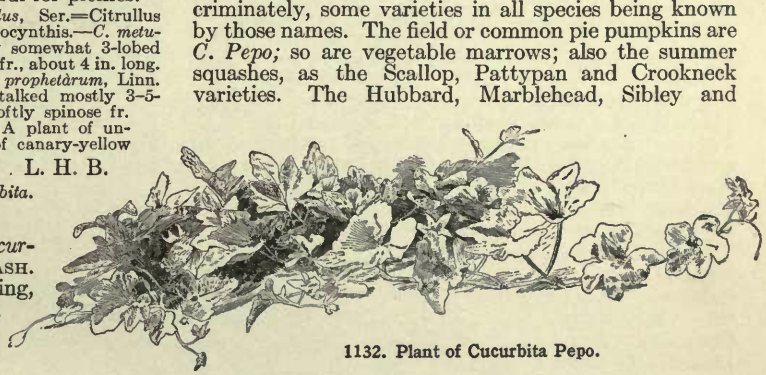


1130. Young Turban squash, in which the withered corolla has become detached, but hangs to the remains of the styles and stigmas.



1131. Section of flower of Turban squash. Showing the ovary inside the hollowed receptacle.

The terms squash and pumpkin are much confused. In Europe, the large varieties of *Curcubita maxima* are known as pumpkins, but in this country the fruits of this species are known usually as squashes. In America, the words pumpkin and squash are used almost indiscriminately, some varieties in all species being known by those names. The field or common pie pumpkins are *C. Pepo;* so are vegetable marrows; also the summer squashes, as the Scallop, Pattypan and Crookneck varieties. The Hubbard, Marblehead, Sibley and Turban kinds are *C. maxima*. The Cushaws, Canada Crookneck, Japanese Crookneck, Dunkard, and Sweet Potato pumpkins (or squashes) are *C. moschata*. The fruit stem (as shown in Figs. 1133, 1136, 1141) is a distinguishing characteristic of the ripe fruits. *C. Pepo* and *C. maxima*, and *C. maxima* and *C. moschata* apparently do not intercross. *C. Pepo* and *C. moschata* have been crossed, but it is doubtful if they intermix when left to themselves. In Europe, the word gourd (or its equivalent in various languages) is used generically for cucurbitas; but in this country it is restricted mostly to the small, hard-shelled forms of *C. Pepo* (var. *ovifera*) grown for ornament, and to *Lagenaria vulgaris*.



1132. Plant of Cucurbita Pepo.

A. *Plant annual.*

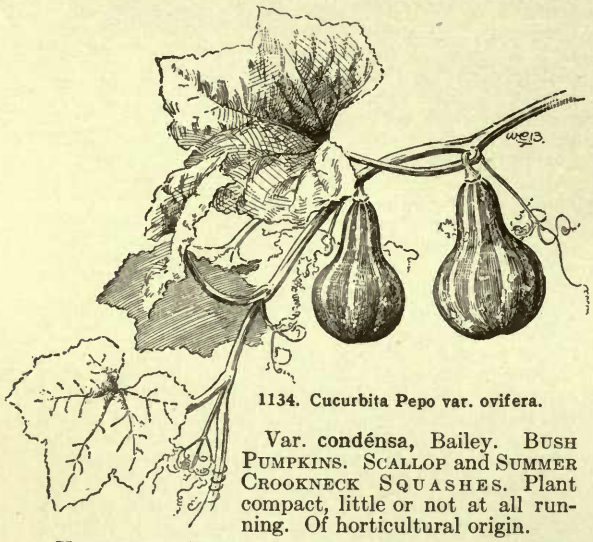
B. *Lvs. lobed: stalks of frs. strongly ridged.*

Pèpo, Linn. (*C. Melopèpo*, Linn.). PUMPKIN. Figs. 1132, 1133. Annual: long-running, prickly on sts. and petioles: lvs. 3–5-lobed, dark dull green: corolla-tube widening upwards, the pointed lobes erect; calyx-lobes narrow, not lf.-like; peduncle very hard and deeply furrowed when mature, not enlarging next the fr.: the fr. very various in form, color, season, size. Probably native to Trop. Amer., but unknown wild.—Cult. by the Indians when Amer. was discovered, in fields of maize. For studies in the nativity



1133. Stem of Cucurbita Pepo.—Early Sugar pumpkin.

of the pumpkins and squashes, see De Candolle, Origin of Cultivated Plants; Gray and Trumbull, Amer. Journ. Sci. 25:372; Sturtevant, Amer. Nat. 1890:727; Wittmack, Ber. der Deutschen Bot. Gesell. 6:378 (1888).



1134. Cucurbita Pepo var. ovifera.

Var. **condénsa**, Bailey. BUSH PUMPKINS. SCALLOP and SUMMER CROOKNECK SQUASHES. Plant compact, little or not at all running. Of horticultural origin.

Var. **ovífera**, Bailey (*C. ovífera*, Linn.). GOURD. Fig. 1134. Plant slender, running: lvs. smaller than in *C. Pepo*, usually very prominently lobed: fr. small, hard and inedible, egg-shaped, globular, pear-shaped, oblate, often striped. R.H. 1894:429.—Sold in many vars. by seedsmen, under the names of *C. Pepo* vars. *pyriformis, depressa, annulata*, etc. See *Gourd*.

moschàta, Duchesne (*C. melonæfórmis*, Carr.). CUSHAW. CHINA, CANADA CROOKNECK and WINTER CROOKNECK SQUASHES. Figs. 1135–37. Annual: long-running, less prickly and sometimes soft-hairy: lvs. more rounded than those of *C. Pepo*, but lobed, often grayish: fl. with a widening tube, and large, erect lobes; calyx-lobes large, often lf.-like; peduncle becoming deeply ridged and much enlarged next the fr. Possibly of E. Asian origin.



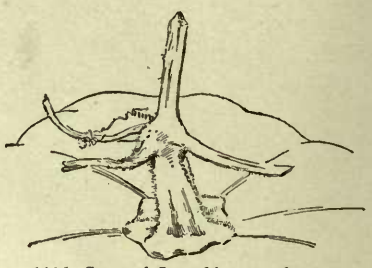
1135. Cucurbita moschata.

BB. *Lvs. not lobed (except sometimes on young shoots): stalks of frs. not prominently ridged.*

máxima, Duchesne. SQUASH. Figs. 1138–41. Annual: long-running, the sts. nearly cylindrical, little prickly and often hairy: lvs. orbicular or kidney-shaped, commonly not lobed, the basal sinus wide or narrow, the margin shallowly apiculate-sinuate: corolla-tube nearly the same diam. at top and bottom (Figs. 1139, 1140), the corolla-lobes large and soft, and wide-spreading or drooping: peduncle at maturity soft and spongy, not ridged nor prominently enlarged next the fr.: fr. very various, but not light yellow nor warty nor crookneck-shaped, usually late-ripening, the flesh orange and not stringy. Nativity undetermined. Var. **sylvéstris**, Naudin. A form found wild in the Himalayan region, with fr. as large as a man's head.

AA. *Plant with perennial root.*

fœtidíssima, Kunth (*C. perénnis*, Gray. *Cùcumis perénnis*, James). CALABAZILLA. Fig. 1142. Perennial: long-running, scarcely prickly: lvs. large, cordate-triangular, grayish pubescent, the margin shallowly apiculate-crenate: fl. nearly as large as in *C. Pepo* and similar in shape, the pistillate on a peduncle 2–3 in. long: fr. size and shape of an orange, smooth, green and yellow splashed, not edible. Sandy arid wastes, Neb. and Colo. to Texas and Mex. and westward to Calif. R.H. 1855:61; 1857, p. 54.—In its native haunts, the root is tuberous, 4–7 in. diam. and penetrating the earth 4–6 ft. Roots at the joints. The plant has a fetid odor. Sold by seedsmen as a gourd, but the fr. does not often ripen in the northern states. Useful on arbors and small trees, when coarse vines are wanted.



1136. Stem of Cucurbita moschata. Large Cheese pumpkin

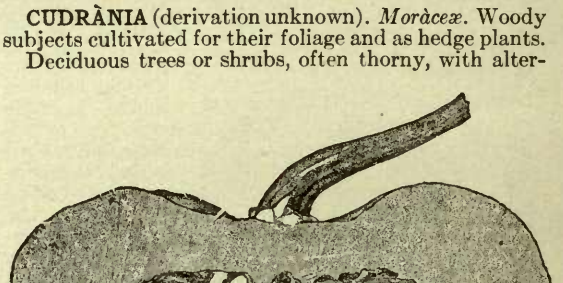
ficifòlia, Bouché (*C. melanospérma*, A. Br.). St. very long, stout, becoming somewhat woody: lvs. pale green, often marbled, in outline ovate or suborbicular, cordate at base, roundly 5-lobed and the sinus rounded: calyx-tube short and campanulate: fr. large (often 1 ft. long), fleshy, round-ovoid, white-striped, the flesh white; seeds ovate, black. E. Asia, but widely cult. in warm countries for its ornamental watermelon-like frs. A var. *mexicàna*, Hort. (*C. mexicàna*, Spreng.), is mentioned, with seeds twice the size of those of the type, and said to grow wild in the neighborhood of Mazatlan, Mex.

C. Andreàna, Naudin. Allied to C. moschata: sts. long and rooting at the nodes: lvs. large, marbled with white: fls. of the form of those of C. maxima but much smaller: fr. obovoid, 8 in. long, marked with white and yellow. Uruguay. R.H. 1896, pp. 542–3.—*C. califórnica*, Torr. Canescent: lvs. thick, 2 in. across, 5-lobed, the lobes triangular and mucronate: tendrils parted to the base: fls. 1 in. or more long on pedicels ½–1 in. long. Calif.; imperfectly known.—*C. digitàta*, Gray. Perennial, the root fleshy: sts. slender and long, usually rooting: tendrils short and weak, 3–5-cleft: lvs. scabrous, 3–5-palmately narrow-lobed: fls. 2–3 in. long on slender pedicels 1–4 in. long: fr. subglobose, yellow, 2–4 in. diam. Calif. to New Mex.—*C. palmàta*, Wats. MOCK ORANGE. Canescent: lvs. cordate, thick, 2 or 3 in. across, palmately 5-cleft to middle with narrow toothed lobes: fls. 3 in. long on stout peduncles: fr. globose, 3 in. diam. S. Calif.

L. H. B.

CUDRÀNIA (derivation unknown). *Moràceæ*. Woody subjects cultivated for their foliage and as hedge plants.

Deciduous trees or shrubs, often thorny, with alter-



1137. Fruit of Cucurbita moschata—Tonasu, a Japanese variety.

nate, petioled and stipulate lvs.: fls. dicœcious, in axillary globular heads; staminate with 4 sepals and 4 stamens and 2–4 bracts at the base; pistillate with 4 sepals inclosing the 1-ovuled ovary, growing into a fleshy subglobose fr. with a crustaceous rind.—About 3 species, in S. and E. Asia and Trop. Austral., of which only one is sometimes cult. It requires protection in the N. and is usually prop. by greenwood cuttings in summer under glass.

tricuspidàta, Bureau (*Maclùra tricuspidàta,* Carr. *C. triloba,* Hance). Shrub, or small tree, to 20, rarely to 60 ft., with slender, thorny branches: lvs. elliptic-ovate, acuminate, entire, sometimes 3-lobed at the apex and on young plants even tricuspidate, nearly glabrous, 1½–3 in. long: fl.-heads axillary, solitary or in 2's, on short peduncles: fr. globose, about 1 in. across. China. R.H. 1864, p. 390; 1872, p. 56; 1905, p. 363 (habit). H.I. 18:1792.—Recently recommended as an excellent hedge-plant for the S. In China the lvs. are used as a substitute for mulberry lvs. and it is called silkworm thorn; the fr. is edible. Between this species and *Maclura pomifera,* a hybrid has been raised, described as *Macludrània hỳbrida,* André. R.H. 1905:362. ALFRED REHDER.

CULINARY HERBS are those herbs used for flavoring in cookery, but the term has a wide application, including species used for garnishing and sometimes as potherbs. The culinary herbs are of very minor importance in American gardens, and yet a few of them, as anise, caraway and coriander, are well and favorably known. The species are mostly aromatic. They are largely of the Umbelliferæ and Labiatæ. No special



1139. Staminate flower of Cucurbita maxima—Hubbard squash. (×⅓)



1140. Pistillate flower of Cucurbita maxima—Hubbard squash. (×⅓)

difficulty attaches to their cultivation, and little more may be said here than to present an alphabetical list with statements as to uses, duration of plant, and means of propagation. They all thrive in mellow fertile garden land. Usually they are grown at the side of the main garden plantation, and they may add a certain charm to the garden as well as to supply an agreeable aroma to the kitchen products. See the little book on "Culinary Herbs" by M. G. Kains, 1912.

Angelica (*Archangelica officinalis*). *Umbelliferæ.* Biennial or perennial. *Uses:* Stems and leaf-stalks as salad, or roasted like potatoes; garnish; as "candied angelica;" stems blanched and used as vegetable; leaves as spinach; seeds for flavoring; oil of angelica obtained from seeds for flavoring. Propagated by seeds in late summer or early autumn.

Anise (*Pimpinella Anisum*). *Umbelliferæ.* Annual. *Uses:* Leaves as garnish, flavoring, and potherb; seeds and oil for flavoring and perfumery. Propagated by seeds in early spring.

Balm (*Melissa officinalis*). *Labiatæ.* Perennial. *Uses:* Foliage for flavoring and salad; oil for perfumery and flavoring beverages. Propagated by divisions, layers, cuttings and seeds.

Basil (*Ocymum basilicum*). *Labiatæ.* Annual. *Uses:* As flavor in highly seasoned dishes; oil as perfumery. Propagated by seeds.

Borage (*Borago officinalis*). *Boraginaceæ.* Annual. *Uses:* Herbage as potherb and salad; garnish; flavor in beverages. Propagated by seeds in spring.

Caraway (*Carum Carvi*). *Umbelliferæ.* Biennial or annual. *Uses:* Herbage eaten cooked or as salad; roots as vegetable; seeds for flavoring; oil in manufacture of perfumery and soaps. Propagated by seeds in May or early June.



1138. Cucurbita maxima.

Catnip or catmint (*Nepeta Cataria*). *Labiatæ.* Perennial. *Uses:* As bee forage; leaves as condiment; formerly a medicinal remedy. Propagated by seeds in autumn or spring.

Chervil (*Anthriscus Cerefolium*). *Umbelliferæ.* Annual. *Uses:* Leaves for seasoning and for mixed salads. Propagated by seeds.

Chives (*Allium Schœnoprasum*). *Liliaceæ.* Perennial. *Uses:* Leaves for flavoring. Propagated by individual bulbs or division of clumps in early spring.

Clary (*Salvia Sclarea*). *Labiatæ.* Perennial. *Uses:* Leaves in cookery; wine made from plant when in flower. Propagated by seeds in spring.

Coriander (*Coriandrum sativum*). *Umbelliferæ.* Annual. *Uses:* Seed in confectionary and as ingredient in condiments; flavor in beverages. Propagated by seeds in spring or autumn.

Cumin (*Cuminum odorum*). *Umbelliferæ.* Annual. *Uses:* Seeds as ingredient in curry powder; for flavoring pickles, pastry and soups. Propagated by seeds in spring.

Dill (*Anethum graveolens*). *Umbelliferæ.* Annual. *Uses:* Seed as seasoning, extensively for commercial pickles; oil for perfuming soap; young leaves as seasoning and salads; dill vinegar as condiment. Propagated by seeds in spring.

Fennel (*Fœniculum vulgare*). *Umbelliferæ.* Biennial or perennial. *Uses:* Herbage as garnishes and flavors; as salads; seeds for flavoring beverages, and for confectionary; oil as perfumery. Propagated by seeds, and grown as an annual.

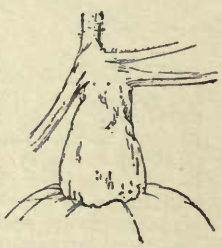
Finocchio or Florence fennel (*Fœniculum dulce*). *Umbelliferæ.* Annual. *Uses:* As a vegetable. Propagated by seeds.

Fennel Flower (*Nigella sativa*). *Ranunculaceæ.* Annual. *Uses:* Whole plant or seed used in cookery. Propagated by seeds in spring.

Hoarhound, or horehound (*Marrubium vulgare*). *Labiatæ.* Perennial. *Uses:* Formerly in cookery and medicine; now for candy only. Propagated by seeds in spring.

Hyssop (*Hyssopus officinalis*). *Labiatæ.* Perennial. *Uses:* Herbage in salads; oil in preparation of soaps, etc. Propagated by divisions, cuttings and seeds in spring.

Lavender (*Lavandula angustifolia, L. Spica*). *Labiatæ.* Perennial. *Uses:* Flowers and oil in perfumery; sometimes as condiment and in salads. Propagated by divisions or cuttings, or rarely seeds.



1141. Stem of Cucurbita maxima—Hubbard squash.

Lovage (*Levisticum officinale*). *Umbelliferæ.* Perennial. *Uses:* Young stems in confectionary. Propagated by division or seeds in late summer.

Marigold (*Calendula officinalis*). *Compositæ.* Annual. *Uses:* Flower-heads as seasoning; fresh flowers to color butter. Propagated by seeds in spring.

Marjoram (*Origanum vulgare* and *O. Marjoram*). *Labiatæ.* Perennial (*O. Marjoram* treated as annual). *Uses:* Herbage for seasoning; oil in perfuming soaps, etc. Propagated by cuttings, division or layers and seeds in spring.

Mint (*Mentha spicata*). *Labiatæ.* Perennial. *Uses:* Herbage as seasoning; leaves in jelly. Propagated by cuttings, offsets and divisions in spring.

Parsley (*Petroselinum hortense*). *Umbelliferæ.* Biennial. *Uses:* Roots as vegetable; top as potherb; leaves for seasoning and garnish. Propagated by seeds in spring.

Pennyroyal (*Mentha Pulegium*). *Labiatæ.* Perennial. *Uses:* Leaves as seasoning; pennyroyal oil. Propagated by division, or rarely cuttings.

Peppermint (*Mentha piperita*). *Labiatæ.* Perennial. *Uses:* Oil as flavoring; perfume in soaps, etc. Propagated by division or running rootstocks.

Rosemary (*Rosemarinus officinalis*). *Labiatæ*. Perennial. *Uses:* Herbage as seasoning; oil for perfuming soaps and in perfumery. Propagated by cuttings, root division, layers in early spring, and seeds.

Rue (*Ruta graveolens*). *Rutaceæ*. Perennial. *Uses:* Leaves as seasoning and flavor in beverages; oil for aromatic vinegar and toilet preparations. Propagated by seeds, cuttings, layers or division of tufts.

Sage (*Salvia officinalis*). *Labiatæ*. Perennial. *Uses:* Leaves for seasoning dressings, sausages, cheese, etc.; oil in perfumery. Propagated by division, layers and cuttings, also seeds.

Samphire (*Crithmum maritimum*). *Umbelliferæ*. Perennial. *Uses:* Leaves pickled in vinegar, sometimes with other vegetables. Propagated by seeds in autumn.

Savory, Summer (*Satureia hortensis*). *Labiatæ*. Annual. *Uses:* Seasoning. Propagated by seeds in spring.

Savory, Winter (*Satureia montana*). *Labiatæ*. Perennial. *Uses:* Seasoning. Propagated by seeds, cuttings, layers and division.

Southernwood (*Artemisia Abrotanum*). *Compositæ*. Perennial. *Uses:* Young shoots for flavoring cakes, etc. Propagated by seed; also cuttings in early summer.

Tansy (*Tanacetum vulgare*). *Compositæ*. Perennial. *Uses:* Seasoning. Propagated by division of clumps, or seeds.

Tarragon (*Artemisia Dracunculus*). *Compositæ*. Perennial. *Uses:* Herbage in salads and with meats; seasoning; as a decoction in vinegar; oil to perfume soaps, etc. Propagated by cuttings, layers and division.

Thyme (*Thymus vulgaris*). *Labiatæ*. Perennial. *Uses:* Herbage as seasoning; oil as perfumery; oil-crystals as disinfectant. Propagated by seeds in spring; also cuttings, layers and divisions.

L. H. B.

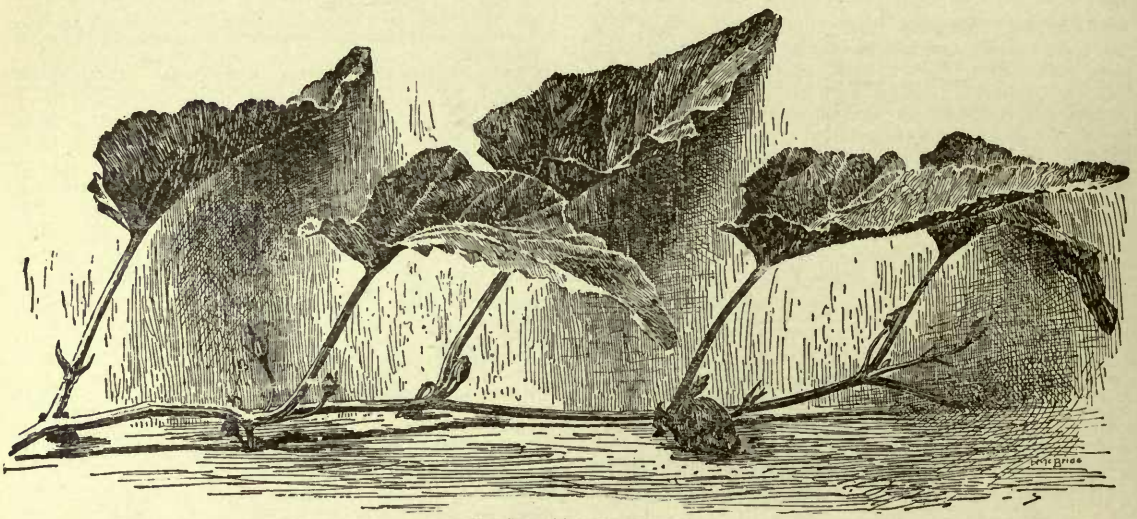
CUMIN, or CUMMIN: The seeds of *Cuminum odorum* (or less properly *C. Cyminum*); black cumin, *Nigella sativa;* sweet cuimn, or anise, *Pimpinella Anisum*. See *Culinary Herbs*.

Flowers small, white or purplish, 2-lipped, borne in corymbed cymes or clusters. The genus contains not more than 16 species, 2 N. American, 2 Mexican, and the others S. American. They are somewhat woody, and usually have small lvs.: the whorls of fls. are sometimes loosely corymbose, sometimes axillary, few-fld., much shorter than the lvs., sometimes many-fld., in dense spikes or terminal heads; calyx 10–13-nerved, 5-toothed; perfect stamens 2.

mariàna, Linn. (*C. origanoìdes*, Brit.). Maryland Dittany. Stone-Mint. Height 1 ft.: lvs. smooth, ovate, serrate, rounded or heart-shaped at the base, nearly sessile, dotted, 1 in. long: fls. purple-pink in a loose cymose cluster which is terminal. Dry hills, S. N. Y. to Ohio., south to Fla. J.H. III. 35:321. Mn. 7:201. See also *Dittany*.

CUNNINGHÁMIA (after J. Cunningham, botanical collector, who discovered this conifer in China in 1702). *Pinàceæ*. Evergreen trees cultivated for their handsome foliage.

Trunk stout: branches verticillate, spreading, pendulous at the extremities: lvs. linear-lanceolate, rigid, densely spirally arranged and 2-rowed in direction: fls. monœcious; staminate oblong, pistillate globose, both sexes in small clusters at the end of the branches: cones roundish-ovate, 1–2 in. long, with roundish-ovate,



1142. Cucurbita fœtidissima.

CUMMÍNGIA (for Lady Gordon Cumming) of gardeners (name bestowed by D. Don in 1828), sometimes spelled **Cumingia** (Kunth, 1843), is now referred to **Conanthèra**. *Amaryllidàceæ*. The conantheras are of about four species in Chile, one of which is rarely in cult. as a tender summer-blooming bulb. They are said to be difficult to keep long in cult. They are cormous plants, with basal linear or linear-lanceolate lvs., erect sts. paniculate-branching above, fls. blue on bractless pedicels: perianth funnelform, the tube short; lobes longer than tube, oblong, nearly equal, spreading or becoming reflexed; stamens 6, attached in the throat, shorter than the perianth-lobes, all perfect, the filaments very short; ovary 3-celled, the style subulate. **Conanthèra campanulàta**, Lindl. (*C. Simsii*, Sweet. *C. bifòlia*, Sims, not Ruiz & Pav. *Cummíngia campanulàta*, D. Don) is 1–1½ ft. high, with linear lvs. shorter than the st. or peduncle and blue paniculate pretty fls. B.M. 2496.

CUNÌLA (origin unknown). *Labiàtæ*. A low-growing tufted hardy native perennial of this genus is rarely cultivated in borders for its profusion of bloom.

serrate and pointed, coriaceous scales, each with 3 narrow-winged seeds at the base.—Two species, in S. W. China and in Formosa. The species in cult. is a very decorative conifer for warmer temperate regions, much resembling the *Araucaria brasiliensis*. It prefers a half-shaded position and sandy and loamy humid soil. Prop. by seeds or cuttings of half-hardy wood in late summer under glass; short sprouts from the old wood of the trunk or larger branches are the best; cuttings from lateral branches grow into weak and one-sided plants.

lanceolàta, Hook. (*C. sinénsis*, R. Br.). Tree, attaining 80 ft.: lvs. linear-lanceolate, with broad, decurrent base, sharply pointed, finely serrulate, light green and shining above and with 2 broad, whitish bands beneath, 1½–2½ in. long: cones 1–2 in. high. China, cult. in Japan. B.M. 2743. S.Z. 104, 105. R.H. 1903, pp. 549–551. G.W. 13, p. 330; 14, p. 13. J.H. III. 49:447. F. 1854, p. 169.—The second species, *C. Konishii*, Hayata, from Formosa, is not in cult.; it has narrower and much smaller lvs., glaucescent on both sides, and smaller cones; it is very different and forms a transition to Taiwania. Alfred Rehder.

CUNÒNIA (named for John Christian Cuno, who catalogued his garden in Amsterdam at the middle of the 18th century). *Cunoniàceæ;* formerly included in the *Saxifragàceæ*. A half dozen trees or shrubs of the southern hemisphere, one of which is sometimes grown under glass. Lvs. opposite, petiolate, thick and leathery, 3-foliolate or odd-pinnate: fls. white, in dense spike-like racemes; calyx-tube short, the limb 5-parted; petals 5; stamens 10: fr. a coriaceous beaked caps. **C. capénsis,** Linn., in moist woody places in Cape Colony, is a large glabrous shrub or tree to 50 ft.: lfts. 2–3 pairs, oblong-lanceolate, sharply serrate: fls. small, very numerous, in opposite racemes, the stamens much exserted. Said to be of easy cult. in a sandy-peaty soil; prop. by cuttings of half-ripened wood. L. H. B.



1143. Cuphea hyssopifolia. (×½)

CUPÀNIA: *Blighia.*

CÙPHEA (Greek, *curved;* referring to the prominent protuberance at the base of the calyx-tube). *Lythràceæ.* Mostly small greenhouse and conservatory plants.

Plants often clammy: lvs. opposite, rarely whorled or alternate, ovate, lanceolate, or linear, entire: the fls. are often borne in 1-sided racemes, and some of the species have a very odd look from the bold angle made by the slender ascending pedicel and the descending calyx-tube, with an odd projection at the base.—An exceedingly interesting genus of 200 species of tropical and subtropical American herbs and shrubby plants, with remarkable variations in the petals. In *C. ignea,* perhaps the most attractive of the group, the petals are entirely absent, and the showy part is the brilliantly colored calyx-tube. At the other extreme is *C. hyssopifolia* with 6 petals (the normal number in the genus), and all of equal size. Between these two extremes (shown in Figs. 1143 and 1145) are at least two well-marked intermediate types. One of these (exemplified in *C. procumbens*) has 2 large and 4 small petals: the other (*C. Llavea*) has 2 conspicuous petals and the other 4 are completely abortive. These two types are unique among garden plants. The series of intergradient forms is completed by *C. cyanea,* in which there are only 2 petals, and these minute, and *C. micropetala* in which there are 12 barely visible petals, alternating with and shorter than the calyx-teeth. In addition to the species described below, *C. Hookeriana,* Walp., is cult. as *C. Roezlii,* Carr. It has lanceolate lvs., with vermilion and orange calyx. R.H. 1877: 470. According to many American botanists, the correct name for these plants is Parsonsia, Cuphea applying only to another widely separated genus.

Nearly all cupheas are grown from seed and treated as tender annuals, but *C. ignea* is chiefly propagated by cuttings. They are of easy culture, and the whole series is worth growing.

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A. *Petals 6, but very minute and inconspicuous.*

1. **micropétala,** HBK. (*C. éminens,* Planch. & Lind.). St. shrubby, more or less branched, 1–2 ft. high: branches and calyx scabrous: lvs. oblong-lanceolate, acute at both ends, but without a distinct petiole, rigid, scabrous: fls. borne singly in succession at a point above the axils, which distinguishes this species from all others here described; petals 6, minute, borne between the calyx-teeth, and shorter than them; calyx 12-toothed, scarlet at the base, yellow towards the top, greenish at the mouth; stamens and filaments red; ovary 2-celled, many-seeded. Mex. HBK. Nov. Gen. Sp. 6, p. 209, t. 551. R.H. 1857, p. 151. F.S. 10:994. —The picture first cited shows a 1-sided raceme, the second a panicle and the third a common raceme. In this species the calyx-tube is the attractive portion, while the petals are inconspicuous. The tube is not 2-lipped, but almost regular. See page 3567.

AA. *Petals 6, all conspicuous, but 2 of them much larger than the others.*

2. **lanceolàta,** Hook. (*C. Zimpànii,* Roezl). An erect sticky annual, 3–4 ft. high, the branches stout, purplish green: lvs. petiolate, opposite and alternate, ¾–3 in. long, entire: fls. axillary, solitary, purple or reddish purple, often deflexed; stamens hardly longer than the petals. Sept., Oct. B.M. 6412.—A good, showy herbaceous border plant.

3. **procúmbens,** Cav. Annual, herbaceous, 1 ft. high, procumbent, sticky-pubescent, with characteristic purplish hairs: lvs. ovate-lanceolate, with white hairs, 1½–3 in. long, gradually decreasing in size until they become bract-like; petiole short: fls. numerous, peduncles longer than the petioles, 2 or 3 times shorter than the calyx; calyx 6-toothed, purplish at the base, green at the tip, with 12 raised streaks, and a pubescence like that of the st.; petals 6, the 2 larger ones on the upper lip of the calyx purple; filaments included. Mex. B.R.



1144. Cuphea Llavea. (Natural size)

182. **C. purpùrea,** Hort. F.S. 4:412. R.B. 22:85, said to be a hybrid between *C. miniata* and *C. viscossima,* is probably not distinct.

4. **pinetòrum,** Benth. Perennial and somewhat woody, usually procumbent: lvs. lanceolate, ciliate, 1–2 in. long: fls. purple, the calyx ¾in. long, colored; stamens 11, the filaments unequal. In sandy plains. Mex. —A useful plant S.

AAA. *Petals 6, all of the same size.*

5. **hyssopifòlia,** HBK. Fig. 1143. St. shrubby: branches numerous, strigose: lvs. lanceolate, rather acute, obtuse at the base, glabrous above, strigose-pilose along the midrib and veins, as may be seen with a hand-lens: fls. with their slender pedicels scarcely longer than the lvs.; calyx glabrous; petals 6, somewhat

unequal, dilute violet; stamens 11, included; filaments villous; ovary 5–6-seeded. Mex.—This is the least attractive of the species here described, and is no longer advertised, but it probably still lingers in conservatories. It is readily distinguished from its showier relatives by its much smaller lvs. (less than ½in. long) and much-branched and woody appearance.



1145. Cuphea ignea. (×⅓)

AAAA. *Petals normally 2, the other 4 abortive.*

B. *Size of petals very small, less than half as long as the calyx.*

6. **cyànea,** Moç. & Sessé (*C. strigulòsa,* Hort., not HBK. *C. Galleottiàna,* Hort.). St. herbaceous, erect: branchlets hispid: lvs. opposite, stalked, ovate, cordate, acuminate, villous on both sides: peduncles alternate, racemose; calyx slightly hispid, scarlet at the base, yellow at the top; petals 2, clawed, spatulate; anthers and petals violet-blue. Mex. B.R. 32:14 (as *C. strigillosa,* Lindl.) F.S. 1:15 and P.M. 11:241 as *C. strigulosa,* but neither of these plates is the *C. strigulosa,* HBK., which is a different species, with a shrubby st.: branches and calyx clammy-hispid: lvs. ovate-oblong, acute at both ends, clammy, glabrous above, strigose-scabrous below: petals nearly equal; ovary about 8-ovuled.

BB. *Size of petals larger, half as long as the calyx or longer.*

C. *Calyx 6-toothed.*

7. **Llàvea,** Lindl. Red-White-and-Blue Flower. Fig. 1144. Sts. numerous, herbaceous, hispid: branches ascending: lvs. almost sessile, especially near the top, ovate-lanceolate, strigose: racemes short, few-fld.; calyx green on the ventral side, purple on the back and at the oblique-6-toothed mouth; petals 2, large, scarlet, obovate, the other 4 abortive; stamens 11. Guatemala. B.R. 1386. J.H. III. 31:305.—It is doubtful whether the plant described by Lindley is the same as the Mexican plant originally described by Lexarza, which was said to have petals of "dilute scarlet." Lindley's plant had a green calyx, but the plant in the trade is colored. Used for baskets and bedding. Often misspelled *Llavæ.*

CC. *Calyx 12-toothed.*

8. **miniàta,** Brongn. St. shrubby, erect: branches few, hispid: lvs. opposite, the upper ones not quite opposite, with a very short petiole, ovate, acute, entire, with white, silky hairs which are denser beneath: fls. solitary, subsessile, axillary, the peduncle adnate to the branch in such a way as to appear between and below the petioles; raceme few-fld., 1-sided. F.S. 2:73. P.M. 14:101. R.H. 1845: 225. R.B. 22:85. Var. **álba,** Hort. A white-fld. variety. Var. **compácta,** Hort. S.H. 2:43. Gt. 46, p. 637.—This is referred to *C. Llavea* of Lexarza, by Index Kewensis. The above description is from the original in F.S. 2:73. Van Houtte describes several hybrid varieties in F.S. 5, p. 487, which differ chiefly in size, color, and marking of petals. Calyx 1 in. long, hispid, green at the base, purple above, 12-toothed at the tip; petals 2, scarlet, wavy. The specific name *miniata* means cinnabar-red, and refers to the petals.

AAAAA. *Petals 0.*

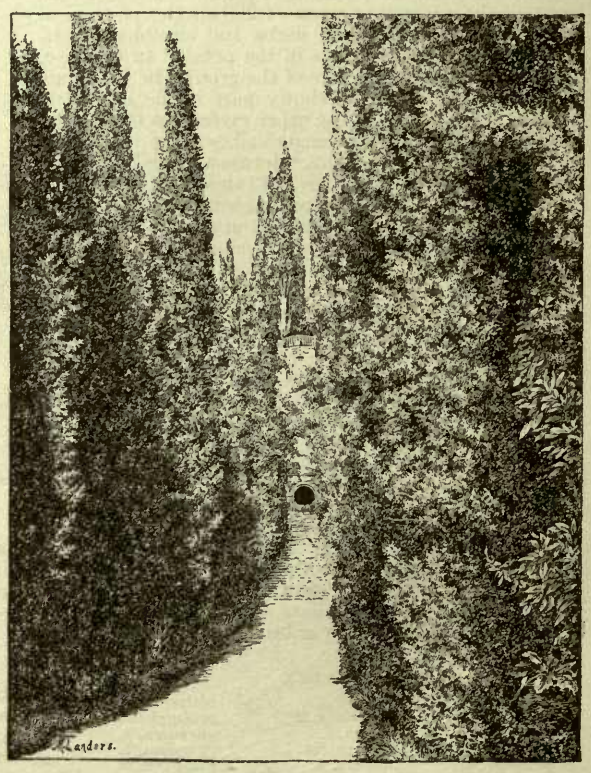
9. **ígnea,** DC. (*C. platycéntra,* Hort., not Benth.). Fig. 1145. Branches somewhat angled: lvs. petioled, ovate-lanceolate, acuminate, narrowed at the base, lightly scabrous: fl.-stalks 2–4 times longer than the lf.-stalks; calyx glabrous, shortly 6-toothed, bright red except at the tip, which has a dark ring and a white mouth; petals 0; stamens 11 or 12, glabrous. Mex. F.S. 2:180. P.M. 13:267.—This is still sold as *C. platycentra,* although De Candolle corrected the error in 1849 (F.S. 5:500 *c*). This is a remarkable instance of the persistence of erroneous trade names.

Wilhelm Miller.
N. Taylor.†

CUPRÉSSUS (ancient Latin name from Greek, *Kuparissos*). Cypress. *Pinàceæ.* Evergreens, cultivated for their graceful habit and the dark green or glaucous foliage; some are timber trees.

Trees, rarely shrubs, with aromatic evergreen foliage: branchlets quadrangular or nearly so: lvs. opposite, small, scale-like, appressed, minutely denticulate-ciliate, on young seedling plants linear-subulate and spreading: fls. monœcious, minute, solitary on short branchlets; staminate ovate or oblong, yellow; pistillate subglobose: cones globular or nearly so, consisting of 3–7 pairs of ligneous, peltate scales, with a mucro or boss on the flattened apex, each bearing many or numerous seeds, but the lower scales usually sterile and smaller; they ripen the second year.—About 12 species in Cent. Amer., north to Calif. and Ariz., and from S. Eu. to S. E. Asia. Monogr. by M. T. Masters in Journ. of Linn. Soc. 31:312–51 (1895). By some botanists, the allied genus Chamæcyparis is included.

The cypresses are highly ornamental evergreen trees, greatly varying in habit, hardy only in California and the Gulf states. The hardiest seems to be *C. Macnabiana* and *C. arizonica,* which will stand many degrees of frost in a sheltered position; also *C. macrocarpa, C. sempervirens, C. funebris* and *C. torulosa* are of greater hardiness than the others. They stand pruning well, and some species are valuable for hedges, *C. macrocarpa* being especially extensively planted for this purpose in California. *C. arizonica* yields excellent timber. The cypresses seem not to be very particular in regard



1146. Cupressus sempervirens. Verona.

to soil and situation, but prefer a deep, sandy-loamy soil. For propagation, see *Chamæcyparis*. The young plants should be removed several times in the nursery to secure a firm root-ball; otherwise they will not bear transplanting well.

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A. *Branches and branchlets erect or spreading; branchlets short and usually rather stout.*

B. *Cones 1–1½ in. across, with 6–14 scales.*

C. *Lvs. obtuse: bark scaly.*

1. **sempérvirens,** Linn. Fig. 1146. Tree, to 80 ft., with erect or horizontal branches and dark green foliage: lvs. closely appressed, ovate, obtuse, glandular: cones oblong or nearly globose; scales 8–14, with a short boss on the back, bract free at the apex. F.S. 7, p. 192. (as *C. torulosa*). S. Eu., W. Asia. Var. **stricta, Ait** (*C. fastigiàta,* DC. *C. Bedfordiàna,* Hort.). ITALIAN CYPRESS. With erect branches, forming a narrow, columnar head. The classical cypress of the Greek and Roman writers, much planted in S. Eu. G.W. 9, p. 127. Gn. 33, p. 3 (as *C. stricta*). Var. **cereifórmis,** Rehd. (*C. fastigiàta cereifórmis,* Carr.). A form with very short branches, forming a narrow and slender columnar head. Var. **índica,** Parl. (*C. Roÿlei,* Carr. *C. Whitleyàna,* Hort.). Similar to var. *fastigiata* in habit: cones globose, with 10 scales; bract acutely mucronate at the apex. Var. **horizontàlis,** Gord. (*C. horizontàlis,* Mill.). Branches horizontally spreading, forming a broad, pyramidal head. The famous avenue of *C. sempervirens* in the Villa Giusti, Verona, Italy, is shown in Fig. 1146 (G.F. 2:464).

2. **macrocárpa,** Hartw. (*C. Hártwegii,* Carr.). MONTEREY CYPRESS. Tree, to 40 ft., occasionally to 70 ft., with horizontal branches, forming a broad, spreading head: branchlets stout: lvs. rhombic-ovate, obtuse, closely appressed, not or obscurely glandular, dark or bright green: cones globular or oblong; scales 8–12, with a short, obtuse boss on the back. Calif., Bay of Monterey. S.S. 10:525. G. 22:30. G.M. 52:952. G.W. 2, p. 497. G.C. III. 18:63; 22:53. Gn. 29, p. 36; 30, p. 189; 38, p. 363; 53, p. 219; 68, p. 237. G.F. 7:245. Var. **Críppsii,** Mast. Lvs. spreading, light glaucous. A juvenile form. Var. **fastigiàta,** Knight. Of narrow, pyramidal, fastigiate habit. Var. **Lambertiàna,** Mast. (*C. Lambertiàna,* Carr.). Dark green form with spreading branches. R.H. 1870, p. 191; 1907, p. 565. Var. **lùtea,** Hort., has yellow foliage. Gn. 68, p. 237. J.H.S. 1902, p. 426, fig. 111.

CC. *Lvs. acute: bark exfoliating, cherry-like.*

3. **guadalupénsis,** Wats. (*C. macrocárpa* var. *guadalupénsis,* Mast.). Wide-spreading tree, 40 ft. high or more: bark grayish brown, exfoliating, brownish red below: branchlets drooping, slender: lvs. bluish green, scentless, acute or acutish, obscurely glandular: cones globose, 1 in. across or more, with 6–8 very thick strongly bossed scales. Guadalupe Isl. G.C. III. 18:62.

BB. *Cones ½–1 in. across, with 6–8 scales.*

C. *Lvs. distinctly glandular.*

4. **Macnabiàna,** Murray (*C. glandulòsa,* Hook.). Fig. 1147. Shrub with several sts., or small tree, to 20 ft., forming a dense, pyramidal head: lvs. ovate, obtuse, thickened at the apex, glandular, dark green or glaucous: cones oblong, ¾–1 in. high; scales usually 6, with prominent conical and curved bosses on the back. Calif. S.S. 10:528. R.H. 1870, p. 155. G.C. III. 9:403. F. 1874, p. 88.

CC. *Lvs. inconspicuously glandular.*

D. *The branchlets slender: lvs. green or sometimes glaucous.*

5. **Goveniàna,** Gord. (*C. califórnica,* Carr.). Tree, to 50 ft., with slender, erect or spreading branches, forming a broad, open or pyramidal head: branchlets slender: lvs. ovate, acute, closely appressed, inconspicuously glandular: abundant staminate fls. in spring: cones subglobose or oblong; scales 6–8, with short, blunt bosses. Calif. S.S. 10:527. R.H. 1875, p. 108. F. 1876, p. 197. Var. **compácta,** André. Of compact, pyramidal habit. R.H. 1896, p. 9. Var. **glaùca,** Carr., with glaucous, and var. **víridis,** Carr., with bright green foliage. Var. **cornùta,** Carr. A form with strongly developed bosses. R.H. 1866, p. 251.



1147. Cupressus Macnabiana. (From a cultivated tree.)

6. **Bénthamii,** Endl. (*C. excélsa,* Scott. *C. Karwinskyàna,* Regel. *C. thurífera,* Schlecht., not HBK.). Tree, to 70 ft., with horizontal branches, forming a pyramidal head: branchlets slender: lvs. ovate, obtuse or acute, keeled and somewhat thickened at the apex, inconspicuously glandular, bright green: cones globular, ½–¾in. across; scales 6–8, with short-pointed bosses. Mex. Var. **Líndleyi,** Mast. (*C. Líndleyi,* Klotzsch). Branchlets regularly arranged, of nearly equal length: cones small, with small-pointed bosses. Var. **Knightiàna,** Mast. (*C. élegans,* Hort.). Branchlets very regularly arranged, fernlike, drooping, glaucous: cones with stout, conical-pointed bosses. G.C. III. 16:669. *C. Benthamii* has been found in prehistoric asphalt beds at Los Angeles.

DD. *The branchlets stout: lvs. glaucous.*

7. **arizónica,** Greene (*C. Bénthamii* var. *arizónica,* Mast.). Tree, to 40, rarely to 70 ft., with horizontal branches, forming a narrow, pyramidal or broad, open head: branchlets stout: lvs. ovate, obtuse, thickened at the apex, usually without glands, very glaucous: cones subglobose, ¾–1 in. across; scales 6–8, with stout, pointed, often curved bosses. Ariz., Calif. S.S. 10:526. G.C. III. 18:63. I.T. 4:145. M.D. 1904:50.

AA. *Branchlets slender, more or less pendulous: lvs. usually acute and keeled, not thickened at the apex: cones about ½in. or less across (see No. 6).*

B. *The branchlets not or only slightly compressed.*

8. **torulòsa,** Don (*C. nepalénsis,* Loud.). Tall, pyramidal tree, to 150 ft., with short, horizontal branches, ascending at the extremities: branchlets slender, drooping: lvs. rhombic-ovate, acutish or obtusish, appressed or slightly spreading at the apex, bright or bluish green: cones globular, nearly sessile, ½–¾in. across; scales 8–10 with a short, obtuse, inconspicuous boss. Himalayas. Gn. 27, p. 39. Var. **Corneyàna,** Mast. (*C. Corneyàna,* Knight). With distinctly pendulous branches: cones oblong, larger. Var. **ma-**

jéstica, Gord. (*C. majéstica,* Knight). Of more vigorous growth, with drooping branchlets, grayish green.

9. **lusitánica,** Mill. (*C. glaùca,* Lam. *C. péndula,* L'Her. *C. sinénsis,* Hort.). Tree, to 50 ft., with spreading branches and more or less pendulous branchlets: lvs. ovate, acutish, glaucous: cones peduncled, about ½in. across, covered with glaucous bloom; scales 6–8, with an elongated, pointed and usually hooked boss. Habitat unknown; cult. in Portugal and naturalized; possibly intro. from India.

BB. *The branchlets distinctly flattened.*

10. **fùnebris,** Endl. (*C. péndula,* Lambert). Tree, to 60 ft., with wide-spreading, pendulous branches and branchlets, branchlets flattened: lvs. deltoid-ovate, acute, light green, often slightly spreading at the apex: cones short-peduncled, globose, ⅓–½in. across; scales 8, with a short-pointed boss. China. G.C. 1850:439. Gn. 28, p. 62. F.S. 6, p. 91.

11. **cashmeriàna,** Royle (*C. torulòsa* var. *kashmiriàna,* Kent. *C. péndula* var. *glaùca,* Nichols.). Tree: branchlets very slender, pendulous, flattened: lvs. rhombic-ovate, spreading at the acute tips, glaucous: cones ⅓in. across. Intro. from Kashmir.

C. formosénsis, Henry=Chamæcyparis formosensis.—*C. Lawsoniàna,* Murr.=Chamæcyparis Lawsoniana.—*C. nootkaténsis,* Lambert = Chamæcyparis nootkatensis. — *C. obtùsa,* Koch= Chamæcyparis obtusa.—*C. pisífera,* Koch=Chamæcyparis pisifera. —*C. pygmæa,* Sarg. (C. Goveniana var. pygmæa, Lemm.). Tree, to 30 ft., often fruiting when only 1 or 2 ft. tall: branchlets rather stout: lvs. dark green, without glands: cones ovoid, ¼–¾in. long, with 6–10 scales; seeds black. Calif., Mendocino Co. S.S. 14:740. —*C. thurífera,* HBK. Tree with spreading branches: lvs. oblong-lanceolate, upright-spreading, not closely appressed: cones globose, about 1 in. across, with slightly mucronate scales.—*C. thyoides,* Linn.=Chamæcyparis thyoides.

ALFRED REHDER.

CURATÉLLA (name refers to the plants being used or *worked:* used for polishing weapons and metal). *Dilleniàceæ.* Three or 4 S. American and W. Indian small trees or scandent shrubs, of which one is sometimes mentioned in horticultural literature. They are warmhouse evergreens, with white fls. in dense panicles. Sepals and petals 4–5; stamens many; carpels 2 (rarely 1), more or less cohering, follicular. *C. americana,* Linn., of W. Indies and S. Amer., grows to 10 ft., erect, tortuous: lvs. oval, rough on the upper side, toothed: fls. malodorous, in lateral compound racemes: bark wrinkled and cracked.



1148. Curculigo latifolia.

CURCÙLIGO (Latin, *curculio,* weevil; referring to the beak of the ovary). *Amaryllidàceæ.* Warmhouse and conservatory foliage plants with the habit of a young palm and an odd flower-cluster.

Stemless herbs, with short rhizomes, radical long narrow usually plicate lvs., and small fls. in spikes or clusters on short scapes that may be nearly concealed at the base of the plant: perianth 6-parted, the segms. spreading and about equal; stamens 6, attached at the base of the segms.; ovary 3-celled.—The genus is closely related to Hypoxis, but differs in its succulent indehiscent fr., and because in many species the ovary has a long beak which looks like a perianth-tube, but this beak is always solid, and bears on its summit the style which is in the center of the perianth.—Twelve species in eastern and western tropics of which *C. recurvata* is grown S. and N., being used by florists for vases, jardinieres, and general decorative work, and also used outdoors in summer. It is of easy cult., but requires perfect drainage. It is a question to be determined whether the plants mostly in cult. are *C. recurvata* or *C. latifolia;* the recurved dense ovoid head of fls. quickly distinguishes the former species.

The curculigos are very ornamental plants for large greenhouses, where a high temperature is maintained. To have them looking their best they should, if possible, be planted out in a bed, where they will attain a height of 5 feet. Their gracefully arching leaves are so constructed that they move continually from side to side with the slightest movement of the air. The variety *variegata* is one of the best variegated-leaved plants. While not so robust as the green form, it is more adapted to pot culture. The soil should be two parts loam and another of rotted cow-manure and sand. Drainage must be carefully arranged, as the plants need an abundance of water. The green-leaved kind stands the summers well in the neighborhood of Washington, D. C., if protected from the sun and afforded an abundant supply of water. As house-plants they are likely to suffer for lack of moisture.

Propagation is by division. The pieces, before potting, will make new roots rapidly if placed in the sand-bed of a warm propagating-house for a few days.

recurvàta, Dry. Height 2½ ft. or more: root tuberous: lvs. from the root, 1–3 ft. long, 2–6 in. wide, with a channeled stalk one-third or one-fourth the length, the blade lanceolate, recurved, plaited: scapes very rarely as long as the lf.-stalks, covered with long, soft brown hairs, recurved at the end, bearing a head of drooping yellow fls., each ¾in. across; the scape is frequently only 1–3 in. long, the fls. appearing almost on the ground; bracts 1 to each fl. and about as long. Trop. Asia, Austral. B.R. 770. (with scape abnormally long). Var. **striàta,** Hort., has a central band of white. Var. **variegàta,** Hort., has longitudinal bars of white.

latifòlia, Dry. Fig. 1148. Height 2–3 ft.: differs from *C. recurvata* in having a very short-stalked erect infl., the bright yellow fls. in a dense cluster near the base of the plant: lvs. lanceolate, 1–2 ft. long and 1–5 in. wide, the petiole 12 in. or less: fr. 1 in. long, club-shaped or pyriform, hairy, with black seeds: the plant produces numerous suckers which, when removed, are easily grown, and bloom in about a year; said to be a beautiful and hardy house-plant, more satisfactory than palms for one without a conservatory. India, Malaysia. B.M. 2034. B.R. 754. L.B.C. 5:443 (as *C. sumatrana*).—Variable in foilage.

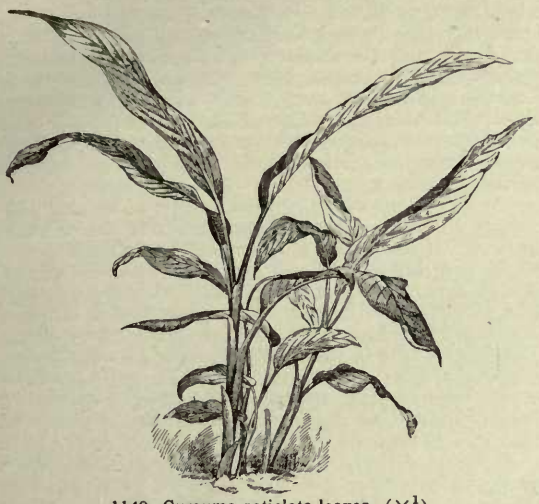
G. W. OLIVER.
WILHELM MILLER.



XXXII. The Fay currant, one of the large red varieties.

CÚRCUMA (Arabic name). *Zingiberàceæ.* Curious and showy warmhouse herbaceous plants with great spikes of large concave or hooded bracts, from which the flowers scarcely protrude.

Erect herbs, the st. rising to 10 ft. from a thick tuberiferous rootstock: lvs. usually large: fls. in a dense cone-



1149. Curcuma petiolata leaves. (×⅛)

like thyrse, borne behind concave or hooded imbricated obtuse often colored bracts; calyx and corolla tubular, the former 2–3-toothed, the latter dilated above and with 5 ovate or oblong lobes; staminodium petal-like, 3-parted, the middle lobe anther-bearing: fr. inclosed by the bracts. The latest monograph, 1904 (by Schumann in Engler's Pflanzenreich, hft. 20), recognizes 42 species, mostly in Trop. Asia and some in Trop. Afr. The fleshy bracts are perhaps the showiest feature of the plant, the topmost ones being colored with gorgeous tropical hues. Rhizomes of some of the species yield East India arrowroot, while others furnish turmeric. The rhizome of *C. zedoaria* of India is very pungent and has properties similar to ginger. The genus is allied to Alpinia and Amomum.

In spring the tubers should be deprived of last year's mold and repotted in a fresh mixture of light loam, leafmold and turfy peat, the pots being well drained, and placed in a warm pit or frame in bottom heat. Water should be given sparingly until after the plant has made some growth. The young roots are soft and succulent, and are likely to rot if the soil remains wet for a long time. After flowering, the leaves soon show signs of decay, and water should be gradually withdrawn. During the resting period the soil should not be allowed to get dust-dry, or the tubers are likely to shrivel. The plants are propagated by dividing the tubers in spring.

cordàta, Wall. Lvs. 1 ft. long, sheathing, ovate, acuminate, the same color on both sides, obliquely penninerved: bracts in a cylindrical spike, the upper part forming a sterile part called a coma, which is a rich violet, with a large, blood-colored spot: fls. yellow, with a pink hood. Burma. B.M. 4435.—This is now referred to *C. petiolata,* Roxbg., but it seems at least horticulturally distinct, with its rose-pink bracts.

petiolàta, Roxbg. QUEEN LILY. Figs. 1149, 1150. Lvs. 6–8 in. long, peculiar in this genus as being more or less rounded or cordate at the base, the stalk 4–5 in. long: fls. spicate, the spikes 5–6 in. long; bracts 20–30, connate at their bases, and wholly including the pale yellow fls. India. B.M. 5821.—The most beautiful and showiest of the curcumas.

lónga, Linn. Lvs. 2–2½ ft., the blade about 1 ft. and narrowed at the base: fls. spicate, autumnal, the spikes 4–6 in. long; bracts pale green, not wholly inclosing the pale yellow fls. India. B.R. 886.—The dried rhizomes of this furnish the well-known turmeric of India, used as a condiment and as a dye. Intro. by the Royal Palm Nurseries.

C. albiflòra, Thwaites, differs from some others here described in having its spikes sunk below the lvs., instead of standing high above the lvs., and all the bracts have fls., while the others have a sterile portion of the spike which is brightly colored. In this species the spike is short and green and the fls. are prominent and white. Ceylon. B.M.5909.—*C. australàsica,* Hook. f., has its upper bracts soft, rosy pink and the fls. pale yellow. Austral. B.M. 5620.—*C. Roscoeàna,* Wall., has a long and splendid spike, with bracts gradually changing from green to the vividest scarlet-orange: fls. pale yellow. Burma. B.M. 4667.—*C. rubéscens,* Roxbg. (C. rubricaulis, Link). Lvs. stalked, oblong, with red sheaths, said to be brown in the center: fls. red. E. Indies.—*C. zedoària,* Roscoe, has the upper bracts white, tinged with carmine, and handsomely variegated lvs., which, with the green of the lower bracts and the yellow of the fls. makes a striking picture of exotic splendor. Himalayas. B.M. 1546.

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CURMÈRIA: *Homalomena.*

CURRANT. The currants grown for their fruit in America are derived mainly from two species, namely, the European red currant, *Ribes vulgare* (*R. rubrum*) (Fig. 1151), and the European black currant, *R. nigrum* (Fig. 1152). There are two promising American species, of which few, if any, improved varieties have been introduced, the swamp red currant (*R. triste*) and the wild black currant (*R. americanum*). Another American species of which at least one named variety has been offered for sale is the Buffalo or Missouri currant (*R. aureum*) (Fig. 1154), also grown because of its ornamental flowers. The currant is not known to have been under cultivation before the middle of the sixteenth century. It is not mentioned by any of the ancient writers who wrote about fruit, and was evidently not known to the Romans.

Currants are natives of comparatively cold or very cold climates; hence most varieties succeed over a very wide area in America. They are among the hardiest of fruits from the standpoint of resistance to cold or changes of temperature, but in hot and dry sections they do not thrive, and, on this account, are unsatisfactory in parts of the southern states.



1150. Curcuma petiolata in flower. (×⅙)

The currant is not so generally used in America as some other fruits, as few persons care for them when eaten raw, and when cooked they are usually made into jelly and consumed by only a comparatively small proportion of the people. In the coldest parts where other fruits do not succeed well, the currant is more popular, and is used much more generally. It is a wholesome and refreshing fruit and deserves much more attention than it receives at the present time.

The currant does not vary so much when grown from seed as most cultivated fruits, and, being so easily propagated from cuttings, it has not been improved so much as it otherwise would have been. Moreover, size in currants was not of great importance until recent years, when competition in marketing has become keener. It is only during the past fifty or sixty years

that many new varieties have been introduced. At the beginning of the nineteenth century, few named sorts were recognized, the currant being generally known simply under the names black, red and white.

Propagation of currants.

The usual method of propagating currants is by means of cuttings. These root very readily and good plants are secured after one season's growth. The best time to make the cuttings is in the autumn, as currants begin to grow very early in the spring, and once the buds have swollen they cannot be rooted successfully. Wood of the current season's growth is used. This may be cut early in the autumn as soon as the wood has ripened, from the end of August to the middle of September being the usual time. It should be cut in as long pieces as possible to save time in the field, and put in a cool moist cellar or buried in sand. If the cuttings can be made at once, it is best to do so. These are made by cutting the wood into pieces, each about 8 to 10 inches long, although an inch or two more or less is not of much consequence. The base of the cutting should be made with a square cut just below the last bud. There should be at least ½ inch of wood left



1151. Common currant—Ribes vulgare, in bloom. (×⅔)

above the top bud of each cutting, as there should be a strong growth from the upper bud, and if the wood is cut too close it is liable to be weakened. A sloping cut is best for the upper cut, as it will shed rain better, but this is not important. When made, the cuttings should be planted at once, which is usually the best plan, or heeled in. If heeled in, they should be tied in bundles and buried upside down in warm well-drained soil, with about 3 inches of soil over them. The object of burying them upside down is that by this method the bases of the cuttings will be nearer the surface where the soil is warmer and there is more air, and will callus more quickly than if they were further down. The cuttings should callus well in a few weeks, and may then be planted outside, if thought advisable. Cuttings may be kept in good condition over winter by heeling-in or burying in sand in a cool cellar, or after callusing under a few inches of soil outside, they may be left there over winter if covered with about 4 to 5 more inches of soil to prevent their drying out. Good results are secured with the least trouble by planting the cuttings in nursery rows as soon as they are made. The soil should be well prepared and should be selected where water will not lie. Furrows are opened 3 feet apart and deep enough so that the top bud, or at most two buds, will be above ground. The cuttings are placed about 6 inches apart on the straight side of the furrows and soil thrown in and tramped well about them. When only a smaller number are to be planted a trench may be opened with a spade. It is important to have a large proportion of the cutting below ground, as more roots will be made and the plants will be stronger. There would also be danger of the cuttings drying up before rooting if too much of the wood is exposed. If the season is favorable the cuttings should callus well and even throw out a few roots by winter. Where there is little snow in winter, it is a good practice to cover the tops of the cuttings with about 2 inches of soil, which will be a good protection for them. This soil should be raked off in spring. In the spring, cultivation should be begun early and kept up regularly during the summer to conserve moisture and favor rooting and the development of the bushes. By autumn they should be large enough to transplant to the field.

In Great Britain and Europe, currants are often grown in tree form and are prevented from throwing up shoots from below ground by removing all the buds of the cuttings except the top one before planting in the nursery. This system is not recommended for most parts of America as it has been found by experience that snow breaks down currants grown in this way, and when borers are troublesome it is not wise to depend on one main stem.

Most of the cultivated varieties of currants have originated as natural seedlings, little artificial crossing having been done with this fruit. Currants grow readily from seeds, and it is easy to get new varieties in this way. The seeds are washed out of the ripe fruit, and after drying, may either be sown at once or mixed with sand and kept over winter in a cool dry place and sown very early in the spring. The best plan is to sow them in the autumn in mellow well-prepared and well-drained soil, since when this is done they will germinate very early in the spring, while if sown in the spring the seed may be all summer without sprouting. The seed should not be sown deep, from ¼ to ½ an inch being quite sufficient. If sown very deep they will not germinate. The young plants may be transplanted from the seed-bed to the open in the autumn of the first year if large enough, but if the plants are very small they may then grow another season, when they should be planted out at least 4 by 5 feet apart, so as to give them room enough to fruit for several seasons, in order that their relative merits may be learned. If intended to remain permanently, the plants should be at least 6 by 5 feet apart. The bushes should begin to bear fruit the second or third year after planting out. Each bush will be a new variety, as cultivated fruits do not come true from seed. If a seedling is considered promising it may be propagated or increased by cuttings, as already described.

The soil and its preparation.

Currants should be planted in rich soil in order to get the best results. The soil should also be cool, as the currant is a moisture-loving bush. The currant roots near the surface; hence if the soil is hot and dry the crop will suffer. A rich, well-drained clay loam is the best for currants, although they do well in most soils. If the soil is not good, it should receive a good dressing of manure before planting, which should be well worked into the soil, the latter being thoroughly

pulverized before planting is done. A northern exposure is to be preferred, as in such a situation the currants are not likely to suffer in a dry time.

Planting.

The best time to plant currants is in the autumn. If planted in the spring, they will probably have sprouted somewhat before planting, and on this account their growth the first season will be checked. When the soil is in good condition, currants, especially the black varieties, make strong growth, and the bushes reach a large size; hence it is best to give them plenty of space, as they will do better and are more easily picked than if crowded. Six by 5 feet is a good distance to plant. If planted closer, especially in good soil, the bushes become very crowded before it is time to renew the plantation. Strong one-year-old plants are the best, but two-year-old plants are better than poorly rooted yearlings. It is better to err on the side of planting a little deeper than is necessary than to plant too shallow. A good rule to follow is to set the plants at least an inch deeper than they were in the nursery. The soil should be well tramped about the young plant so that there will be no danger of its drying out. After planting, the soil should be leveled and the surface loosened to help retain moisture.

Cultivation.

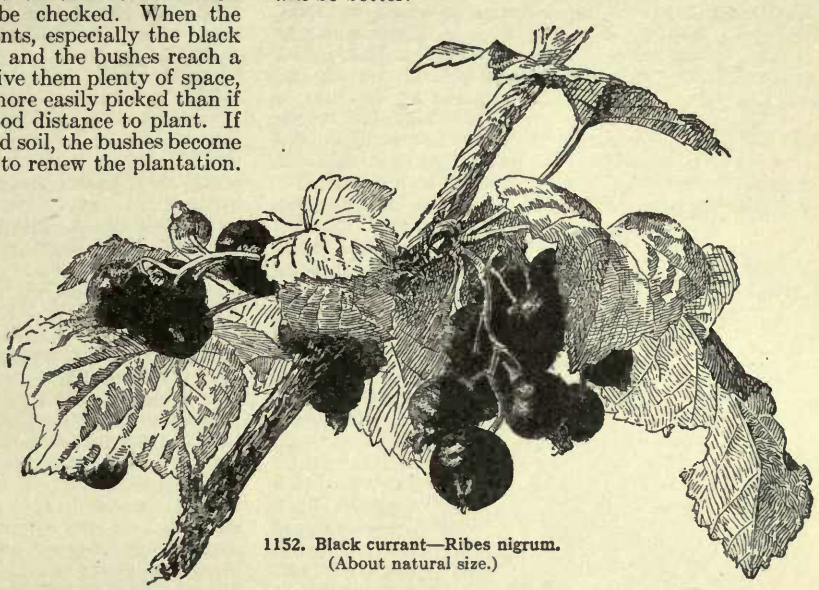
As the currant, to do well, must have a good supply of moisture, cultivation should be begun soon after planting, and the surface soil kept loose during the summer. While the plants are young the cultivation may be fairly deep between the rows, but when the roots begin to extend across the rows, cultivation should be shallow, as many of the roots are quite near the surface.

Fertilizers.

After the first application of manure, no more should be necessary until the plants begin to fruit, unless other crops are grown between, after which an annual top-dressing of well-rotted barnyard manure is desirable. When only a light application of manure is given, the addition of 200 to 300 pounds to the acre of muriate of potash would be very beneficial. Wood-ashes also would make a good fertilizer with barnyard manure. There is little danger of giving the currant plantation too much fertilizer. Unfortunately, it is usually the other way, this fruit being often very much neglected.

Pruning.

The black and red currants bear most of their fruit on wood of different ages; hence the pruning of one is a little different from the other. The black currant bears most of its fruit on wood of the previous season's growth, and it is important always to have a plentiful supply of one-year-old healthy wood. The red and white currants produce their fruit on spurs which develop from the wood two or more years of age, and it is important in pruning red and white currants to have a liberal supply of wood two years and older; but, as the fruit on the very old wood is not so good as that on the younger, it is best to depend largely on two- and three-year-old wood to bear the fruit. A little pruning may be necessary at the end of the first season after planting in order to get the bush into shape. From six to eight main stems, or even less, with their side branches, will, when properly distributed, bear a good crop of fruit. Future pruning should be done with the aim of having from six to eight main branches each season and a few others coming on to take their places. By judicious annual pruning, the bush can be kept sufficiently open to admit light and sunshine. A good rule is not to have any of the branches more than three years of age, since when kept down to this limit the wood will be healthier, stronger growth will be made, and the fruit will be better.



1152. Black currant—Ribes nigrum.
(About natural size.)

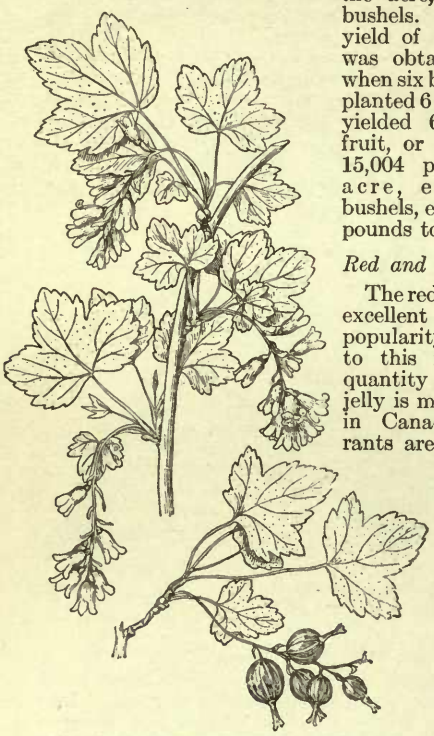
When to renew the plantation.

A currant plantation will bear a great many good crops if well cared for, but if neglected the bushes lose their vigor in a few years. The grower will have to decide by the appearance of the bushes when to renew the plantation; but as a currant plantation can be renewed at comparatively little labor, it is best to have new bushes coming on before the old ones show signs of weakness. At least six good crops may be removed with fair treatment, and ten or more can be obtained if the bushes are in rich soil and well cared for. When one has only a few bushes for home use, they may be reinvigorated by cutting them down to the ground in alternate years, and thus securing a fresh supply of vigorous young wood.

Yield of currants.

The red currant is one of the most regular in bearing of all fruits, and as it is naturally productive, the average yield should be large. Bailey, in the "Farm and Garden Rule-Book," puts the average yield at 100 bushels per acre. Card, in his book on "Bush-Fruits," says that it ought to be 100 to 150 bushels, "with good care," and reports 320 bushels. At the Central Experimental Farm, Ottawa, Canada, the Red Dutch currant averaged for four years at the rate of 7,335 pounds to the acre, or over 183 bushels. The largest yield from red currants obtained at the Central Experimental Farm was in 1900, when six bushes of the Red Dutch currant yielded 73 pounds, 15 ounces of fruit. The bushes were 6 by 5 feet apart. This means a yield at the rate of 17,892 pounds to the acre, or, at 40 pounds per bushel, 447 bushels 12 pounds to the acre. The same variety in 1905, in a new plantation, yielded 55½ pounds from six bushes, or at the rate of 13,431 pounds to the acre, or 335 bushels 31 pounds. These are very large yields, and while half of this amount may not be expected in ordinary field culture, the fact that such yields can be produced on a small area should be an inspiration to get more on a larger one.

The average yield of black currants has been somewhat less than the red, although individual yields have been large. The Saunders currant yielded for four years at the rate of 6,534 pounds to the acre, or over 163 bushels; the Kerry at the rate of 6,382 pounds to the acre, or over 159 bushels. The highest yield of black currants was obtained in 1905, when six bushes of Kerry planted 6 by 5 feet apart, yielded 62 pounds of fruit, or at the rate of 15,004 pounds to the acre, equal to 375 bushels, estimating at 40 pounds to the bushel.



1153. Native black currant—Ribes floridum. The fruit is immature. (×½)

Red and white currants.

The red currant makes excellent jelly, and its popularity is largely due to this fact. A large quantity of red currant jelly is made every year in Canada. Red currants are used to a less extent for pies and as jam and are also eaten raw with sugar. As a fruit for eating out-of-hand, the red currant is not very popular, but there are few fruits so refreshing. The white currants are better liked for eating off the bush than the red, as they are not so acid. The Moore Ruby is a red variety, however, which is milder than most others, and for this reason is better adapted for eating raw. The red currant does not vary so much in quality as the black.

Red currants will remain in condition on the bushes for some time after ripening, and therefore do not have to be picked so promptly as the black.

Varieties. Varieties of red currants vary considerably in hardiness, the Cherry, Fay, Comet, Versaillaise, Wilder and others, while bearing very large fruit, are decidedly more tender than some of the others, hence they should not be planted in the coldest parts. The Franco-German and Prince Albert currants are later than most other varieties, and when it is desired to lengthen the season, these may be planted.

Varieties of red and white currants recommended: Red—for general culture—Pomona, Victoria, Cumberland Red, Red Dutch, Long Bunched Holland, Red Grape. Where bushes are protected with snow in winter, and for the milder districts.—Pomona, Victoria, Cumberland Red, Wilder, Cherry, Fay, and Red Cross. White.—White Cherry, Large White, White Grape.

Black currants.

There are not so many black currants grown in America as red, but there is a steady demand for them, and it is thought there will be an increasing demand as they become better appreciated. They make excellent jelly and the merits of black currant jam have long been known.

Black currants vary considerably in season, yield and quality, and therefore it is important to know those that are the best. As most varieties of black currants drop badly from the bushes as soon as ripe, it is important to pick them in good time.

Varieties of black currants recommended: Saunders, Collins Prolific, Buddenborg, Victoria, Boskoop Giant. Of those not yet on the market which are considered equal or better than those above, the following are the best: Kerry, Eclipse, Magnus, Clipper, Climax and Eagle, and the Success, for an early variety when yield is not so important as size and quality.

Crandall currant.

This is a variety of the Buffalo or Missouri currant (*Ribes odoratum*). A tall, strong, moderately upright grower; moderately productive. Fruit varies in size from small to large, in small, close bunches; bluish black, skin thick; sub-acid with a peculiar flavor. Quality medium. Ripens very unevenly. Season late July to September. As this variety ripens after the others, the birds concentrate on it and get a large proportion of the fruit.

Some of the most injurious insects affecting the currant.

Currant aphis (*Myzus ribis*). When the leaves of currant bushes are nearly full grown, many of them bear blister-like elevations of a reddish color, beneath which will be found yellowish plant-lice, some winged and some wingless. The blisters are due to the attacks of these insects, and when, as is sometimes the case, they are very abundant, considerable injury is done to the bushes. Spraying forcibly with whale-oil soap, or kerosene emulsion will destroy large numbers of these plant-lice at each application; but the liquid must be copiously applied and driven well up beneath the foliage by means of an angled nozzle. Two or three applications at short intervals may be necessary.

Currant borer (*Sesia tipuliformis*). Early in June a beautiful little bluish black fly-like moth, with three bright yellow bands around the body may be seen darting about, around, or at rest on the leaves of currant bushes of all kinds. This is one of the most troublesome enemies of these fruits. The moth lays an egg at a bud on the young wood, and the caterpillar, when hatched, eats its way into the cane and destroys the pith. It remains in the wood during the winter, and the moth emerges during the following summer. Close pruning is the best remedy. Burn the wood.

Currant maggot (*Epochra canadensis*). Red, black and white currants are in some places seriously attacked by the maggots of a small fly. These maggots come to full growth just as the berries are about to ripen, causing them to fall from the bushes, when the insects leave them and burrow into the ground to pupate. Attacked fruit is rendered useless by the presence of the maggots inside the berries; and frequently it is not until the fruit is cooked that



1154. Buffalo currant. R. aureum (×½)



1155. Currant cutting.

the white maggots can be detected. Gooseberries are sometimes injured but far less frequently than black and red currants. The only treatment which has given any results is the laborious one of removing about 3 inches of the soil from beneath bushes which are known to have been infested, and replacing this with fresh soil. That which was removed must be treated in some way, so that the contained puparia may be destroyed. This may be done either by throwing it into a pond or by burying it deeply in the earth.

Currant worm or *imported currant sawfly* (*Pteronus ribesii*). By far the best known of all the insects that injure currants and gooseberries, is the "currant worm." The black-spotted dark green false caterpillars of this insect may unfortunately be found in almost every plantation of currants or gooseberries, every year in almost all parts of America where these fruits are grown. The white eggs are laid in rows along the ribs of the leaf on the lower side, toward the end of May. From these the young larvæ hatch and soon make their presence known by the small holes they eat through the leaves. Unless promptly destroyed, they will soon strip the bushes of their leaves, thus weakening them considerably so as to prevent the fruit from ripening the first year, and also reducing the quality of the crop of the following season. There are at least two broods in a season in most places; the first appears just as the leaves are attaining full growth, and the second just as the fruit is ripening. The perfect insect is a four-winged fly which may be seen flying about the bushes early in spring. The male is blackish, with yellow legs and of about the same size as a house-fly, but with a more slender body. The female is larger and has the body as well as the legs yellow. For the first brood a weak mixture of paris green, one ounce to ten gallons of water, may be sprayed over the bushes, or a dry mixture, one ounce to six pounds of flour, may be dusted over the foliage after a shower or when the leaves are damp with dew. For the second brood paris green must not be used, but white hellebore; or hellebore may be used for first brood, but it is necessary to kill quickly. This is dusted on as a dry powder, or a decoction, one ounce to two gallons of water, may be sprayed over the bushes. It is, of course, far better to treat the first brood thoroughly, to reduce the number of females which lay eggs for the second brood.

Oyster-shell scale (*Lepidosaphes ulmi*). Several kinds of scale insects attack currants. These plants seem to be particularly susceptible to the attacks of the well-known oyster-shell scale of the apple, and the San José scale. In neglected plantations these injurious insects increase rapidly, and a great deal of injury results to the bushes. The remedies for scale insects are direct treatment for the destruction of the infesting insect, and preventive measures, such as the invigoration of the bush by special culture and pruning, to enable it to throw off or outgrow injury. Infested plantations should be cultivated and fertilized early in the season, and all unnecessary wood should be pruned out. As direct remedies, spraying the bushes at the time the young scale insects first appear in June with kerosene emulsion or whale-oil soap, or spraying in autumn before the hard weather of winter sets in with a simple whitewash made with one pound of lime in each gallon of water, give the best results. Two coats of the whitewash should be applied, the second one immediately after the first is dry. In putting on two thin coats of the wash instead of one thick one, far better results have been secured.



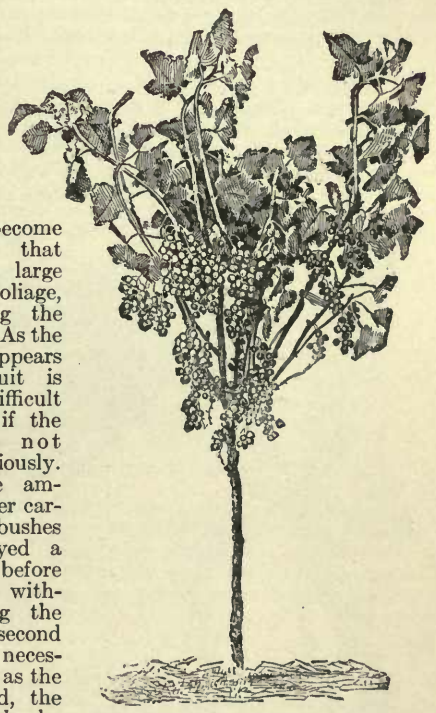
1156. To illustrate the pruning of a currant bush. The old cane, *a*, is to be cut away. The straight new canes at left are to remain.

For the San José scale, the lime-and-sulfur wash is necessary, and must be repeated every year.

Diseases of the currant.

The currant is affected by very few diseases. The only ones that do much injury are the following:

Leaf-spot, rust (*Septoria ribis*). The leaf-spot fungus affects black, red and white currants, causing the leaves to fall prematurely, and thus weakening the bushes. This disease is first noticed about midsummer, when small brownish spots appear on the leaves. These often become so numerous that they affect a large part of the foliage, soon causing the leaves to fall. As the disease often appears before the fruit is picked, it is difficult to control it if the bushes are not sprayed previously. By using the ammoniacal copper carbonate the bushes may be sprayed a week or two before it is expected, without discoloring the fruit, giving a second application, if necessary. As soon as the fruit is picked, the bushes should be thoroughly sprayed with bordeaux mixture. Experiments have shown that this disease can be controlled by spraying.



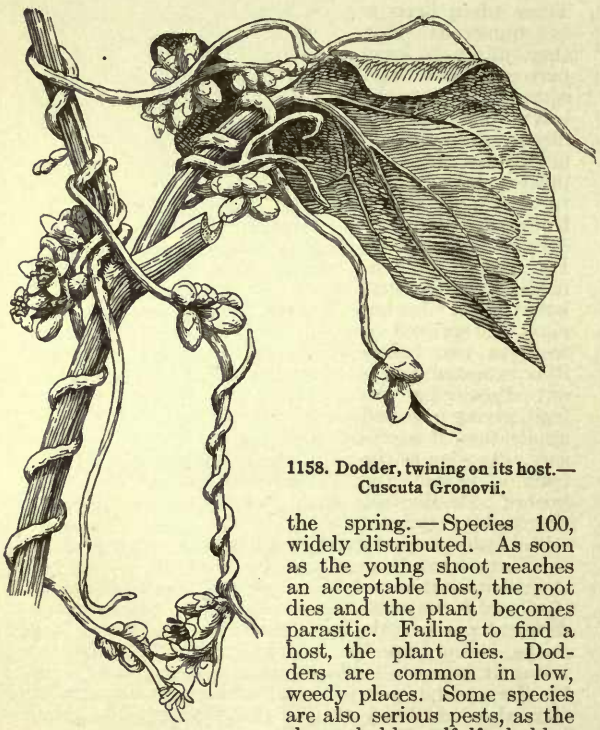
1157. Tree-form training of currant.

Currant anthracnose (*Glœosporium ribis*). This disease, which may be mistaken for the leaf-spot, affects different parts of the bush, including the leaves, leaf-stalks, young branches, fruit and fruit-stalks. On the leaves it is made evident during the month of June by the small brown spots which are usually smaller than those made by the leaf-spot fungus. The lower leaves are affected first, and finally the upper ones. They turn yellow and gradually fall to the ground, and when the disease is bad the bushes are defoliated before their time. On the petioles or leaf-stalks, the disease causes slightly sunken spots. The fruit is affected with roundish black spots which are more easily seen when the fruit is green. On the young wood the diseased areas are light in color and are not so noticeable. The wood is not nearly so much injured by the disease as the leaves. The spores which spread this disease are formed in pustules, the majority of which are under the upper epidermis of the leaf. Where the spores are to appear, the surface of the leaf is raised and blackened

in spots looking like small pimples. When the spores are ready to come out the skin breaks and they escape and re-infect other parts. When the foliage drops early on account of this disease the fruit is liable to be scalded by the sun. The fruit may also wither before ripening properly, owing to lack of food or of moisture, as, the leaves having fallen, they are unable to keep up the necessary supply. The premature falling of the leaves prevents the buds from maturing properly, hence they are not in so good condition to bear fruit the next year. Spraying with bordeaux mixture is recommended as an aid in controlling this disease. It would be wise, when currant anthracnose is troublesome, to spray the bushes thoroughly before the leaves appear. A second spraying should be made when the leaves are unfolding, and successive sprayings at intervals of ten to fourteen days until the fruit is nearly full grown, and there is danger of its being discolored by the spray when ripe. Paris green should be added to the mixture when the first brood of the currant worm appears. A thorough spraying after the fruit is harvested is desirable.

W. T. Macoun.

CÚSCUTA (origin of name obscure). *Convolvulàceæ.* Dodder. Degenerate parasitic twiners, bearing clusters of small flowers. They are leafless annuals, with very slender yellow, white, or red stems, which become attached to the host-plant by means of root-like suckers. The seeds fall to the ground and germinate in the spring. — Species 100, widely distributed. As soon as the young shoot reaches an acceptable host, the root dies and the plant becomes parasitic. Failing to find a host, the plant dies. Dodders are common in low, weedy places. Some species are also serious pests, as the clover dodder, alfalfa dodder, and flax dodder. One of the common species (*C. Gronovii*, Willd.), of low grounds, is shown in Fig. 1158.



1158. Dodder, twining on its host.— Cuscuta Gronovii.

CUSHAW: *Cucurbita moschata.*

CUSTARD APPLE: *Annona.*

CUT-FLOWER INDUSTRY IN NORTH AMERICA. The feature that most distinguishes American floriculture from that of Europe is the great preponderance of the cut-flower trade as compared with the sales of plants. Forty years ago the passion of Americans for cut-flowers was remarked by travelers, but however important the cut-flower trade may then have appeared it has had a marvelous growth since that time. Prior to the Civil War it would have been impossible to purchase any considerable quantity of cut-flowers in the winter season in any of the large cities. The greenhouses were small flue-heated structures in which a great variety of plants was grown; hence it would have been impossible to secure a quantity of any one kind. There were no middlemen to collect even the small quantities produced in a locality, and when large numbers of blooms were required, advance notice was expected and the person wishing the flowers had to do the collecting from the various establishments. After the period mentioned, floricultural establishments rapidly increased in number and size. This growth has continued until today. Instead of being concentrated about large cities, there is scarcely a city of 5,000 or even less that does not have its florist. Not less than $100,000,000 is now invested in the cultivation and sale of cut-flowers in America. Although statistics of the cut-flowers alone are not available, a conservative estimate based on the United States census of 1910 places their annual value at $25,000,000.

From forty to sixty years ago the camellia was the most valued cut-flower, either for personal adornment or for bouquets, and sometimes as much as $1, $2 and even $3 were obtained for single flowers at the height of the holiday season. Then came a period of decline during which they were almost forgotten except in a few private collections, but now they are seen upon the market as pot-plants. The florist of the present generation wonders how they could have been admired to the extent that they should lead as cut-flowers. Perhaps no better idea of the requirements of the former cut-flower trade can be given than to quote the record of a leading New York florist establishment for 1867 which shows a product as follows: Camellias about 45,000, bouvardias 20,000, carnations 70,000, double primroses 100,000, and tuberoses 50,000. Other flowers on the market in those days were daphne, abutilon, callas, sweet alyssum, poinsettia, eupatorium, heliotrope and a few tea roses. The most profitable white cut-flowers, in the opinion of many florists, were *Stevia serrata*, Double White camellia, *Calla æthiopica*, *Lilium candidum*, *Deutzia gracilis*, and Double White Chinese primrose.

It will be noted that roses were not important in the cut-flower trade of this period. It is a fact that very few were grown under glass. A few florists were growing Bon Silene, Lamarque and Safrano roses, occasionally devoting an entire house to them, but more often in houses with other flowers. The rapidly-awakening demand for all kinds of flowers brought good prices for roses and stimulated the florists to give this flower more attention. The time was one of changing ideals and the old formal camellia, show dahlia and Chinese chrysanthemum were passing, while new and less formal flowers were coming into favor. The flower-buying public, however, wanted something larger than the small tea varieties then grown. Every new variety from Europe that had any promise was tried, and from that day to this scarcely a new introduction has escaped a searching test as to its adaptability for culture under glass. The Marechal Niel was grown for the discriminating trade, and it continued the leading variety until it was supplanted by the everblooming, more prolific and more easily cultivated Perle des Jardins. Likewise, the hybrid perpetuals were tried, and some of them, notably General Jacqueminot, were found to force well. This variety, when it could be had for the holidays, brought $1 and $2 a bud.

The roses of this time were produced on plants grown in deep beds or in pots or boxes. The latter method enabled the grower better to time his crops, while the former involved less time and attention. The endeavor to secure the advantages of both naturally resulted in

the shallow raised bench, and this method of growing cut-flowers has been adopted for practically all now grown in large quantities; in fact, this system of culture is perhaps the greatest single feature which distinguishes American floricultural methods from those of Europe. Simultaneously it became very generally recognized that to grow roses successfully required separate houses and a different temperature. For a long time it was thought that a special form or construction was necessary, viz., the three-quarter span, but now the even-span house is in general use.

The present cut-flower production.

Having made these important advances in cultural methods, it needed but the introduction of the epoch-making rose, Catherine Mermet, to place the rose in the first place among cut-flowers. This variety came at once into great popularity with the flower-buying public and was very profitable to the growers, thereby attracting capital to the flower business. The competition to produce and market the best quality of flowers elevated the standards in cut-flowers to a higher level. Although the introduction of Catherine Mermet did much for the flower business, it is as the parent of Bride and Bridesmaid that the variety is generally remembered. These "sports" have been the leading white and pink varieties for twenty years, and have been displaced only during the last five years by White Killarney and Killarney, although many claimants arose to dispute their leadership. These roses succeeded because they were profitable with every florist who could grow roses, and it is doubtful whether we shall ever see varieties so generally successful over so wide a territory. The market is seeking a greater variety among roses than it did during the years these roses held sway, but all this is advantageous to the rose specialists. Next in importance to Bride and Bridesmaid and their successors, White Killarney and Killarney, is the American Beauty (Madame Ferdinand Jamain). This variety can be grown successfully and profitably only by growers who have special conditions. As the variety is still without a rival, it continues to be popular with the wealthy flower-buyers.

The American carnation may be regarded as the greatest contribution America has yet made to the floriculture of the world. The plant is unlike any type grown in Europe and its development is due to American plant-breeders, Dorner, Fisher, Ward and many others. During the last fifty years it has been improved in form, size, color and productiveness. Hundreds of varieties have been introduced and the progress has been so rapid that the best have lasted but a few years. Within the last ten years the American carnation has become popular in England, and now new varieties are appearing from over the sea. The United States census of 1890 shows that roses were first, carnations second, and that the two comprised 65 per cent of all cut-flowers. This relative standing has been maintained to the present time.

The development in chrysanthemums has been no less marked. From the old formal Chinese sorts, the popular fancy turned to the large informal Japanese kinds. Now a change to the single and pompon types is being experienced. The varieties of greatest commercial importance have been for the last ten or fifteen years of American origin. The English, French and, finally, the Australian varieties have led as exhibition flowers, but only an occasional variety has proved meritorious as market cut-flowers. (See *Carnation*, *Chrysanthemum*, *Rose*, and other special articles.)

At the present time the important cut-flowers are roses, carnations, violets, chrysanthemums, sweet peas, lilies, narcissi, orchids, lilies-of-the-valley, mignonette, snapdragons, marguerites and gardenias. A modern cut-flower establishment in the region of New York grows for its wholesale trade the following numbers of plants:

Roses	100,000
Chrysanthemums	240,000
Carnations	45,000
Lilies (75,000 for Easter)	150,000
Lilies-of-the-valley	300,000
Orchids	25,000

These are grown in a range of houses comprising 900,000 square feet of glass requiring 8,000 tons of coal, 300 employees, 25 horses, 4 automobiles, and a 250-acre farm with a dairy of 160 cows to suppy the manure required.

The past ten years have witnessed the development of the new winter-flowering types of sweet peas, and now these flowers bid fair to rival the violet and chrysanthemum for position after roses and carnations.

Orchids, particularly cattleyas, now are being grown by commercial florists for cut-flowers. Although of recent development, during the last ten or twelve years, all large establishments have an orchid department, while many smaller growers are specializing in their culture.

Lilies, through the means of cold storage, may now be had by forcing throughout the year. The varieties of Japanese longiflorums have largely supplanted the old *Lilium Harrisii* kind. *Lilium speciosum* varieties are now largely grown.

The antirrhinum is now being grown by several specialists and doubtless will yield varieties adapted to greenhouse culture.

The most important outdoor flowers for cutting are peonies, gladioli and asters. The peony is now a most important Memorial Day cut-flower, and many acres are devoted to its culture in regions in which the improved varieties mature their flowers early enough. By means of cold storage, flowers of certain varieties may be kept in good condition for as much as four weeks. The florists are enabled to have a supply of this flower for commencements, weddings, and the like, throughout the latter part of May, June and early July.

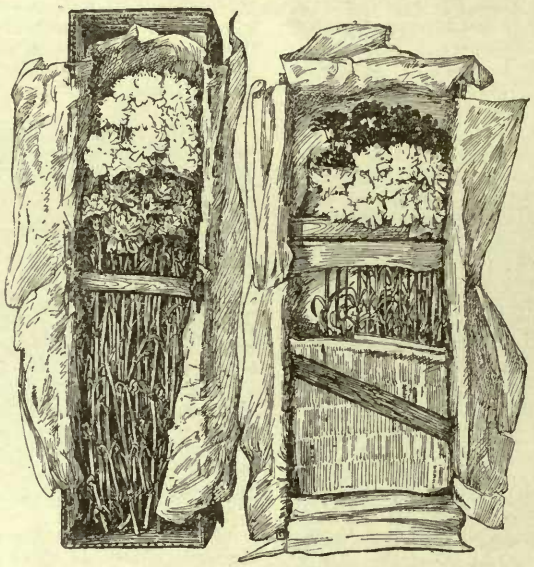
Gladioli are increasing in popularity as summer cut-flowers because of their keeping qualities under ordinary conditions. Not only are the white varieties useful, but the magnificent colored varieties are being used in large numbers for bouquets on dining-tables in hotels and restaurants.

The selling.

The marketing of cut-flowers is a business of itself. Many an excellent grower fails because he is not expert in selling his blooms. The cutting of the blooms must be properly done and at the right stage of development. The proper stage in the development when cutting should be done varies with the variety and the season. Roses should be cut as the petals begin to unfold, when the tip of the bud is bursting and the outer petals have reached the proper color. Carnations are picked when fully developed or when three-quarters developed. The latter stage is determined by the pistils having reached an even length with the center petals. Most flowers should be cut early in the morning, and as soon as cut should be placed in clean fresh water, after which they are carried to the cooling-room. The vases in which the flowers are placed should be deep enough to allow plunging the stems two-thirds their length in water. The temperature of the water should be 10° to 15° higher than that of the cooling-room which is 45° to 50°. The temperature is thus gradually lowered to that of the storage-room. The flowers remain in the cooling-room until the picking is done, when they are graded.

Along with the advance in cultural methods and to meet market requirements, flowers have been graded. Although the kinds of flowers grown and the quality

differ but little in the various flower markets, the grades are not yet uniform. However, this ultimately will be brought about through the Florists' Telegraph Delivery Association, an organization which enables a resident of San Francisco, for example, to have an order filled and delivered at an address in Boston, Montreal, Baltimore or elsewhere. The American Rose Society adopted the following grades for tea and hybrid tea roses: 9, 12, 15, 18, 24 inches of stem. Of course the flowers must be good to accord with this standard. American Beauty is graded: Specials, above 38 inches; fancy, 32 to 36 inches; extras, 24 to 32 inches; firsts, 13 to 23 inches; seconds, 8 to 13 inches; thirds all under 8 inches. On the Chicago market this variety is graded into specials, 36-, 30-, 24-, 20-, 18- and 12-inch stems. Carnations on the New York market are usually graded into fancies, extras and firsts. Fancies are all perfect blooms, from 2¾ to 3½ inches in diameter, with straight stems 16 to 24 inches or more in length. Extras are those blooms which fall short in one or the other of the above requirements. Firsts comprise all merchantable flowers which do not pass as extras or fancies. During the grading, all the leaves from the lower 6 inches are stripped off as well as any side shoots in the axils of the remaining leaves. Chrysanthemums are classed as small, medium, fancy and special. Whatever the grades used in any market, it is important that they be definite, and that the grower use care in grading his own products.



1159. Carnations packed for shipment.

The present methods of the growers in disposing of their flowers to the retail florists are as follows: The large wholesale growers maintain wholesale stores of their own, dealing with the retailers direct and conducting a shipping trade. The growers at a distance from the city market usually consign to the wholesale commission florist whose field is as broad as that of the wholesale grower. These two classes of florists keep in close touch with their customers, even those at a distance, by the ordinary means of communication and in some cases by traveling representatives. The smaller growers living close to a large city adopt any one of five methods, that is, (1) form a coöperative association with an expert salesman to sell the flowers; (2) organize a flower-market and operate a flower-stand; (3) consign the flowers to a commission florist; (4) supply certain retailers regularly; (5) operate their own retail stores. The particular method to be adopted in any individual case depends upon the local conditions and the business ability of the grower. The grower-specialist usually will find it more remunerative to arrange with retailers better able to dispose of his high-class product.

The development of the methods of packing and handling flowers has been a great factor in the business. In the old days flowers were brought to market, or as was more often the case, the retailers went to the growers and carried them into the city in market-baskets. They were delivered to the customers in the same way. When flowers were to be shipped, which was seldom, any convenient box was adapted to the purpose. At present the florists employ wooden and folding paper boxes for different classes of trade. These are in various sizes adapted to the kind of flower to be packed and to the quality shipped. Furthermore, the package is clean, light, strong and entirely in keeping with the goods. The perfection of the railway and express service has facilitated the delivery of flowers to the consignee. Not only has this enabled growers to get their flowers to the city, but has made it possible for florists over the country to secure flowers when they do not have a sufficient supply. The great wholesale flower business of Chicago is built in a large measure upon the demand of florists in towns and cities over the vast territory extending from Winnipeg to the Gulf of Mexico, and from the Alleghanies to the Rockies.

The packages now used to carry the flowers to the wholesale market are either return or gift boxes; the former, are strong wooden boxes with a hinged lid 12 to 16 inches wide and 5 to 6 feet long. These packages are returned to the grower. Some do not find it profitable or possible to have shipping-boxes or -crates returned and must use gift boxes which may be of wood or heavy paper. The common box used by the wholesalers in shipping flowers to distant customers when the package must be handled many times, is the light wooden box. This is made of thin wood, ½-inch ends and ¼-inch tops, bottoms and sides, with two interior cleats to hold the flowers down. These boxes are made in sizes 4 to 8 inches deep, 12 to 16 inches wide, and 36 to 50 inches or more long. The boxes are first lined with paper, usually four to eight thicknesses of newspapers, according to the season. Then a layer of waxed paper is put in. Roses, whether on their way into or out of the wholesale market, are seldom bunched. Carnations, when shipped out or when sent in by a wholesale grower to his own store, are usually not bunched, but growers who sell through the commission florist should bunch the flowers as it facilitates handling when the flowers arrive on the market. Sweet peas, violets and similar flowers are always bunched. The number of flowers in a bunch will depend upon the requirements of the market. Usually sweet pea bunches contain twenty-five; violets, fifty or one hundred; peonies, thirteen; and carnations, twenty-five flowers. The bunches of violets are encircled by a rim of twenty to thirty leaves and the combination must be attractively done if even the best flowers are to bring a good price. Sweet peas are bunched without foliage, while most flowers bear their natural foliage.

Long-stem flowers, such as roses and carnations, when not tied in bunches, are packed one by one in rows across the width of the box, beginning at one end. The first row rests upon a pillow made of a roll of paper, and each succeeding row is separated from the preceding row by a strip of wax paper. This continues until five rows have been put in each end of the box. Five or six rows of flowers in each end constitute a layer. The flowers of each layer are covered with a sheet of wax paper, and the packing goes on until the box is filled; but only four to six layers should be put in a box.

Over the stems in the center are placed eight to ten thicknesses of well-saturated newspapers, after which cleats are nailed in place. This will prevent the flowers from becoming disarranged in shipping. When different grades of roses are to be packed in the same box, the specials are placed in first unless shipment has a long distance to travel, when two or three rows of the cheap, short grades should go next the end of the box because of danger of injury to the flowers. Each grade is separated from the next by sheets of tissue paper and the different grades are filled in until the short lengths complete the box. It should be a general rule to pack white flowers in the top of the box. Every box should contain a statement of the contents for the information of the recipient. No icing is usually needed in winter, but in warm weather the foliage of roses may be sprinkled with water or chipped ice. Carnations are cooled by lumps of ice wrapped in wet newspapers and placed between the cleats of the boxes. Violets are preserved by wrapping the stems in soft tissue paper and dipping this in cool water. Sweet pea stems are wrapped in wet cotton wool, great care is being taken to prevent wetting the blooms.

In the early days of the cut-flower business, the grower retailed his own flowers. He found time to propagate the plants, tend the furnace, grow the crops, cut the blooms, make floral designs and, if necessary, pack and ship his product. The rapid growth of the cities, making it impossible for the florist to conduct his business near the centers of trade, led to the retail florist. This man, having no glass, could open a flower-stand or store in the most favorable locations, giving it his entire time. The present-day flower stores are the achievements of his skill and industry in developing the art side of the florist business.

The changing demands.

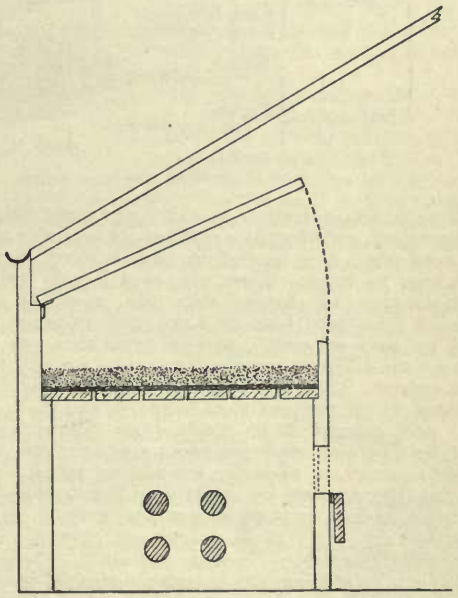
The uses to which cut-flowers are put have changed. Forty years ago the taste was for formal designs. The flowers were picked with short stems, and in the case of carnations only the open buds were cut, while the remaining buds on the stem were allowed to develop. These flowers were wired to wooden sticks for basket work or to broom-corn straws for bouquets. The details for making the formal pieces of that time will be found in Henderson's "Practical Floriculture." That the florists of that day enjoyed a good trade is seen in the fact that on New Year's Day, 1867, one New York firm sold $6,000 worth of flowers, and it was estimated that the total sales in the city amounted to $50,000. The same authority estimates the annual sales of flowers in New York at $400,000 and in Boston $200,000. Probably the sales of the whole country did not exceed $1,000,000. Often $200 or $300 were spent for flowers for a reception, and the spending of $1,500 for a similar purpose, as well as a $6,000 church decoration, were then the highest achievements of the profession.

The public taste of the present day is for loose, artistic arrangements of long-stemmed flowers. The popular funeral emblems are forms of the wreath which are either made of one kind of flowers or of a great variety of material. Flat sprays and bunches of flowers, and palm (sago) leaves tied with ribbon are also commonly used. House decorations consist of vases of long-stemmed flowers. Roses, carnations, chrysanthemums, peonies and gladioli are suitable for this purpose. Table decorations for dinner are also made of long-stemmed flowers in vases, with some placed on the cloth with ferns or asparagus. Bridal bouquets are arranged often in shower effects by means of narrow ribbon. A remarkable advance has been made in the use of ribbon. Instead of the florist going to the nearest drygoods store for the ribbon he needed, the present-day florist carries his own supply of specially prepared ribbon. As soon as a new shade of color appears in roses, a new ribbon is manufactured to match the color. The accessories now required to conduct a successful florist business are numerous, requiring a considerable outlay of money; and the trade in this class of floral supplies is a very large one. Every large city now has its supply houses. The kinds of flowers used throughout the United States and Canada vary very little and this is confined to varieties rather than species. The growth of the cut-flower business in Canada also has been rapid, and artificial boundaries have not divided the florists of the two countries. A good book on cut-flower culture is "How to Grow Cut-Flowers," by M. A. Hunt. There are no works on the handling of cut-flowers. On the use and arrangement of flowers, the best literature is found in the current trade papers. Among the foreign works which may prove helpful are "Floral Decoration," by Felton; "The Book of Cut-Flowers," by R. P. Brotherston; and the German special journal, "Die Bindekunst."

A. C. Beal.

CUTTINGS, PROPAGATION BY. A cutting is the gardener's name for a piece of stem, root, rootstock or leaf, which, if cut off and planted under suitable conditions, will form new roots and buds, reproducing the parent plant.

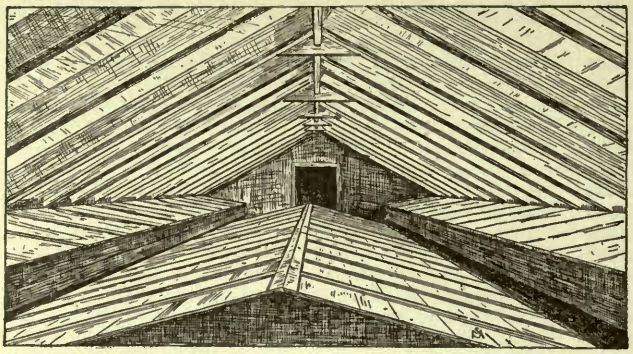
The word cutting, when unrestricted, is given to parts of the stem; a part or the whole of the leaf, when so used, is called a leaf-cutting; a piece of root or rootstock is called a root-cutting. The scales of some bulbous plants, as of the lily, can also be used as cuttings. A cion used in grafting might be called a cutting which unites and grows on another plant. Plants secured by division or layering are provided with roots before they are detached from the parent plants, and, therefore, are not properly cuttings. There are intermediate states between these different categories, however, so that hard-and-fast definitions do not hold.



1160. Section of propagating-bed. Shows four pipes beneath, the door in the side, and the frame cover.

The practice of propagating by means of cuttings, together with the discussion of the reasons, results and bearings, constitutes a department of horticultural knowledge that has been denominated *cuttage*, as the practices, reasons and philosophy of tilling have been called tillage.

Multiplication by cuttings is a form of bud-propagation in contradistinction to sexual reproduction, i.e.,



1161. Permanent propagating-frames in a greenhouse.

propagation by seeds. It is a cheap and convenient way of securing new plants. All plants cannot be profitably increased by these means. Why they differ we do not know; the gardener learns by experience what species yield a good percentage of healthy plants, and acts accordingly.

The following table will show the different ways in which cuttings are made:

- Cuttings
  - Stem
    - Growing wood
      - Soft — e.g., verbena.
      - Hardened — e.g., tea roses.
    - Ripened wood
      - Long, in open air — e.g., grape.
      - Short, under glass — e.g., Japanese cedar.
  - Roots or rootstocks
    - Short, under glass — e. g., *Anemone japonica.*
    - Long, in open air — e. g., blackberry.
  - Leaf
    - Entire — e. g., echeveria.
    - Divided — e. g., *Begonia Rex.*
    - Bulb-scales — e. g., lilies.

There is less variation in cutting-progeny than in seed-progeny, and therefore cuttings (or layers or cions) are used when it is desired to keep a stock particularly true to name. They are used largely for the multiplication of forms that are specially variable from seed (which have not become fixed by seed selection), and of mutations as between the different branches or parts of a plant (bud sports). Thus, the varieties of roses, chrysanthemums, carnations, most begonias, and currants and grapes can be grown from cuttings. Cuttings are also employed when seeds are difficult to secure, as in many greenhouse plants, or when propagation by seeds is difficult and cuttings are easy, as in poplars and willows.

The cutting-bed.

Under glass cuttings are commonly planted in pure sand, such as a mason would use for making mortar. Sphagnum moss is sometimes used and various substances like brick-dust, coal-ashes jadoo fiber have been tried, but without much success. Sand and well-rotted leaf-mold mixed half and half, is occasionally employed for geraniums, for lily scales, root-cuttings and some succulent plants.

Sphagnum is useful in rooting *Ficus elastica,* the base of the cutting being wrapped in a ball of moss and plunged in a bed of moss. English ivy, oleander and other plants can be struck in water, but this method is cumbersome. Peter Henderson's saucer method is valuable in hot weather: the cuttings are planted in sand, kept saturated and fully exposed to sun.

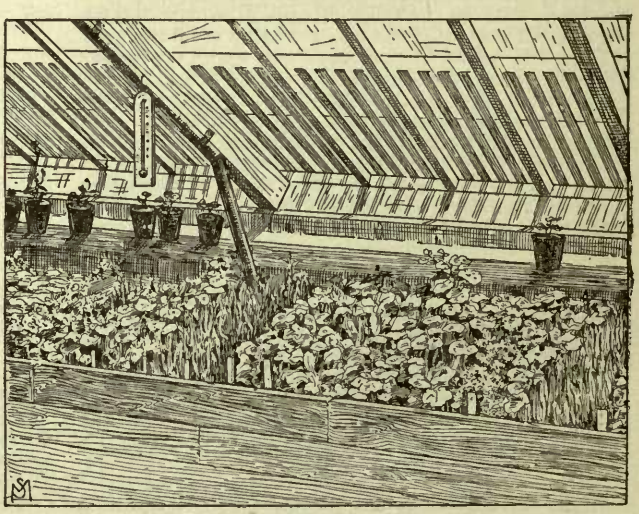
In the open air, a well-protected place, a part of the frame-yard, for example, should be chosen for a cutting-bed. The aspect should be southerly and the soil must be well drained. The soil should also be trenched to the depth of 2½ to 3 feet, all poor material removed and additions of humus, in the form of peat, leaf-mold or well-rotted barnyard manure incorporated. Provision for watering should be easy. If the soil is a heavy clay, add sand.

Structures in which cuttings are started. Figs. 1160–1165.

Large establishments have one or more houses set apart for this and similar purposes called "propagating-houses." In smaller places a propagating-bed or -bench can be made at the warmest end of the warmest house. It should be placed over the pipes where they leave the boiler, and, in order to secure bottom heat when needed, the space between the bench and the floor should be boarded up, having a trap-door to open on cold nights (Fig. 1160). Cutting-frames inside a greenhouse are also shown in Fig. 1161. Side partitions should also be provided to box in all the heat from the pipes under that part of the bench. Good dimensions for such a bed are, width 3 feet, length 6 feet or any multiple of six thus making it simple to use a hotbed sash when confined air is wanted. The depth of the frame should be from 6 to 10 inches in front and about the same behind. The bottom of the bed may be either wood, slate or metal and should be well drained: place a layer of potsherds first, then moss, and from 2 to 3 inches of sand on top. The sand should be clean, sharp and well compacted: before planting it should be watered if at all dry. It is sometimes advisable to have the bed filled with moss (sphagnum), into which pots or boxes containing cuttings are plunged: the moss should be moist, neither too wet nor dry, and well packed.

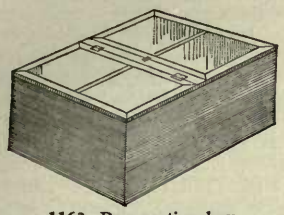
In many cases, when large quantities of one sort of easily struck cuttings are to be planted, the ordinary greenhouse bench covered with sand is sufficient (Fig. 1162).

Hand-lights and bell-glasses are sometimes used under glass for small quantities of cuttings instead of frames. They may be of every convenient size up to 12 or 15 inches in diameter. The important point is that



1162. Cutting-bench shaded with lath.

provision for good ventilation be always provided: if too much water accumulates inside the glass it can be wiped off with a cloth. They are somewhat obsolete devices for providing a close atmosphere and intensifying bottom heat. The modern gardener finds that sunlight and shading with papers put directly over the cuttings is quite sufficient for all plants except a few difficult subjects. Figs. 1163–1165 illustrate forms of hand structures.

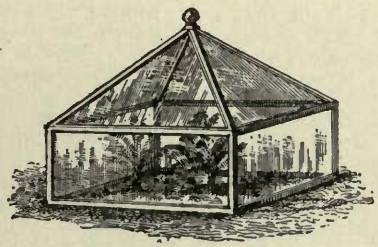


1163. Propagating-box.

Out-of-doors cold-frames are employed for striking cuttings in summer. They are made of concrete or plank, and are about 5½ feet wide, 18 inches deep behind and 12 inches in front. They are of any convenient length, which is a multiple of three and are covered with standard hotbed sash. Instead of coldframes, light hotbeds are sometimes employed for rooting cuttings in the open air in summer. They entail more care and the results do not offset the gain.

Cuttings of growing wood. Figs. 1166–1171.

These cuttings are made either of the soft growing tips, as in coleus (Fig. 1166; also Fig. 1027, p. 827), salvia, verbena (Fig. 1167), geranium (Fig. 1168) and others, or, of the same wood in more mature condition, but by no means ripe, as in tender roses (Fig. 1169), and *Azalea indica*. The cuttings of plants like *Euphorbia pulcherrima*, erica, epacris, are used in the soft growing state, if a well-built propagating-house is obtainable; but in an ordinary house, a part of which is used for other purposes, the older and better ripened wood will be more successful.



1164. Propagating-box or hood.

It is generally true that cuttings of hardened wood will always root, although they require more time and may not make the best plants, but it is not true that cuttings of the soft wood will always root. In many cases, as in the rose, they succumb before they callus, much less produce roots. In plants of rapid growth and good vitality, the proper condition of the soft growing wood for cuttings can be determined by its readiness to snap, not bend, when bent back: the hardened wood is in the right state as long as it continues to grow.

The treatment of cuttings in both classes is practically the same. They should be planted in sand under glass.

The wood for soft cuttings should be fresh, and precautions should be taken to prevent wilting during making and planting: if the weather is hot, sprinkle the floor and bench of the workroom: if they are delicate and exposed for an hour or more, lay them between folds of moistened paper. The average length of these cuttings is from 1 to 3 inches, but they can be made longer or shorter; much depends upon the nature of the plant. The best growers prefer short cuttings; the advantage of a long piece to begin with is more than offset by greater danger of wilting and consequent retrogression. It is not necessary to cut to a bud, i. e., at the node, in the more easily handled plants except in some herbaceous tuberous-rooted plants, like dahlia (see Fig. 1170), and *Salvia patens*, in which a crown must be formed to insure future growth. Make the cut where it will give the proper length. A part of the leaves should be removed, always enough to secure a clean stem for planting, and as many more as are needed to prevent disastrous wilting: this factor varies greatly. In a hardwood cutting of lemon verbena all leaves are taken off, in zonale geraniums from the open ground few if any are left, in coleus and verbena about one half are removed, while in *Olea fragrans*, *Daphne odora*, and heath, only enough for planting. Use a sharp knife; but scissors are handy for trimming and sometimes for making cuttings of those small-wooded plants which root easily.



1166. Cutting of soft growing wood. (as of Coleus.)

The cuttings of plants with milky juice should be washed before planting. Sometimes the lower ends are allowed to dry for several hours, the tops being protected against wilting. Large and succulent cuttings, e. g., of pineapple, cotyledon and cactus, should be dried before planting by letting them lie on the surface of the propagating-bed for several days, or they may be planted in dry sand at first. Under these conditions a callus forms which tends to prevent decay; but the wood must not shrivel.

Peter Henderson has introduced a method which is likely to increase the percentage of rooted plants, and which is desirable in slow-growing varieties, like the tricolor geraniums. He advises that the cutting should be partly severed and allowed to hang to the parent plant for a few days; this results in a partial callus or even roots, before the cutting is entirely removed.

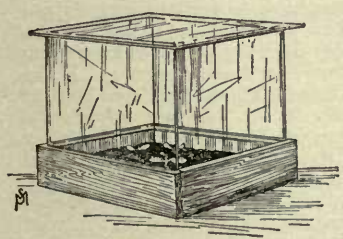
In planting cuttings, use a dibble or open a V-shaped trench. Never thrust the cutting directly into the soil. Plant deep enough to hold the cutting upright and no deeper (as in Fig. 1171), making due allowance for the sand settling; the distance apart should be just enough to prevent them from pressing against each other. It must be remembered that they stay in the bed only until rooted. As soon as growth begins, they are potted off. When the cuttings are inserted, the sand should be firmly pressed about them, and they should be watered with a syringe or with a fine rose; the forcible application of water compacts the sand, thus excluding air, and prevents undue wilting.



1167. A rooted verbena cutting.

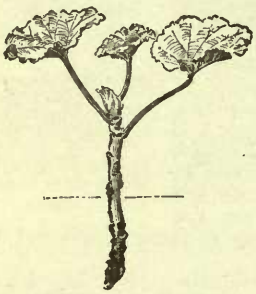
Give shade immediately, using lath shutters outside, cloth screens or papers placed directly on the cuttings within, and attend to this very carefully for the first few days. Lift the shades early in the afternoon, and put them on late in the morning, but keep them on during the middle of the day, thus gradually accustoming them to full light.

Cuttings should never suffer from dryness. The sand should always be kept moist to the verge of wetness. Ventilation should be given on bright days, but all exposure to draft avoided. A good temperature for propagating is from 60° to 65° F., increasing these figures for tropical plants and reducing them for more hardy kinds. It is debatable whether bottom heat and



1165. Small propagating-box, adapted to a window.

confined air are advisable for cuttings of growing wood. The older gardeners employed both, but now neither is commonly used, except for tropical plants, like croton, or when a constant succession of crops of cuttings is required. There is no doubt that with this aid cuttings will root more quickly, but more skill and care are required, neglect bringing on fungous disease, which results in unhealthy plants or total loss. If bottom heat is used, the average temperature of the bed should be 10° or so above that of the air, but less will suffice. Indeed, in beds made as described above, in good weather the sand is enough warmer than the greenhouse atmosphere to answer every purpose. If a confined air is wanted, ventilation and shading must be carefully looked after, and precautions taken against the accumulation of condensed moisture within the bell-glass or frame.



1168. A geranium cutting.



1169. A rose cutting.

Although it is tender plants, in the main, that are propagated by cuttings of growing wood, the above methods can be practised advantageously with some hardy plants. The wood, which is invariably more successful if hardened, is obtained either from plants forced for this purpose, e. g., spirea, *Deutzia gracilis*, or it is gathered in June and July out-of-doors, e.g., lilac, hydrangea. They should be potted off in 2- or 3-inch pots, in a rather sandy soil, when the roots are from ¼ to ½ inch long. It is sometimes good economy to box them, i.e., plant them a few inches apart in flats, when not immediately required.

Some hardy perennials, like *Phlox subulata*, *Campanula carpatica*, *Gentiana acaulis* and the hardy candytuft, can also be easily increased in this way. Make the cuttings 2 to 3 inches long and plant in flats or pots in sand or a sandy soil in October, November or December, before any hard frost. Keep in a coolhouse and pot off when rooted. They make nice plants for planting out the following spring. Plants of this same nature can also be propagated in the open air in autumn. Make the cutting longer, 6 inches when possible, and do the work earlier, in September or in August in some cases.



1170. Hardened-wood cutting of dahlia.



1171. A carnation cutting.

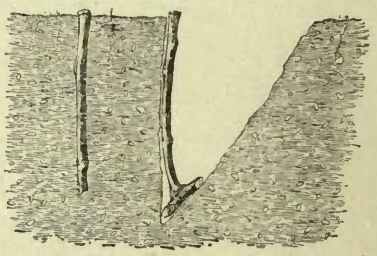


1172. Hardwood cutting of currant.

Cutting of ripened or dormant wood. Figs. 1172–1174.

Many plants grow readily from twigs of the year's growth taken in fall or winter or very early spring. The "soft-wooded" plants usually propagate most readily by this means. These cuttings of mature wood may be either long or short.

Long cuttings of ripened wood in open air.—This method is used to propagate many hardy trees and shrubs, e.g., willows, currants, grapes, forsythia. Wood of the current year's growth is gathered in autumn or early winter, before severe frost, and either stored in a cool cellar, covering with moss or fresh earth to prevent drying, or immediately made into cuttings. These cuttings are usually 6 inches or more long and should contain at least two buds. It is not necessary to cut to a bud at the base, but the upper cut should be just above one. Figs. 1172, 1173. They should be tied in bundles with tarred rope, taking care to have them lie "heads and tails" to facilitate planting, and with the butts on the same level, to promote callusing. They should then be buried in well-drained soil, with the butts down and protected against frost. In early spring they should be firmly planted in V-shaped trenches in well prepared soil: set an inch or so apart, with the rows 1 or 1½ ft. apart. The upper bud should be just at the surface; to prevent suckers the lower buds may be removed. In autumn they should be dug, graded and heeled-in for winter. Some varieties will require a second or third year's growth in the nursery; others are ready for permanent planting, as willows and poplars, which often grow 6 feet the first year. This is one of the very cheapest ways of propagating, and will pay when only 25 per cent root. This method is generally used with deciduous-leaved plants, but some conifers, e.g., Siberian arborvitæ, will strike. Remove enough twigs to get a clean stem for planting, and allow 2 or 3 inches of top above ground.



1173. Cuttings of grape, to show how planted.

The excrescences, knots or knaurs, which are found on the trunks and the main limbs of olive trees, are sometimes used as cuttings for propagation.

Short cuttings of ripened wood. (Fig. 1174.) Cuttings of this class are used under glass with tender or half-hardy species, and sometimes with new introductions, in cases in which the grower is short of stock, and when the plant is delicate and small. The wood should be gathered before severe frost and the cuttings made and planted directly in October and November. Make them from 2 to 4 inches long (sometimes a single eye only is used), and plant with a dibble, in pure sand in pots, pans or flats (boxes about 16 inches square and 3 inches deep). If a layer of potting soil is placed under the sand, the young plants have something to feed on and do not need to be potted so soon after rooting; if this is done, drainage should be given. It is important to keep them cool until a callus is formed or roots produced. If the buds start into growth before this, the cuttings become exhausted and are likely to die. After rooting,—the time required varies from one to six months—they may either be potted or the strong-growing sorts be planted out in well-prepared beds in May or June, where they are likely to make a satisfactory growth. The weaker kinds may remain a year in pots or flats, be wintered in a pit, and planted out the next spring. Some greenhouse plants, e.g., camellia, laurestinus, tender grapes,

are propagated in this way with cuttings of fully ripened wood, and others, as cactus and dracena, with wood which is much older. They should be given the care described under the head of "Cuttings of growing wood" (p. 927), but they must not be forced too hard at first. The temperature should be regulated by the nature of the plant. The safest rule to follow is to give a few degrees more heat for propagating than the plant received when the cutting was removed.



1174. Short cuttings of ripened wood.

Hardy shrubs can also be propagated by cuttings of growing wood, somewhat hardened, planted in coldframes in June and July. They are called "cuttings of green wood," and are made from 4 to 6 inches long and sometimes longer. They are closely planted in sand, or soil one-half sand and one-half leaf-mold, in rows 4 to 6 inches apart. They must be carefully watered, shaded and ventilated for ten days or more after planting. Much of the success of this method depends upon the weather; it brings in a gambling element: a few hot and dry days are dangerous. A light hotbed may be used instead of a coldframe but this means more care. The rooted plants are left in the frame all winter, protected and planted out the following spring.

Root-cuttings. Fig. 1175.

The cuttings of this class are made of either root or rootstock and are useful in propagating some plants, either in the greenhouse or in the open air. Tender plants, like bouvardia, and those which are hardy but of delicate growth, e.g., *Anemone japonica*, are handled under glass; blackberries, horse-radish, and so on out-of-doors. The cuttings are made in autumn or winter, the roots of hardy plants being gathered before severe frost and either planted directly or kept in moss until spring. This process of storing develops a callus and has a tendency to produce buds. For greenhouse work, the cuttings are made from 1 to 2 inches long, the larger roots being selected, although the small ones will grow. They are planted in pans or flats, in soil composed of equal parts sand and well-rotted leaf-mold. Ordinarily they are set horizontally. If planted vertically, in cuttings from the true root, the end which was nearest the crown should be uppermost; but if made from the rootstock, that end should be uppermost which grew farthest from the crown. In either case they should be covered, as seeds are covered, and the whole made firm. Root-cuttings of hardy plants should be kept cool at first and brought into heat only when ready to grow. They may be kept in a pit or cool cellar. Tender plants require the same or a little higher temperature than that in which they thrive.

In sweet potato, the tuber is cut lengthwise and laid, with the cut side down, on moist sand or moss, the edges being slightly covered. Buds develop on these edges and are removed when of proper size and treated as cuttings of growing wood, or allowed to remain until rooted. In dracena (see Fig. 1052, page 842)—and this applies to stem- as well as root-cuttings—the buds are not taken off until rooted the original cutting remains in the sand and sometimes produces a second or even a third crop. The tuberous rootstock of *Arum maculatum*, and plants of like nature, can be cut into pieces, remembering that the bud-producing portion of arum is the top, and each part will grow successfully. Exercise care in watering and maintain a good temperature.



1175. Root-cutting of blackberry. (×⅙)

The rootstocks of cannas are cleaned and cut into pieces 1½ to 2 inches long and planted in a warmhouse in February (Fig. 784, p. 657). As soon as buds push and roots form they are potted off and grown until the season for bedding out. Dahlias are not, properly speaking, propagated from rootstock, but by division; the plant cannot produce adventitious buds. There must always be a bit of the crown attached to the tuber. The propagation of dahlias so closely resembles the methods here described that it is perhaps well to mention it.

Root-cuttings for planting in the open ground are made from 4 to 6 inches long, and are planted firmly in V-shaped trenches or furrows in spring, being covered 2 inches or more deep. Roots as large as one's little finger are chosen, and good results are secured with plants of vigorous growth. In plants like lily-of-the-valley, common lilac, calycanthus, Scotch and moss roses, unless short of stock, it is better to encourage the natural growth of the suckers and propagate by division, but they all can be multiplied as above described.

Variegation, curiously enough, is not always reproduced by means of root-cuttings.

Leaf-cuttings. Fig. 1176.



1176. Leaf-cutting of gloxinia.

Many leaves are capable of producing roots. Some have the further power of developing buds after rooting, and of these last a few furnish an economical means of bud-propagation, particularly when the stem growth is insufficient. In cotyledon (echeveria) the whole leaf is used, the smaller ones from the flower-stalk being often the best. Choose those that are fully matured, and dry them for a few days on sand, but do not let them shrivel. The treatment, otherwise, is as given above for cuttings of growing wood. In gloxinia and other Gesneraceæ, the whole leaf (Fig. 1176), half a leaf, or even a lesser portion, is used. When enough clear petiole is obtainable, no further preparation is needed. When a part only of the leaf is planted, some of the blade must be cut away. As a rule, no bud is developed the first season: a tuber is formed, which will grow in due time.



1177. Lily scale producing bulblets.

The common *Begonia Rex* is increased by leaves in various ways. The whole leaf may be planted as a cutting, keeping the petiole entire or cutting it off where it unites with the blade; or the whole leaf may be pinned or weighted to the surface of moist sand (Figs. 501–503, p. 470), and, if the principal veins are severed at intervals of an inch, a plantlet will appear at every cut. The best way is to divide the leaf into somewhat triangular pieces, each part having a strong vein near the center. Plant in sand, in good temperature, and treat precisely as if they were cuttings of growing wood. Roots and buds will soon grow, and a good plant will result within a reasonable time. Pot off when roots are ¼ inch long. Certain other begonias may be similarly multiplied.

Other cuttings.

The thickened scales of bulbs, like lilies, can be used for propagation. Remove the scales intact and plant upright, like seeds, in soil made of equal parts of sand and rotted leaf-mold (Fig. 1177). September and October are the usual months for this work. If they

are kept in a cool greenhouse, the young bulblets will appear in the course of the winter, but top growth will come later, in summer. This is a slow, laborious process, and is seldom practised except in propagating new varieties. The granular scales of achimenes and plants of like nature can be used for propagating, sowing them in a sandy soil as seeds are sown; but this method is not a good one in ordinary cases. The scales of *Zamia horrida* have been made to produce new plants, as have also the tunicated scales of an amaryllis.

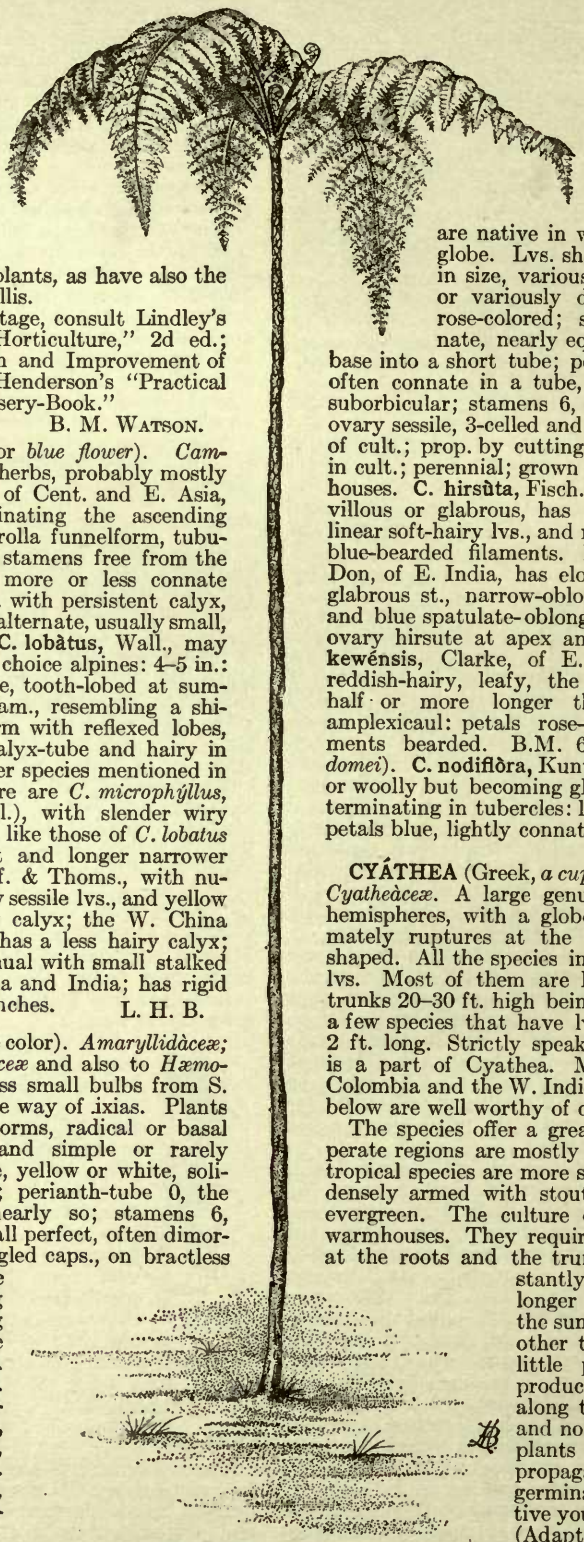
For further details of cuttage, consult Lindley's "Theory and Practice of Horticulture," 2d ed.; Burbidge, "The Propagation and Improvement of Cultivated Plants;" Peter Henderson's "Practical Floriculture;" Bailey's "Nursery-Book."

B. M. WATSON.

CYANÁNTHUS (Greek for *blue flower*). *Campanulàceæ*. Ten or a dozen herbs, probably mostly perennial, of the high mts. of Cent. and E. Asia, with showy blue fls. terminating the ascending mostly simple hairy sts.: corolla funnelform, tubular or bell-shaped, 5-lobed; stamens free from the corolla, the ovate anthers more or less connate around the pistil: fr. a caps. with persistent calyx, loculicidally 3–5-valved: lvs. alternate, usually small, entire or somewhat lobed. **C. lobàtus**, Wall., may be expected in collections of choice alpines: 4–5 in.: lvs. small, narrowing to base, tooth-lobed at summit: fls. bright blue, 1 in. diam., resembling a shining periwinkle fl., funnelform with reflexed lobes, the corolla exceeding the calyx-tube and hairy in the throat. B.M. 6485. Other species mentioned in recent horticultural literature are *C. microphýllus*, Edgew. (*C. linifòlius*, Wall.), with slender wiry sts., small entire lvs., and fls. like those of *C. lobatus* but with very hairy throat and longer narrower segms.; *C. incànus*, Hook. f. & Thoms., with numerous wiry sts., small nearly sessile lvs., and yellow campanulate fls. with hairy calyx; the W. China form of this (var. *leiocàlyx*) has a less hairy calyx; *C. Hoòkeri*, Clarke, is an annual with small stalked lvs. and blue fls., from China and India; has rigid sts. with short lateral fl.-branches. L. H. B.

CYANÉLLA (from the blue color). *Amaryllidàceæ;* it has been referred to *Liliàceæ* and also to *Hæmodoràceæ*. A half-dozen or less small bulbs from S. Afr., sometimes grown in the way of ixias. Plants with rhizomes or tunicate corms, radical or basal lanceolate or linear lvs., and simple or rarely branched sts.: fls. violet, rose, yellow or white, solitary or racemed-paniculate; perianth-tube 0, the segms. distinct or very nearly so; stamens 6, attached to base of segms., all perfect, often dimorphous: fr. a loculicidal 3-angled caps., on bractless pedicel. The cyanellas are summer- and fall-flowering bulbs with us. The following are the kinds likely to be found: **C. capénsis**, Linn. Lvs. lanceolate, undulate: st. panicled, leafy, 1 ft.: fl. purple. B.M. 568. **C. lùtea**, Linn. f. (*C. odoratíssima*, Lindl.). Less branched: lvs. linear-lanceolate, acuminate, not undulate: fls. rose, changing to yellow. B.R. 1111.

L. H. B.



1178. Cyathea meridensis.

CYANIDING, CYANIDIZING: *Diseases and Insects*, p. 1044, discussion of fumigating by hydrocyanic acid gas.

CYANOPHÝLLUM: *Tamonea.*

CYANÒTIS (Greek, referring to the blue petals). *Commelinàceæ*. Probably 40 creeping, ascending or weak branching often woolly or hairy herbs, much like Tradescantia; they are native in warm countries about the globe. Lvs. sheathing, small or medium in size, various: fls. in scirpioid cymes or variously disposed, mostly blue or rose-colored; sepals 3, lanceolate-carinate, nearly equal, usually combined at base into a short tube; petals 3, also nearly equal, often connate in a tube, the limb spreading and suborbicular; stamens 6, all perfect, nearly equal; ovary sessile, 3-celled and each cell 2-ovuled. Easy of cult.; prop. by cuttings. There are few species in cult.; perennial; grown in greenhouses or warmhouses. **C. hirsùta**, Fisch. & Mey., from Abyssinia, villous or glabrous, has erect st., globose tubers, linear soft-hairy lvs., and rose-colored perianth and blue-bearded filaments. B.M. 7785. **C. barbàta**, Don, of E. India, has elongated branching nearly glabrous st., narrow-oblong or nearly linear lvs., and blue spatulate-oblong petals free to the base: ovary hirsute at apex and the style bearded. **C. kewénsis**, Clarke, of E. Indies, is procumbent, reddish-hairy, leafy, the branches fleshy: lvs. a half or more longer than broad, sessile and amplexicaul: petals rose-purple, ovate, free; filaments bearded. B.M. 6150 (as *Erythrotis Beddomei*). **C. nodiflòra**, Kunth, of S. Afr., is cobwebby or woolly but becoming glabrous, the fibrous roots terminating in tubercles: lvs. narrowly lance-linear: petals blue, lightly connate. B.M. 5471. L. H. B.

CYÁTHEA (Greek, *a cup*, alluding to the indusia). *Cyatheàceæ*. A large genus of tree ferns in both hemispheres, with a globose indusium which ultimately ruptures at the apex and becomes cup-shaped. All the species in cult. have decompound lvs. Most of them are large plants, species with trunks 20–30 ft. high being common, but there are a few species that have lvs. and sts. no more than 2 ft. long. Strictly speaking, the genus Alsophila is a part of Cyathea. Many other species from Colombia and the W. Indies besides those described below are well worthy of cult.

The species offer a great variety. Those of temperate regions are mostly stout and not spiny; the tropical species are more slender and in many cases densely armed with stout spines. All species are evergreen. The culture of cyatheas is simple in warmhouses. They require an abundance of water at the roots and the trunks should be kept constantly moist. The foliage lasts longer if it has been inured to the sun during summer. Like all other tree ferns, cyatheas need little pot-room. They rarely produce adventitious growths along the trunk or at the base and none is proliferous. The plants are, therefore, usually propagated by spores, which germinate freely, making attractive young plants in two seasons. (Adapted from Schneider, "Book of Choice Ferns.")



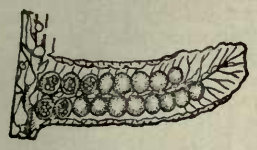
XXXIII. Cycas circinalis, the male plant.

A. *Rachides unarmed: lvs. white beneath.*

dealbàta, Swartz. Rachides with pale rusty wool when young: lvs. firm, bi-tripinnate, almost pure white beneath. New Zeal.—*C. Smíthii,* Hort., is regarded by some as a horticultural variety.

AA. *Rachides unarmed: lvs. green beneath.*

Búrkei, Hook. Stalks with tubercles near the base bearing large, glossy rusty scales: lvs. bipinnate, with broad pinnules. S. Afr.



1179. Fruiting pinnule of Cyathea meridensis.

meridénsis, Karst. Figs. 1178, 1179. Lvs. tripinnatifid, with oblong-lanceolate pinnæ and rather narrow lanceolate pinnules; segms. scaly on the ribs beneath. Colombia.

AAA. *Rachides spiny: lvs. green beneath.*

medullàris, Swartz. Lvs. bi-tripinnate, densely scaly when young, with soft, deciduous hair-like scales; segms. coarsely serrate or pinnatifid, on spore-bearing lvs. New Zeal.

C. angolénsis, Welw. A greenhouse species said to have fronds 6–8 ft. long produced from a trunk which attains 12–15 ft. Trop. W. Afr.

L. M. UNDERWOOD.

CỲCAS (Greek *kúkas,* the name of a palm tree). *Cycadàceæ.* Several beautiful palm-like plants, common in cultivation under glass. Plate XXXIII.

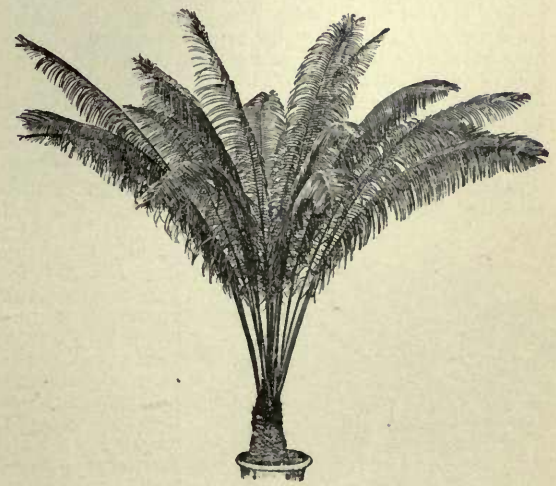
The Cycadaceæ are of great interest because they occupy a place intermediate between flowering plants and the cryptogams. Like the former they have fr. with a large starchy endocarp; but like the latter their sexual prop. is accomplished by means of spermatozoids and archegonia, corresponding to the male and female elements in animals. The plants are dicœcious; the male infl. is in the form of an erect cone composed of modified staminal lvs. which bear on the under surface globose pollen sacs corresponding to microsporangia; the female infl. consists of a tuft of spreading carpellary lvs. having their margins coarsely notched; in the notches are situated the ovules, which are devoid of any protective covering, and correspond to macrosporangia. Pollination under natural conditions is effected by the wind. The pollen settles on the ovules and sends down a tube into the tissue of the nucellus. Archegonia are formed; egg-cells develop, and in the pollen-tube are produced spermatozoids provided with minute movable cilia by which they are propelled, very much as in the spermatozoa of animals. These are discharged over the archegonia and fecundate the egg. The discovery of spermatozoids in the cycads was made by a Japanese student, S. Ikeno, while investigating the process of reproduction of *Cycas circinalis.* Those of Zamia, endemic in Fla., were described and figured by H. J. Webber, who found the mature spermatozoids of the latter genus to be the largest known to occur in any plant or animal.

Most of the species of Cycas are arborescent, having a trunk marked with rings of growth and with the scars of fallen petioles. The trunk is usually simple and columnar (though sometimes it is branched), and is elongated by a terminal bud. The pinnate leaves form a beautiful terminal crown like that of a palm or tree-fern. Cycads are found among the fossils of many geological formations, especially in those of the early Mesozoic. The latter formations are grouped together on this account, and the geological epoch which they represent is sometimes designated as the "Age of the Cycads."

Cycads are among the most ornamental plants of tropical and subtropical gardens. In the United States they are often designated "sago palms," although they have nothing in common with a palm except the general habit of growth. In Florida, according to H. Nehrling who has a plantation at Gotha, near the center of the state, they thrive equally well on high pine land and in the rich soil of the low hummocks. *C. circinalis* is apparently the most sturdy of the cultivated species. It is almost free from diseases; but it is more sensitive to cold than *C. revoluta.* The latter, on the other hand, is subject to diseases in low flat wooded situations. A third species, *C. siamensis,* which is comparatively rare, seems to be perfectly hardy in Florida. In cultivating cycads, Nehrling has attained the best results by keeping the weeds away from the base of the trees and loosening the soil from time to time, taking care not to injure the small network of tubercle-bearing roots surrounding the trunk. The tubercles, which are about the size of a pea, are interesting to the plant physiologist, and are apparently conducive to the plant's well-being. Nehrling gathers the pollen from the male plants and sprinkles it by hand over the female flowers to insure fertilization of the naked ovules.

Plants are propagated by seeds, which keep well for a month or more after ripening. According to E. N. Reasoner, they should be sown in shallow boxes or the greenhouse bench, lightly covered with sand, and after germination, potted off in small pots of moderately rich, light soil. The growing plants do best in partial shade. The old plants frequently send up suckers around the base of the trunk. These may be taken off when in a dormant state and rooted, care being taken to remove the leaves to guard against excessive transpiration. Growing cycads require sunshine and moisture.

The beautiful glossy leaves of cycads are used in many countries for ornamenting temples and for decorating altars. On the island of Guam they are used for palm leaves on Palm Sunday, and in the early days they were carried by children in religious processions, marching from one village to another under the guidance of the Jesuit missionaries. Cycads are popular conservatory plants, of easy culture, and tenacious of life, even when neglected for a long time. Their stems



1180. Cycas pectinata.

deprived of leaves are easily transported in bulk and will soon resume growth when planted. In the southern United States, cycads are injured by frost but often revive after having apparently been killed.

A. *Margins of pinnæ flat.*

B. *Modified fr.-bearing lvs. (carpophylls) spinous-toothed along the margin.*

C. *Scales of male infl. tapering into a long spine.*

D. *Lvs. 5–8 feet long, with pinnæ 10–12 in. long.*

circinàlis, Linn. (*C. Thouársii,* R. Br.). FERN PALM. A palm-like tree with cylindrical trunk and a crown of

glossy, fern-like, stiff but gracefully curved pinnate lvs.: trunk clothed with the compacted woody bases of petioles, usually columnar and simple, but often branching when the terminal bud has been cut off, or in clusters of several springing from the base of an old trunk which has been cut down; in addition to the true lvs., modified lvs. in the form of simple short subulate woolly prophylla; true lvs. 5–8 ft. long, long-petioled, the petiole bearing short deflexed spines near the base; pinnæ alternate, 10–12 in. long and quite narrow, linear-lanceolate, acuminate, subfalcate, the midrib stout and prominent beneath, bright green above, paler beneath: male infl. in the form of an erect woolly cone composed of scales bearing globose pollen-sacs on the under surface and tapering at the apex into a long spine; female infl. in the center of the crown of lvs., consisting of a tuft of spreading buff-colored, woolly, pinnately-notched lvs. (carpophylls) about 6–12 in. long, spinous toothed along the margin, and bearing in the notches the naked ovules; ovules 3–5 pairs, borne above the middle: fr. about the size of a walnut, with a thin fleshy covering, and a fleshy starchy endosperm resembling that of a horse-chestnut. S. India, Ceylon, Sumatra, Java, Philippines, Madagascar, E. Trop. Afr., Guam.—In Fla. the lvs. of this species are often destroyed by sharp frosts, but the trunk is rarely injured and will soon send forth new lvs. when the weather becomes warm again. Nehrling recommends that fine specimens be protected by a tent or by a house of lattice-work covered with canvas, and with the sides also inclosed if necessary. In this house a large kerosene lamp will be sufficient to keep the plant from freezing. In Tampa, Fla., this species appears to flourish, some of the specimens having trunks 6–8 ft. high. It grows best in rich moist soil and in partial shade. On the island of Guam, the nuts of this species form a food staple for the natives in times of famine following hurricanes. These are so poisonous that the water in which the kernels are soaked is fatal to animals. After having been soaked for some time and the water repeatedly changed, the kernels become harmless, and are ground up into meal and dried for future use. They are usually prepared in the form of cakes, which are said to be nutritious although rather tasteless.

DD. *Lvs. less than 5 ft. long; pinnæ 3–8 in. long.*

mèdia, R. Br. NUT PALM of Australia. Trunk attaining height of 8–10 ft. or sometimes twice this height, rarely branched at the top: lvs. 2–4 ft. long or more, the pinnæ very numerous, straight or falcate, obtuse or pungent-pointed, flat or slightly concave above when young, prominently keeled beneath, the margins often slightly decurrent on the rachis, glabrous or slightly pubescent when young, the longer ones varying from 3–8 in., the lower ones shorter and more contracted at the base, the lowest ones prickle-like, sometimes continuing to base of petiole: cones variable in size, but apparently smaller than in *C. circinalis*, which this species otherwise resembles; seeds 1–1½ in. long, glabrous. Austral, along the northern coasts; also Queensland.



1181. Cycas revoluta.

CC. *Scales of male infl. shortly acuminate.*

Rúmphii, Miq. Closely related to the preceding, but growing taller in its natural habitat, sometimes reaching a height of 20 ft. or more: lvs. shorter and with fewer lfts.: scales of male cone thickened and obliquely truncate at the tip, with a short upcurved sometimes caducous point; carpophylls a foot long, narrower than in *C. circinalis*, with an entire often elongate subulate tip; seeds oval or subglobose, 2–2¾ in. long by 1½–1¾ in. diam. Moist wooded regions of Burma, Ceylon (possibly intro.), Andaman Isls., Nicobar, Malaya, New Guinea, and N. Austral.—This species when growing in cult. is usually much lower, and has a full large crown of lvs., with lanceolate pinnæ thinner and paler than those of *C. circinalis*. Much grown in tropical gardens of E. Indies; male plants rare.

BB. *Modified fr.-bearing lvs. pectinate along the margins.*

C. *Trunk much swollen at the base: blade of carpophyll ovate-rhomboid.*

siamênsis, Miq. A small palm-like tree: sts. 2–6 ft., much swollen at the base: lvs. 2–4 ft., stiff spreading; pinnæ 3–8 in. long, linear mucronate-acuminate; blade of carpophyll tawny-woolly when young, at length glabrescent above, ovate-rhomboid, long-acuminate, margin deeply pectinate lacerate: scales of male infl. about ¾in. long, with a slender terminal point of the same length: seeds 1½ in. long, obovoid-oblong. Burma, Siam, Cochin China.—Apparently hardy in Fla. It is rare, occurring in only a few gardens. It is a beautiful species, easily recognizable by its trunk which is swollen very much like that of Dasylirion, and according to Nehrling grows much faster than the species more commonly cult. It is certainly deserving of more general cult.

CC. *Trunk not swollen at the base: blade of carpophyll broadly orbicular.*

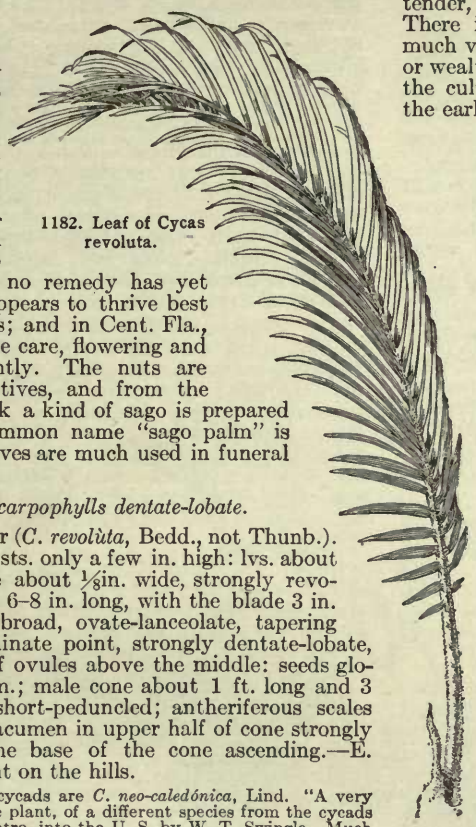
pectinàta, Griff. Fig. 1180. A glabrous evergreen palm-like tree, to 10 ft. high in its native habitat but usually much shorter in cult.: lvs. ascending, recurved, 5–7 ft. long; pinnæ 7–10 in. long, narrowly linear tapering into a minute apical spine, subfalcate; blade of carpophyll covered with dense tawny wool throughout, 6 in. long, broadly orbicular, long-acuminate, its margin deeply subulate-pectinate, stalk about equal in length to the blade with 2 or 3 pairs of ovules above the middle; spiny marginal teeth ¾in. long; terminal point 1½ in. long, tapering from a flat base, with 1 or 2 spinous teeth: seeds about 1½ in. long, ovoid: male cone 18 in. long, 6 in. diam., cylindric-ovoid; anther-bearing scales 1½ in. long, 1 in. diam., deltoid-clavate, the apex much thickened, abruptly acuminate, terminal point 1½ in. long, spine-like, ascending. India, Nepaul, East Bengal, 2,000 ft. elevation, Assam, Martaban, in pine forests. G.F. 4:114 (adapted in Fig. 1180).

AA. *Margins of pinnæ revolute.*

B. *Blade of carpophyll pectinate.*

revolùta, Thunb. SAGO PALM. Figs. 1181, 1182. A graceful palm-like tree or shrub, becoming 6–10 ft. high, with the trunk simple or branching: lvs. long and recurved (2–7 ft.); pinnæ numerous, subopposite, curved downward, narrow, stiff, acute, terminating in a spine-like tip, dark shining green, the margin revolute; carpophylls with the blade broadly ovate, densely clothed with brownish felt-like wool, pectinate; ovules 2 or 3 pairs borne near the base: fr. ovate, compressed, red, about 1½ in. long. S. Japan.—This is the most common cycas in conservatories. It is of Javanese origin and is much hardier than the species mentioned above. In Fla. it is usually found in all of the better parks and gardens, where it is suitable as a center about which to arrange other ornamental

shrubs. According to Nehrling, this species is of slow growth. In the male plants there are usually several heads. The male infl. is usually 18–20 in. long and cylindrical in form. The female infl. is in the form of a semi-globose head, yielding 100–200 large bright red nut-like seeds, which ripen about Christmas time. The new lvs. appear all at one time, usually in May. They have a beautiful glaucous green color and at first stand erect. Young plants are easily grown from seeds. Unfortunately this beautiful species is, in Fla., subject to blight for which no remedy has yet been found. It appears to thrive best in open situations; and in Cent. Fla., it grows with little care, flowering and fruiting abundantly. The nuts are eaten by the natives, and from the pith of the trunk a kind of sago is prepared for which the common name "sago palm" is given it. The leaves are much used in funeral decorations.



1182. Leaf of Cycas revoluta.

BB. *Blade of carpophylls dentate-lobate.*

Béddomei, Dyer (*C. revolùta*, Bedd., not Thunb.). A low shrub with sts. only a few in. high: lvs. about 3 ft. long; pinnæ about ⅛in. wide, strongly revolute; carpophylls 6–8 in. long, with the blade 3 in. long and 1 in. broad, ovate-lanceolate, tapering into a long-acuminate point, strongly dentate-lobate, bearing 2 pairs of ovules above the middle: seeds globose, 1½ in. diam.; male cone about 1 ft. long and 3 in. diam., very short-peduncled; antheriferous scales long-acuminate, acumen in upper half of cone strongly deflexed, near the base of the cone ascending.—E. Madras, abundant on the hills.

Other cultivated cycads are *C. neo-caledónica*, Lind. "A very ornamental palm-like plant, of a different species from the cycads ordinarily grown," intro. into the U. S. by W. T. Swingle. Much like C. circinalis but with fronds narrower and pinnæ closer.—*C. Normanbyàna*, Muell., intro. into the U. S. from France by W. T. Swingle, a species with oblong-obovate lvs., having numerous linear pinnæ 6 in. long. Austral.—*C. Riuminiàna*, Regel. St. rather stout: lvs. bright green, erect, spreading in a vase-like crown, the pinnæ fine-pointed. Philippines. I.H. 11:405.

W. E. Safford.

CÝCLAMEN (classical name, probably from the Greek word for circle, in allusion to the spirally twisted peduncles). *Primulàceæ*. Herbaceous and low plants, with a flattish tuber or corm, grown sometimes in the open and one of them much prized as a florist's and window-garden subject.

Flower single, on a scape, with usually 5-parted calyx and corolla (the parts strongly reflexed), 5 connivent stamens, with pointed sessile anthers, 1 style and stigma, and a 5-splitting caps.: lvs. cordate or reniform, long-petioled, entire or sinuate-dentate: fls. nodding or declined, purple, rose or white.—About 20 species of the Medit. region, extending to Cent. Eu. *C. persicum* is the source of the standard florists' cyclamens. Most of the other species are essentially outdoor plants. They are little known in outdoor planting in N. Amer., however. The European catalogues list several species aside from *C. persicum*, and they are here described; and others are included in the supplementary list that are recently mentioned in horticultural literature. Old English name sow-bread, from the tubers being sought by swine. Consult Fr. Hildebrand, Die Gattung Cyclamen, Jena, 1898; also Pax & Knuth in Engler's Pflanzenreich, hft. 22, 1905.

All cyclamens are very beautiful, and would be much more popular were they hardy in our eastern climate. On the Pacific slope many of them probably would be perfectly at home as outdoor plants, producing a great number of flowers above the bare soil in the depth of winter before the leaves are developed.—It is, however, with the Persian cyclamen (*C. persicum*), which is tender, that florists have had the greatest success. There is no common winter-flowering subject of as much value for duration in bloom, variety of coloring, or wealth of color. It is preferable at all times to begin the culture of Persian cyclamen with seeds, sown in the early winter months. Grow on without any check for the following year. They should bloom freely about fifteen months from planting. Old tubers, such as are offered in fall with other florists' bulbs, rarely give satisfaction as compared with a packet of seeds. It is not the nature of the plant to have all its roots dried off, as if it were a hyacinth or tulip. Our summers are rather too warm to suit cyclamen perfectly, and it will be found that the most growth is made in the early autumn. It is best to give the plants a little shade in the hot months, such as a frame outdoors near the shade of overhanging trees at midday. This is better than growing them under painted glass, as more light is available, together with plenty of fresh air on hot days. It will be found that cyclamen seeds require a long time in which to germinate,—often two months. This is due to the fact that the seed produces a bulb or corm before leaf-growth is visible. As soon as two leaves are well developed, place the plants around the edge of 4- or 5-inch pots until every one is large enough for a 3-inch pot. The roots are produced sparingly in the initial stages, and too much pot-room would be fatal at the start. By the middle of summer another shift may be given, and in September all will be ready for the pots in which they are to flower,—5- or 6-inch pots, according to the vigor of the plants. It will always be found, however, that there will be a certain percentage that will not grow, no matter how much persuasion is used. These may be thrown away, to save time and labor early in the season. In the house they should have the lightest bench. It is impossible to grow them in a warm, shady house. About 50° at night is the ideal temperature when in flower. The best soil is a fresh, tufty loam, with a fourth or fifth of well-rotted horse-manure, to which add some clean sand if the soil is heavy. At all times, the pots should be well drained.—The Giganteum strains of the Persian cyclamen produce the largest blooms, but at the expense of quantity. For the average cultivator it is better to try a good strain that is not gigantic. There is a recent departure in the form of crested flowers. Cyclamens come true to color from seeds, and one can now buy named varieties that will reproduce themselves almost to a certainty.—Of recent years cultivators have had much trouble with a tiny pest or mite that attacks the plants and renders them useless for bloom. Its work is done mostly after the plants are taken into the greenhouse and when about to mature into blooming specimens. If the first flowers come deformed or abnormally streaked with colors that are darker in shade, it is a sure indication that the pest is present. Frequent light fumigation with hydrocyanic acid gas as soon as the pest is discovered will in time eradicate it, but being very small, and able to hide under the divisions of the calyx, seldom coming out except on bright days, makes the pest a difficult one to fight. The gas cannot be used during sunshine. Tobacco stems used freely between the pots is a good preventive measure. Greenfly is likely to attack the

plants at all stages of growth. In the frames the plants may be plunged in tobacco stems, and in the greenhouse they must be fumigated or vaporized with some of the nicotine extracts. Great vigilance must be exercised in growing cyclamens. (E. O. Orpet.)

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A. *Plant blooming in spring (or in winter under glass).*

B. *Corolla-lobes not eared.*

1. pérsicum, Mill. (*C. hederæfòlium*, Sibth. & Smith. *C. índicum*, Linn. *C. latifòlium*, Sibth. & Smith. *C. macrophýllum*, Sieb. *C. pùnicum*, Pomel. *C. pyrolæfòlium*, Salisb.). Fig. 1183. The common greenhouse or Persian cyclamen, in many forms: tuber large, flattened endwise, corky on the outside: lvs. appearing with the fls., ovate, crenate-dentate, base deeply cordate, usually marbled or variegated with white: fls. on scapes 6–7 in. high, large, scentless, white, purple-blotched at the mouth, but with rose-colored, purple and spotted forms, the segms. oblong-spatulate in shape, not eared or lobed at the base: pedicel not coiling in fr. Greece to Syria. The large-fld. cult. forms are grouped as follows by Pax & Knuth: Var. **álbum** (*C. aléppicum*, Hort.). Pure white. Var. **gigantèum.** White with red throat; very large. Var. **magnìficum** (var. *punctàtum*). White, speckled with red, large. Var. **rùbrum.** Red. Var. **sanguíneum.** Light blood-red, large. Var. **ròsea-supérbum.** Brilliant rose-red, large. Var. **purpùreum.** Purple with bluish markings, large. Var. **violàceum.** Violet-red. Var. **àtro-rùbrum** and var. **splèndens.** Dark red, large. The var. *gigantèum* (*C. gigantèum*, Hort.) is the common large-fld., improved form of the florist's cyclamen. There are also double-fld. forms (R.H. 1886, p. 250); also fimbriate or crested forms, *C. Papìlio* (I.H. 43:63. G.F. 5:235. G.C. III. 21:71; 23:173). Other portraits of *C. persicum* are: B.M. 44. I.H. 35:43. Gn. 47:378; 48:182. J.H. III. 34:578. Gt. 44, p. 203; 45, p. 164. F.S. 22:2345. A.G. 14:390–2; 17:261. A.F. 7:521–5; 11:1176–9; 12:499. The species is frequently figured in the trade catalogues.



1183. Cyclamen persicum. Showing a flower of perfect form, and the crested variety. (×⅓)

2. còum, Mill. (*C. vérnum*, Sweet). Tuber smaller than in the last, globose or flattened: lvs. with or preceding the fls., nearly orbicular or round-reniform, entire, firm, not marbled nor variegated: fls. small, scentless, half or less as large as those of the last, purple and spotted in the throat. S. E. Eu. to Persia. B.M. 4. L.B.C. 2:108. F.S. 22:2345.—There is a white-fld. form (*C. álbum*, Hort.).

3. ibéricum, Goldie (*C. còum* var. *ibèricum*, Boiss. *C. élegans*, Boiss. & Buhse. *C. vernàle*, Koch). Dwarf: lvs. appearing before the fls., ovate-orbicular and rounded at the apex, entire or obscurely undulate, more or less zoned with white above: fls. purple with a darker colored throat. Caucasus.—Perhaps a geographical form of *C. coum*. **C. Átkinsii,** Moore, is *C. coum* × *C. ibericum*, Hildeb. Lvs. reniform, apex rounded, more or less shining, deep green, spotted silver-white, the corolla-lobes pale rose or white and usually lined or spotted red. F.S. 23:2425.

BB. *Corolla-lobes eared.*

4. libanóticum, Hildeb. Tuber globose with a cork-like covering: lvs. autumnal, the blade obcordate, sinuate, dentate or crenulate or rarely entire, marked with white above, deep violet or purple beneath: fls. fragrant; calyx-lobes oblong-acuminate, the margin lightly undulate, 5-nerved; corolla-tube somewhat globose-campanulate, the lobes lightly eared at base and broad-ovate, entire, pale or deep rose-color with a deep red T-form mark at the base; style exserted. Lebanon.

AA. *Plant blooming in summer and autumn.*

B. *Corolla-lobes not eared.*

5. europæum, Linn. (*C. Clùsii*, Lindl. *C. æstìvum*, Park. *C. cordifòlium*, Stokes. *C. floribúndum*, Salisb. *C. orbiculàtum*, and *C. purpuráscens*, Mill.). Tuber with corky exterior: lvs. ovate-orbicular or reniform, entire or nearly so, with a deep and narrow basal sinus, more or less white-marbled above, purple-tinted beneath: fls. on scapes 4–5 in. high, bright red and very fragrant, not spotted; the corolla-segms. oblong-spatulate (¾in. or less long); calyx glabrous: pedicel spirally coiling in fr. Cent. and S. Eu. B.R. 1013.—Lvs. appearing with the fls., more or less evergreen. Variable.

6. cilícicum, Boiss. & Heldr. Much like *C. europæum:* tuber hairy: fls. pale rose, with purple at the mouth, about twice larger; corolla-lobes elongated; calyx puberulent. Sicily. G.C. III. 23:81.

BB. *Corolla-lobes eared.*

7. africànum, Boiss. & Reut. (*C. saldénse*, Pomel). Large: tuber large: lvs. ovate-cordate to reniform, coarsely toothed, pale beneath, dull and pale green marbled above: calyx pubescent, the lobes broadly ovate-acuminate; corolla nearly white, faintly rose- or purple-tinged, the segms. 1 in. long and deep purple at the base; calyx-lobes lanceolate. Algeria. B.M. 5758. F.S. 8:841.—Little known in this country, but sold by the American agencies of the Dutch bulb houses.

8. neapolitànum, Tenore (*C. autumnàle*, Boos. *C. ficariæfòlium* and *C. subhastàtum*, Reichb. *C. hederifòlium*, Ait. *C. vernàle*, Mill.). Tuber very large, black, thick-rinded: lvs. variable, from hastate to round-reniform, more or less wavy-plaited on the edges, green or somewhat parti-colored: calyx small; corolla pink or rarely white, the segms. short and twisted and the edges raised and white-edged at the base; calyx-lobes triangular to oblong. S. and E. Eu. B.R. 24:49. Gn. 51, p. 37.

C. æquinóctium, Hildeb. Intermediate between C. græcum and C. pseudo-græcum; from the former it differs in its small fls. and other parts and from the latter in having more rounded lvs. Greece. —*C. græcum*, Link. Autumn-flowering: lvs. obcordate, irregularly cartilaginous-dentate: corolla-lobes lanceolate or oblong-lanceolate, eared at base, rose-colored with deep purple at base. S. E. Eu. —*C. hiemále*, Hildeb. Winter-flowering: lvs. round-reniform, bright green and silver-zoned: fl. purple with deep red in the throat; corolla-lobes round-ovate, not eared. Asia Minor.—*C. Jòvis*, Hildeb. Differs from C. neapolitanum in its more slender fls. with longer lobes of calyx and corolla. Asia Minor.—*C. maritimum*, Hildeb. Lvs. variable in form, mostly ovate, brown-green: fls. in Sept., inconspicuous, pale rose with marked throat, the corolla-lobes rounded. Asia Minor.—*C. Meliarakisii*, Hort.=C. græcum.—*C. pseùdo-græcum*, Hildeb. Differs from C. græcum in having filaments and anthers longer, the latter 3-angled and acuminate: corolla pale rose or almost white. Crete.—*C. pseùdo-ibéricum*, Hildeb. Spring-flowering: lvs. obcordate, rounded at base and top, the margin cartilaginous-crenulate, deep green and spotted silvery white: fl. violet, spotted with darker color, white at base; corolla-lobes oblong-ovate, not eared: pedicel spiral in fr. Probably Asia Minor.—*C. pseùdo-marítimum*, Hildeb. Differs from C. maritimum in lvs. being lanceolate-acuminate, calyx-lobes rounded and corolla-lobes long-acuminate. Asia Minor.—*C. repándum*, Sibth. & Smith. Spring-flowering: tuber small: lvs. cordate, undulate-lobed, the lobes usually mucronate: fl. beautiful purple, the throat constricted and deeper-colored. Cent. and E. Medit. basin.

L. H. B.

CYCLANTHÈRA (Greek, *anthers in a circle*). *Cucurbitàceæ*. Annual- or perennial-rooted herbs, one of which is sometimes grown for its ornamental character.

Climbing by tendrils, glabrous or pubescent: lvs. entire, lobed or 5–7-foliolate: fls. monœcious, minute, yellow, greenish or white, with their parts in 6's, stamen 1 with a 1-celled anther. The plant is a climbing half-hardy annual of easy cult. The seed should be started indoors early. The genus is near Echinocystis and Elaterium, and has more than 30 species, all from Trop. Amer.

pedàta, Schrad. Annual: st. glabrous: lvs. pedately 5–7-foliolate, the lfts. sessile or nearly so and lanceolate or oblong-lanceolate, serrate: tendrils 3–4-parted: male fls. small, in panicles equaling or exceeding the lvs.: fr. nearly sessile, somewhat soft-prickly or smooth, oblong and attenuate at base, green becoming yellowish white, 2-locular. Mex. south.—A strong ornamental climber. *C. explòdens*, Naudin, with somewhat 3-lobed lvs. and short spiny explosive fr., may be in cult.

L. H. B.

CYCLÁNTHUS (*flowers in a circle*). *Cyclanthàceæ*. A Trop. American genus of 4 species giving name to a small order which is allied to the palms. They are acaulescent palm-like herbs with a milky juice: lvs. long-stalked, entire or bi-furcate, the segms. lanceolate, 1-nerved: fls. fragrant. The species are not in the American trade. Cult. of Carludovica (which see). *C. bipartìtus*, Poit., of Guiana, has lvs. sometimes divided into 2 long narrow lobes, the petioles being 3–6 ft. long: spadix straight and cylindrical, in a 4-lvd. yellow spathe, the scape 2 ft. long. G.W. 8, p. 153; 15, p. 610. *C. cristàtus*, Klotzsch, of Colombia, has short-stalked bifid lvs., with the parts falcate and connivent: spadix about 8 in. long. G.W. 8, p. 202. *C. discolor*, Hort., has young lvs. streaked with brown-orange: lvs. bifid, the parts lanceolate, acuminate, the margins frilled. Probably S. Amer. *C. Godseffiànus*, Hort., exhibited in 1892, "has noble lvs. of a rich green color, oblong, obovate, tapering to a sheathing stalk." Sander.

CYCLOBÒTHRA: *Calochortus*.

CYCLOLÒMA (Greek for *circle* and *border*, from the encircling wing of the calyx). *Chenopodiàceæ*. One weedy herb, *C. atriplicifòlium*, Coulter (*C. platyphýllum*, Moq.), of sandy soils from Minn., west and south, which was once intro. as the "cyclone plant," since the plant is a tumble-weed or rolls before the wind when it is matured and becomes detached from the soil. The plant is a much-branched rank-growing annual, 1–2 ft. high, pubescent or nearly glabrous, with narrow but flat and sinuate lvs., and bractless fls. in an open panicle. The fls. are very small, perfect or sometimes lacking the stamens; calyx 5-cleft, the lobes strongly keeled and becoming winged and inclosing the seed. Plant not fleshy or jointed.

CYCLÓPHORUS (Greek, *circle-bearing*). *Polypodiàceæ*. An E. Indian and Malaysian genus of simple-lvd. ferns, related to some species of Polypodium. The genus is characterized by having creeping scaly rootstocks, simple lvs. usually densely covered with star-shaped scales, at least on the back. The sori are round, naked, and placed so closely together as to appear often completely to cover the back of the lf. The venation consists of a very fine close network difficult to distinguish. Often listed in trade under Polypodium.

Língua, Desv. (*Niphóbolus Língua*, Spreng.). Lvs. 6–12 in. long, on short stalks, the lf.-blades thick, leathery, narrowly oblong, 4–8 in. long, 1–2 in. broad, densely covered beneath with rusty white scales. Var. **corymbífera**, Hort. A form with the tips of the lvs. much forked, making the blade much broader than in the type. Var. **variegàta**, Hort. A form with "light yellow lines about ⅛in. wide and ¾in. apart, running across the fronds at right angles to the midrib." See also *Polypodium*.

R. C. Benedict.

CYCNÒCHES (Greek, *swan's neck*, referring to the shape of the column). *Orchidàceæ*. Epiphytic orchids, requiring warmhouse treatment when growing.

Pseudobulbs fusiform: lvs. plicate: fls. of 2 sexes, the perianth alike, the lip entire, or that of the staminate very different, with the sepals and petals narrower, the lip clawed and with finger-like projections from the side, the column much elongated and arched; pollinia 2. Both sexes may be produced in the same plant. A third form of fl., usually perfect, occasionally appears; this is intermediate between the others.—About a dozen species of Trop. Amer.

A. *Perianth alike in both sexes; lip entire.*

chlorochílon, Klotzsch. Pseudobulbs 5–7 in. tall: lvs. lanceolate: raceme erect, 2- or 3-fld.; fls. 4–6 in. across; sepals and petals yellowish green, acute, the lateral sepals broader than the dorsal; lip obovate or elliptic, acute, a dark green depression near the triangular erect callus. Venezuela. G.C. III. 3:145. I.H. 35:65. R. 1:39. J.H. III. 35:285. Gn. 49, p. 403; 51:172.

ventricòsum, Batem. Pseudobulbs 8–10 in. tall: lvs. lanceolate: raceme drooping, 4–6-fld.; fls. 4–5 in. across; sepals and petals yellowish green, acute, the petals broader than the sepals; lip white, cordate, acuminate, clawed, a black callus at the junction of the claw with the lip. Guatemala.

AA. *Perianth differing in the sexes; lip with finger-like lateral projections.*

aùreum, Lindl. Male racemes pendulous, 8–12-fld.; fls. 2–3 in. across, yellow, red-spotted; sepals and petals similar, the former spreading, the latter reflexed; lip clawed, the dilated middle giving rise to a number of projections, forked at the end. Cent. Amer. J.F. 3:264.

pentadáctylon, Lindl. Male racemes usually pendulous, many-fld.; sepals and petals greenish yellow barred with brown; lip white, red-spotted, with 5 finger-like projections; female racemes erect, few-fld.; sepals and petals broader than in the male fls., spotted; lip ovate, entire. Brazil. B.R. 29:22. J.H. III. 62: 305. O.R. 8:312.

peruviàna, Rolfe. Male racemes pendulous, many-fld.; sepals and petals light green, copiously brown-spotted; lip, with its projections, white. Peru. Lind. 7:301.

C. densiflòrum, Rolfe. Male racemes pendulous, many-fld., the fls. greenish with purple blotches; female racemes short, erect, 2-fld., the sepals and petals green, the lip ivory-white. Colombia. O.R. 17:204; 20:331. B.M. 8268.—*C. maculàtum*, Lindl. Male racemes pendulous, the sepals and petals light yellowish green, spotted with red-purple, the lip white. Mex. O. 1910:104. O.R. 17:273; 20:315.

George V. Nash.

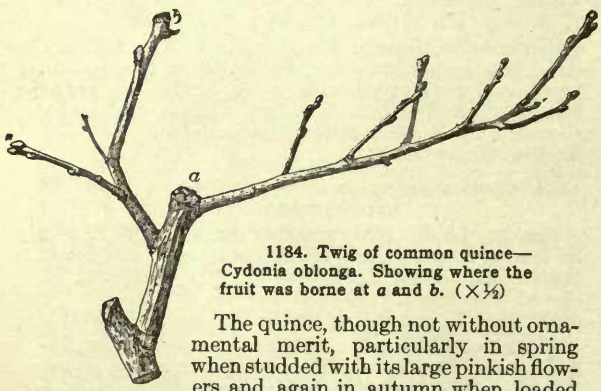
CYDÍSTA (Greek, *kydistos*, most glorious; alluding to the beautiful flowers). *Bignoniàceæ*. Ornamental vines, grown for their beautiful flowers.

Evergreen shrubs, climbing by lf.-tendrils: lvs. opposite, with 2 lfts., the rachis elongated into a simple slender tendril, sometimes wanting: fls. in terminal or axillary panicles, sometimes 2; calyx campanulate-turbinate, truncate or with 5 short teeth; corolla funnel-form-campanulate, with imbricate lobes; stamens 4, inclosed, with spreading anther-cells; disk wanting; ovary linear, with numerous ovules in 2 rows: caps. linear, septicid, with numerous, nearly orbicular, winged seeds.—One or 2 species in the W. Indies and S. Amer. Closely allied to Bignonia, but easily distinguished by its simple slender tendrils, by the paniculate fls., the usually truncate calyx and the wanting disk. Suited for cult. in tropical and subtropical regions only and as a stove plant in the N. For cult. and prop., see *Bignonia*.

æquinoctiàlis, Miers (*Bignònia æquinoctiàlis*, Linn.). High climbing: lfts. ovate to ovate-oblong, obtuse-acuminate, undulate, lustrous, reticulate, 3–4 in. long; petioles ⅛–¾in. long: calyx campanulate-turbinate, truncate; corolla white or pink, with dark pink or purplish veins, 2½ in. long. W. Indies, Brazil.—The *B. æquinoctialis* var. (B.R. 9:741) with yellow fls. in elongated racemes is *Anemopægma Chamberlaynii*, Bur. & Schum. (*Bignonia Chamberlaynii*, Sims B.M. 2148. F.S. 3:235. P.M. 14:3.). See page 502. ALFRED REHDER.

CYDÒNIA (the fruits known to the Romans as *Mala Cydonia*, apples from Cydon, now Canea, in Crete). *Rosàceæ*, subfamily *Pòmeæ*. QUINCE. Shrub or small tree, grown for its fruit, which is much used for preserves and sometimes baked.

Branches unarmed: lvs. deciduous, alternate, petioled, stipulate, entire: fls. white or light pink, rather large, terminal on short leafy branchlets; petals 5; stamens numerous; styles 5, free; ovary 5-celled, cells with many ovules: fr. a 5-celled, many-seeded pome.—One species from Persia to Turkestan. The genus Chænomeles, often included under Cydonia, is easily distinguished by the serrate or crenate chartaceous lvs. and the connate styles.



1184. Twig of common quince—Cydonia oblonga. Showing where the fruit was borne at *a* and *b*. (×⅓)

The quince, though not without ornamental merit, particularly in spring when studded with its large pinkish flowers and again in autumn when loaded with its golden fragrant fruits, is rarely planted as an ornamental shrub, but chiefly, though not very extensively, grown for its fruit which is made into preserves. It is of slow growth and prefers heavy and rather moist soil. It may be propagated by seeds stratified and sown in spring, but is usually increased by cuttings of one- to four-year-old wood, taken in fall and stored until spring in sand or moss in a cellar or frame; also by layers and budding, or by grafting on vigorous growing varieties. See *Quince*.

oblónga, Mill. (*C. Cydònia*, Pers. *C. vulgàris*, Pers. *Pỳrus Cydònia*, Linn.). QUINCE. Fig. 1184. Shrub or small tree to 15, rarely to 25 ft., with slender, spineless branches: lvs. oval or oblong, rounded or slightly cordate at the base, acute, entire, villous-pubescent beneath, 2–4 in. long: fls. white or light pink, 2 in. across: fr. large, yellow, villous, pyriform or globular. May; fr. in Sept. and Oct. Cent. and E. Asia. Gn. 33, p. 491. F.S.R. 2, p. 379: 3, p. 283. Seeds have mucilaginous and demulcent properties. Var. **pyrifórmis,** Rehd. (*C. vulgàris* var. *pyrifórmis*, Kirchn.) Fr. pear-shaped, the typical form. Var. **lusitánica,** Schneid. (*C. lusitánica*, Mill.). Fr. pear-shaped and ribbed: lvs. larger; of more vigorous growth. Var. **malifórmis,** Schneid. (*C. malifórmis*, Mill.). Fr. apple-shaped. Var. **pyramidàlis,** Schneid. Of pyramidal habit. Var. **marmoràta,** Schneid. Lvs. whitish and yellow variegated. For pomological varieties, see *Quince*.

For *Cydonia japónica*, Pers., *C. Maùlei*, Moore, and *C. sinénsis*, Thouin, see Chænomeles.

ALFRED REHDER.

CYMBÍDIUM (*boat*, from the Greek, referring to the shape of the lip). *Orchidàceæ*. Handsome epiphytal, rarely terrestrial orchids, requiring warmhouse conditions.

Stems pseudobulbous or not so: lvs. coriaceous, long, rarely short, persistent: sepals and petals sub-equal, labellum usually tri-lobed, adnate to the base of the column; column erect; pollinia 2.—Species 30 and more, tropical or subtropical, found on mountains at high elevations in Asia, and a few species in Afr. and Austral.

These are among the most decorative of orchids when in bloom, and are attractive all the time owing to the graceful foliage seen on well-grown specimens. There are now many handsome species and varieties and these in their turn have produced, at the hands of the hybridizer, many fine decorative plants, so that a house of cymbidiums produces flowers most of the time, and these last many weeks in full beauty. There are few orchids whose flowers last so long, and the spikes of bloom, often 2 to 3 feet in length, are useful for decorative purposes of all kinds, either on the plants or cut. The recent species, *C. insigne*, is the most beautiful of all and has already lent itself to hybridization, so that to the very many known hybrids *C. insigne* will soon add its influence and coloring.—Cultivated cymbidiums are terrestrial, with thick fleshy roots best contained in pots. A portion of tough fibrous loam should be added to the osmundine, about half of each with plenty of broken charcoal to keep the whole porous. The plants will do well for years without disturbance at the roots, but when this is necessary, great care must be taken not to injure them. Division is, in fact, very difficult to accomplish when the pots are full of roots, and it is best practice to pot the plant in a larger receptacle if the roots are healthy, washing out loose earth and removing dead portions of roots first. Cymbidiums may be grown in a temperature of 50° as a minimum in winter, must not be subjected to strong sunlight after March, and never allowed to become dry at the roots, as these are more or less active, even in winter. Being terrestrial, weak manure-water may be applied during active growth. Many species thrive well when planted out in large palm and fern houses among rocks arranged in a natural manner, and when the plants are placed so that the flower-spikes are on a level with the vision, they have a charming effect for many weeks when in bloom, and the environment suits them well. Of the few well-marked species, there are many forms that have been collected and when flowered in cultivation, proved distinct. These in some cases have been called new species, but are now being better understood; some prove to be natural hybrids, others are varieties. (E. O. Orpet.)

A. *Fls. white.*

ebúrneum, Lindl. Sts. tufted: lvs. distichous at base, 1 or 2 ft. long, linear or lorate, bifid at apices:

peduncles not so long as the lvs., few-fld.; fls. about 3 in. across, ivory-white, sometimes tinged with rose; sepals and petals oblong-lanceolate; lip 3-lobed with a golden yellow ridge running down the center. Khasia Hills, at an elevation of 5,000–6,000 ft. B.R. 33:67. B.M. 5126. Gn. 46, p. 398. G.C. III. 35:99. Var. **Goodsoniànum**, Hort. Fls. white, with broad rose-purple band down middle of lip. Var. **Dayànum**, Hort. (*C. Dayànum*, Reichb. *C. ebúrneum Dáyi*, Jenm.). Lvs. longer and narrower: lip with a row of purple spots each side of disk.



1185. Cymbidium giganteum. (×⅓)

AA. *Fls. not white.*

B. *Infl. arching or erect.*

C. *Sepals and petals veined with red, brown or purple.*

D. *Ground-color of sepals and petals not white.*

E. *Middle lobe of lip purple-maroon, margined yellow.*

Lowiànum, Reichb. f. Pseudobulbs oblong: lvs. 2–3 ft. long, linear-acute, recurved: racemes many-fld.; fls. about 20 in number, 3–4 in. across; sepals and petals oblong-lanceolate (lateral ones sub-falcate), greenish yellow marked with brown; lateral lobes of lip yellowish; midlobe reflexed, purple-maroon, margined with yellow. Burma. Gn. 48, p. 263. Gng. 5:73. A.F. 34:1089. R.B. 30:276. Var. **Mandaiànum**, Hort. (*C. Mandaiànum*, Hort.), has yellow fls.

EE. *Middle lobe of lip yellow, spotted.*

gigantèum, Wall. Fig. 1185. Fls. dull purple (brownish, or yellowish green striped with purple); sepals and petals oblong, the petals narrow and shorter; midlobe of lip reflexed, yellow, spotted with red; lateral lobes yellowish green. Nepal. B.M. 4844. P.M. 12:241.

Traceyànum, Hort. Pseudobulbs and foliage as in *C. giganteum:* racemes 3–4 ft. long, ascending, 15–20-fld.; fls. 4–5 in. across; sepals and petals greenish yellow, lined with crimson; middle lobe of lip oblong, reflexed, crisped, cream-white, crimson-spotted. Burma. C.O. 4. R.B. 29:25.—By some considered a natural hybrid between *C. grandiflorum* and *C. giganteum.*

DD. *Ground-color of sepals and petals white, flushed rose.*

insígne, Rolfe (*C. Sánderi*, Hort. *C. insígne Sánderi*, Hort.). Lvs. up to 3 ft. long: infl. long, ascending; fls. rosy white; sepals and petals elliptic; lip marked with lines of purple dots, the middle lobe short, obtuse, emarginate; disk yellow. C.O. 10. B.M. 8312. O. 1911: 64. R.B. 33:53. R.H. 1907:496. G.C. III. 37:115.

CC. *Sepals and petals not veined.*

tigrìnum, Parish. Lvs. oblong-lanceolate: peduncles slender, 3–6-fld.; sepals and petals linear-oblong, acute, green, spotted at base; petals often paler and with more spots than the sepals; lip with yellow, red-brown striped lateral lobes; midlobe white, transversely streaked with purple. Burma. B.M. 5457. A.G. 22:715.

grandiflòrum, Griff. (*C. Hookerianum*, Reichb. f.). Lvs. about 2 ft. long, acute: peduncle arching above, erect at base; fls. from 6–12, large, sepals and petals oblong, greenish; lip yellow, spotted with purple. Sikkim. B.M. 5574.

BB. *Infl. pendulous.*

péndulum, Swartz. The leathery lvs. distichous, 2–3 ft. long, broadly linear: fls. yellowish; side lobes and midlobe of lip rose-color; the disk more or less white with yellow crests; sepals and petals narrowly oblong, with a purple median line. E. Indies.

Finlaysoniànum, Lindl. (*C. péndulum*, Lindl.). Lvs. ensiform: raceme many-fld.; sepals and petals linear-oblong, obtuse, dull yellow, sometimes with a reddish median line; lateral lobes of lip crimson; midlobe white, tipped with crimson. Malaysia. Var. **atropurpùreum**, Hort. Lvs. narrower, racemes longer, with larger fls.: sepals and petals purplish, front lobe of lip white, spotted with purple. Borneo.

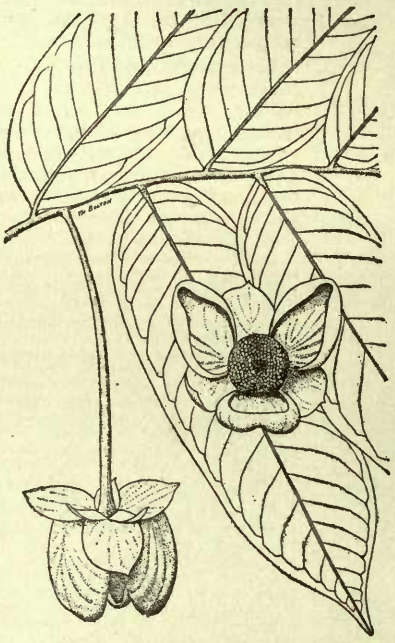
C. Alexánderi, Hort. Hybrid between C. eburneo-Lowianum × C. insigne.—*C. aloifòlium*, Swartz. Racemes many-fld., arched; fls. pale purple, black-striped. E. Indies.—*C. Ballianum*, Hort. Natural hybrid between C. eburneum × C. Mastersii.—*C. Còlmanæ*, Hort. Hybrid between C. eburneo-Lowianum × C. eburneum Dayanum.—*C. Cravenianum*, Hort. Hybrid between C. Lowianum × C. Traceyanum.—*C. Devonianum*, Paxt. Racemes many-fld., pendulous; sepals and petals greenish or reddish yellow, spotted or lined with purple; lip purple. India. C.O. 8.—*C. ebúrneo-gigantèum*, Hort. Hybrid between C. eburneum × C. giganteum.—*C. ebúrneo-Lowianum*, Hort. Hybrid between C. eburneum × C. Lowianum.—*C. ensifòlium*, Swartz. Lvs. ensiform, acute: racemes many-fld.; fls. greenish yellow, purple-veined; sepals and petals linear-oblong, acute; lip spotted. India. Japan. B.M. 1751.—*C. erythrostỳlum*, Rolfe. Sepals and petals white; lip yellowish white, lined red-purple; column crimson. Annam. B.M. 8131. G.C. III. 40:286.—*C. galtonénse*, Hort. Hybrid between C. Lowianum × C. Traceyanum.—*C. Gammieànum*, Rolfe. Supposed to be a natural hybrid between C. giganteum × C. elegans. G.C. III. 38:427.—*C. glebelandsénse*, Hort. Hybrid between C. Schrœderi × C. insigne.—*C. Gottianum*, Hort. Hybrid between C. eburneum × C. insigne Sanderi. Fls. white, the sepals with a faint greenish tinge, the lip blotched with ruby-purple. G.C. III. 49:180.—*C. Holfordianum*, Hort. Hybrid between C. grandiflorum × C. eburneum.—*C. Hòlmesii*, Hort. Hybrid between C. Mastersii × C. giganteum.—*C. Hùttonii*, Hook. f.=Grammangis.—*C. langleyénse*, Hort. Hybrid between C. Lowianum × C. Devonianum. Sepals and petals greenish brown, the lip marked with reddish brown. G.C. III. 49:146.—*C. Lindleyi*=(?).—*C. longifòlium*, Don. Lvs. linear, acuminate: racemes suberect; fls. about 12; sepals and petals green, striped brownish purple, the sepals oblong, the dorsal one broader and incurved; lip with the lateral lobes purple-lined, the middle lobe and disk white. Himalayas. G.M. 54:472.—*C. lowgrìnum*, Hort. Hybrid between C. Lowianum × C. tigrinum.—*C. Lòwi-grandiflòrum*, Hort. Hybrid between C. Lowianum × C. grandiflorum.—*C. Lòwi-Mástersii*, Hort. Hybrid between C. Lowianum × C. Mastersii.—*C. Mástersii*, Griff.=Cyperorchis.—*C. Párishii* var. *Sánderæ*, Rolfe (C. Sanderae, Hort.). Sepals and petals ivory-white, the front lobe of lip heavily blotched with crimson-purple, the crests orange-yellow. Burma. G.C. III. 35:338.—*C. Paùlwelsii*, Hort.=C. insigne × C. Lowianum concolor.—*C. pùmilum*, Rolfe. Scape 4–6 in. long, many-fld.; sepals light reddish brown; lip white with red-brown spots; disk and keels bright yellow. China.—*C. rhodochilum*, Rolfe. A striking plant: raceme many-fld.; sepals and petals pale green; the latter with darker green spots; lip with the lateral lobes pale green, margined crimson, the middle lobe obcordate, crimson, with a yellow central band which is green-spotted. Madagascar. B.M. 7932–3. O.R. 14:209. A.F. 18:810. G.C. III. 37:378. Gn. 61, p. 383.—*C. rosefieldénse*, Hort. Hybrid between C. Traceyanum × C. grandiflorum.—*C. Sándersonii*=Ansellia.—*C. Schrèderi*, Rolfe. Petals and sepals lanceolate, green, lined and dotted with reddish brown; lip light yellow striped with brown. Annam.—*C. Simonsianum*, Ruiz & Prantl. Sepals and petals grayish white, streaked blood-red in the center; lip white, streaked blood-red, the middle lobe revolute, with a yellow blotch. Assam. B.M. 7863.—*C. Steppeànum*, Pynært. Hybrid between Cyperorchis Mastersii × Cymbidium giganteum. Sepals and petals yellowish green, the lip white marked brown and yellow. R.B. 36:397.—*C. Veitchii*, Hort. Hybrid between C. eburneum × C. Lowianum. Fls. fragrant, about 5 in. across; sepals and petals white, tinted yellow; lip white, tinted yellow, with a large V-shaped purple-crimson spot on the middle lobe. G.C. III. 47:407. O.R. 12:369; 16:325. C.O.1.—*C. virescens*, Lindl. Sepals and petals greenish, the lip yellow, red-blotched. Japan.—*C. Wiganianum*, Hort. Hybrid between C. eburneum × C. Traceyanum.—*C. Wilsonii*, Hort. Sepals and petals green, indistinctly marked at base with lines of reddish dots; lip cream, the lateral lobes lined with sepia-brown and reddish markings on the front lobe. China. G.C. III. 35:157.—*C. Winnianum*, Hort. Hybrid

between C. giganteum×C. eburneum. Racemes 10–15-fld.; fls. about 4 in. across; sepals and petals ivory-white; lip ivory-white, spotted with crimson. O.R. 1:361; 12:369. G.M. 51:179.—*C. Woodhamsiànum*, Hort. Hybrid between C. Lowianum×C. Veitchii. G. 30:107.—*C. woodlandénse*, Hort. Hybrid between C. Traceyanum×C. Mastersii.—*C. Zaleskiànum*, Hort. Natural hybrid between C. giganteum×C. grandiflorum.

GEORGE V. NASH.†

CYMBOPÉTALUM (Latin, signifying *boat-petal*, from the shape of its petals). *Annonàceæ*. A group of plants remarkable for the fragrance of their aromatic flowers.

Flowers with the 3 inner petals having the margin incurved somewhat like the upper part of the human ear, the several-ovuled carpels forming a cluster issuing from a globose mass of stamens: fr. in the form of separate oblong berries borne on the hardened torus or receptacle and resembling that of our papaw (*Asimina triloba*).—Several species, all of them endemic in Trop. Amer. Among the species thus far described are *C. brasiliensis*, Benth. (*Uvaria brasiliensis*, Velloso). *C. penduliflorum*, Baill. (*Unona penduliflora*, Dunal). *C. longipes*, Diels, and *C. stenophyllum*, Donnell Smith.



1186. Cymbopetalum penduliflorum. (×½)

penduliflòrum, Baill. XOCHINACAZTLI. TEONACAZTLI. SACRED EARFLOWER of the Aztecs. OREJUELA. FLOR DE LA OREJA. MEXICAN EARFLOWER. Figs. 1186, 1187. A shrub or small tree with distichous, membranaceous, subsessile lvs. oblanceolate in form, subcordate and usually unequal at the base, acute at the apex: solitary fls. borne on long slender peduncles issuing from the internodes of the smaller branches; sepals broadly ovate or suborbicular, cuspidate, reflexed at length; outer petals similar to the sepals but much larger; inner petals thick and fleshy, their margin involute, causing them to resemble a human ear.—The pungently aromatic fls. when fresh are greenish yellow, with the inner surface of the inner petals inclining to orange-color, at length turning brownish purple or maroon, breaking with a bright orange-colored fracture. The tree is planted for the sake of its fragrant fls., the petals of which are dried and are used medicinally as well as for imparting a spicy flavor to food. They were used by the ancient Mexicans before the intro. of cinnamon and other spices from the E. Indies for flavoring their chocolate. Though described by Hernandez more than two centuries ago, the botanical identity of the xochinacaztli remained unknown until quite recently (see Smithsonian Report for 1910, pp. 427–431, 1911). This species is native of the mts. of S. Mex. and Guatemala. A closely related species, *C. stenophyllum*, Donnell Smith, was discovered by Capt. John Donnell Smith in the Dept. of Quetzaltenango, Guatemala; and another species, *C. costaricense*, Safford (*Asimina costaricensis*, Donnell Smith) was collected by Adolfo Tonduz in the Dept. of Talamanca, Costa Rica, in April, 1894. Steps have been taken by the Bureau of Plant Industry to intro. into the U. S. *C. penduliflorum*, seeds of which have been sent from Guatemala by the American Consul-General, George A. Bucklin. The other Cent. American species, as well as *C. brasiliense*, recently collected by Henry Pittier in Venezuela, are equally worthy of cult. in greenhouses and in the warmer regions of Fla., Calif. and the Island possessions.

W. E. SAFFORD.

CYMBOPÒGON (Greek *kumbo*, a cup, and *pogon*, beard). *Gramíneæ*. Oil-producing grasses.

The genus resembles Andropogon, of which it is considered by some a subgenus, but differs in having some of the lower pairs of spikelets in each spike staminate. The spike-like racemes are borne in pairs at the ends of the short branches of the infl. and are subtended by a somewhat inflated sheath.—About 40 species, mostly of the tropics of the Old World. Several species furnish essential oils and some are cult. for that purpose. They are known under the general name of oil grasses or lemon grasses. Some of the more important are: *C. Schœnánthus*, Spreng. CAMEL HAY. Fig. 1188. G.W. 14:399; *C. Nárdus*, Rendle. CITRONELLA GRASS. Gn. 12:495; *C. citràtus*, DC. LEMON GRASS. Gn. 12:495. For a full account of these, see Kew Bull. Misc. Inf. No. 8, 1906. See also *Vetiveria*.

A. S. HITCHCOCK.



1187. Cymbopetalum penduliflorum.

CYNÁNCHUM (Greek, *dog strangle*). *Asclepiadàceæ*. Herbaceous or sometimes half woody at the base, twining, sometimes seen in gardens.

In the restricted sense as limited by Bentham & Hooker, perhaps 25 species differing from Vincetoxicum in having a scale or ligule on the inside of each of the 5 parts of the crown: lvs. opposite, cordiform or hastate: fls. small, in umbelliform or racemiform cymes; calyx 5-parted; corolla nearly rotate, deeply 5-cut, the lobes oblong or roundish; corona membranaceous, adnate to the stamen-tube, cup-shaped or at base ringed, 5-lobed opposite the anthers and with inner scales or small lobes: follicles rather fleshy, acuminate and smooth.—The genus is mostly of S. Eu., Afr., Asia and Austral. Schumann in Engler & Prantl combines Vincetoxicum and other genera with it, making more than 100 species in the warmer parts of both hemispheres. Vincetoxicum is here kept distinct.

acuminatifòlium, Hemsl. (*Vincetóxicum acumindtum*, Decne. *V. japónicum*, Hort.). MOSQUITO PLANT. CRUEL PLANT. Perennial: erect or nearly so, or the tips showing a somewhat twining habit: sts. grayish and more or less angular: lvs. opposite, broadly ovate and acuminate, short-petioled, strongly pinnate-veined, entire, usually conspicuously gray-pubescent beneath:

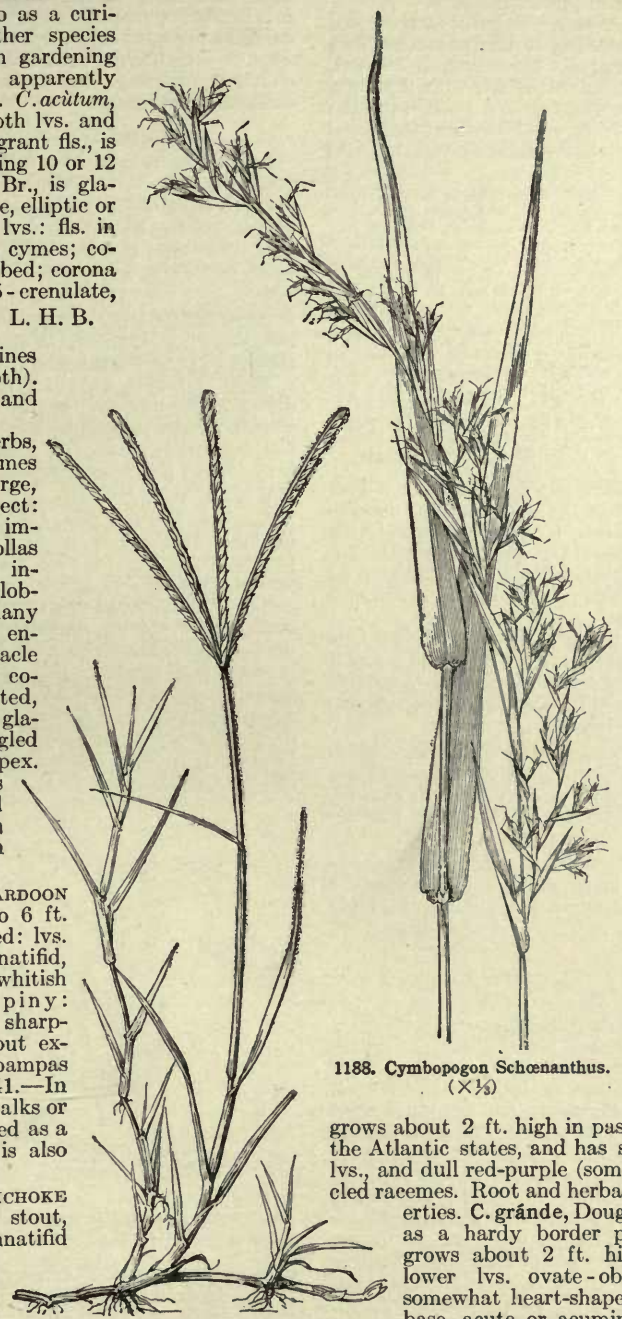
fl.-clusters lateral (1–2 between the lvs.), shorter than the lvs.; fls. white, small, in umbel-like cymes: fr. a milkweed-like follicle. Japan.—In the fls. mosquitos and other insects are caught, much as they are in other asclepiadaceous plants. The native *Amsonia Tabernæmontana* is sometimes sold as this plant, and it has been figured as such. This plant attracted attention some years ago as a curious garden subject. Other species are mentioned in foreign gardening literature, but they are apparently not in the American trade. *C. acùtum*, Linn., with cordate smooth lvs. and white or rose-colored fragrant fls., is a climber in S. Eu., reaching 10 or 12 ft. *C. formòsum*, N. E. Br., is glabrous, with petiolate ovate, elliptic or oblong-ovate acuminate lvs.: fls. in large lateral pedunculate cymes; corolla pale green, deeply lobed; corona tubular-bell-shaped, 15-crenulate, prominent. Peru. L. H. B.

CÝNARA (involucre spines likened to a dog's tooth). *Compósitæ*. ARTICHOKE and CARDOON.

Thistle-like perennial herbs, mostly coarse, and sometimes prickly: lvs. commonly large, variously lobed or pinnatisect: head large, terminating important branches, the corollas violet, blue, or white; involucre broad or nearly globular, with bracts in many series and more or less enlarged at the base; receptacle fleshy and plane, bristly; corolla slender-tubed, 5-parted, not ligulate: fr. a thick glabrous compressed or 4-angled achene with a truncate apex. —Ten or a dozen species in the Medit. region and Canary Isls., two of which are grown as garden vegetables.

Cardúnculus, Linn. CARDOON (which see). Robust, to 6 ft. tall and more: st. grooved: lvs. very large, deeply pinnatifid, grayish green above and whitish beneath, prominently spiny: heads purple-fld., with sharp-pointed scales. S. Eu., but extensively run wild on the pampas of S. Amer. B.M. 3241.—In cult., the thickened lf.-stalks or ribs are blanched and used as a pot-herb, and the root is also edible.

Scólymus, Linn. ARTICHOKE (which see). Not so stout, usually 3–5 ft.: lvs. less pinnatifid and spiny: scales of involucre broad, thickened at base, unarmed: heads larger than in *C. Cardunculus*, the receptacle enlarged and fleshy.—Probably a derivative of the last. L. H. B.



1189. Cynodon dactylon. (Natural size.)

CÝNODON (Greek *kuon*, a dog, and *odons*, a tooth). *Gramíneæ*. Low creeping perennials, used for lawns and pasture.

Flowers in slender digitate spikes; spikelets 1-fld., compressed, awnless, sessile in 2 rows along one side of a slender rachis.—Species 4, in warm regions.

dáctylon, Pers. (*Capriòla dáctylon*, Kuntze). BERMUDA-GRASS. WIRE-GRASS. Fig. 1189. Sts. flattened, slender, creeping and rooting at the nodes, producing numerous slender or stout creeping rootstocks: blades hairy around the base: spikes 4–5, 1–1½ in. long. Dept. Agric., Div. Agrost. 20: 99.—A native of the warmer parts of the Old World, now widely distributed in the warmer parts of the western hemisphere. Cult. as a pasture and lawn grass in the southern states. Often a troublesome weed in cult. ground. A fine-lvd. form with runners above ground, much used in the S. for lawns, is called St. Lucie grass. In Eu. the stolons are said to be used medicinally like couch-grass, principally as a diuretic.

C. incompletus, Nees. BLUE COUCH-GRASS. Occurs in E. and S. Afr. and also New S. Wales, where it is used as a pasture grass. It is reported as poisoning stock, at certain stages of its growth producing hydrocyanic (prussic) acid.

A. S. HITCHCOCK.

1188. Cymbopogon Schœnanthus. (×⅓)

CYNOGLÓSSUM (Greek, *hound's tongue*, from the shape and soft surface of the lvs. of the commonest species). *Borragināceæ*. A widely dispersed genus of little horticultural interest, being mostly tall, coarse, weedy herbs. Lvs. alternate: fls. always in elongated, often 1-sided racemes.—Species 75. **C. officinàle**, Linn., Fig. 1190 (stick-tight), has a bur that becomes attached to clothing and to fleece of sheep. It is a biennial weed, naturalized from the Old World; grows about 2 ft. high in pastures and waste places of the Atlantic states, and has soft-pubescent, lanceolate lvs., and dull red-purple (sometimes white) fls. in panicled racemes. Root and herbage possess medicinal properties. **C. grânde**, Douglas. Once cult. from Calif. as a hardy border perennial; grows about 2 ft. high, with lower lvs. ovate-oblong, or somewhat heart-shaped at the base, acute or acuminate, 4–8 in. long, on margined petioles of about the same length: upper lvs. smaller, ovate to lanceolate, abruptly contracted into shorter winged petioles: fls. violet or blue. For *C. appennìnum*, Linn., see *Solenanthus*. A new plant, **C. furcàtum**, Wall., has recently been



1190. Bur of Hound's tongue or stick-tight. (×1½)

intro. It is a hairy herb, 1–3 ft. high, with large lvs. and numerous blue fls. in clusters as in forget-me-not. India. Fls. in June. See page 3567.

C. amábile, Stapf & Drummond. Allied to C. furcatum, but has larger fls. Perennial. S.W. China. N. TAYLOR.†

CYNÓRCHIS (Greek for *dog orchid*). *Orchidàceæ.* Terrestrial orchids, grown in the warmhouse.

Flower-clusters loose; sepals and petals similar, or the petals smaller, spreading; lip spreading, 3–5-lobed, spurred; anther short, with 2 points, between which arises the middle lobe of the beak.—About 25 species, of the Mascarene Islands and tropical Africa.

The following have been in cult.: *C. compácta*, Reichb. f. Fls. white, the disk of lip red-spotted. Natal. B.M. 8053. O.R. 19:265. —*C. Lowiàna*, Reichb. f. Lateral sepals light green, the lip bright rose-purple, the spur clavate. Madagascar. B.M. 7551. (as C. purpurascens). O.R. 19:273. G. C. III. 43: 184.—*C. Mórlandii*, Rolfe. Racemes 5–9-fld.; fls. medium-sized, lilac. Mozambique.—*C. purpurâscens*, Thomas. Fls. numerous in a spike-like raceme or head, rose, with the disk of the lip white. Mascarene Isls. B.M. 7852. O.R. 14:305; 15:121; 19:272. G. C. III. 29: 87; 35:227.—*C. villòsa*, Rolfe. Raceme spike-like, densely fld.; fls. rose-purple, the sepals glandular-hairy. Madagascar. B.M. 7845.

GEORGE V. NASH.



1191. Cynosurus cristatus. (×½)

CYNOSÙRUS (Greek *kuon*, a dog, and *oura*, a tail). *Gramíneæ.* DOG'S-TAIL-GRASS. Cespitose grasses with flat blades and spike-like panicles, two species of which are cultivated as ornamental grasses and in lawns and pastures.

Spikelets of 2 forms in small fascicles, the terminal spikelets perfect, the lower sterile, consisting of several empty glumes.—Species about 6, in the north temperate regions of the Old World.

cristàtus, Linn. CRESTED DOG'S-TAIL. Fig. 1191. Perennial, 1–2 ft.: spike 1–3 in. long; awns shorter than the lemmas. Eu. Dept. Agric., Div. Agrost. 20:146. —Sometimes used in mixtures of lawn or pasture grasses.

élegans, Desf. Annual, 6–18 in.: panicle loose, 1-sided, about 1 in. long; awns silky, longer than the lemmas, sometimes as much as 1 in. Eu.—Used for dry bouquets. A. S. HITCHCOCK.

CÝNTHIA: *Krigia.*

CYPÉLLA (application obscure). *Iridàceæ.* South American bulbs, resembling Iris.

Half-hardy: bulb tunicate: lvs. radical or cauline: fls. 1–3 from a spathe, yellow, orange or blue; segms. free, narrow or broadly unguiculate, the outer ones spreading and the inner erect and somewhat recurved at the apex. The genus differs from Iris and Moræa in its stigmas, which are neither petal-like nor filiform, but erect, and in the anthers, which are broad, erect, not curved, bearing the pollen on their edges, also in the plaited lvs. Perhaps a half-dozen species.—The bulbs should be set out in spring, lifted in fall and stored over winter. Prop. by offsets or by seed, which should be sown as soon as ripe. The blue-fld. species are presumably equally worthy of cult. For the still showier *C. cærulea*, see *Marica.*

A. *Style appendages spur-like.*

Hérbertii, Herb. Lvs. about 1 ft. long, linear, acuminate, twice plaited, the angles of the plaits winged: scape 2–3 ft. high, erect, flexuose, glaucous, branched, many-fld.; fls. 3 in. across, chiefly yellow, odorless, soon withering; outer segms. bearing a rather long cusp or tail. S. Brazil. Uruguay. Argentine. B.R. 949 (as Moræa) and B.M. 2599 (as Tigridia) show very distinct colors, but Baker says there is a lilac variety.

plúmbea, Lindl. Three to 4 ft., the st. glaucous, round and thickish: lvs. not very close together, sheathing at the base, plicate and glaucous: fls. fleeting, at their best early in the morning, not unlike those of *Iris versicolor*, and the same color; style slender, broadening at the apex into a spur-like appendage. Trop. S. Amer.—Has been offered under the name *C. platensis*, which is otherwise unknown in botanical and horticultural literature.

AA. *Style appendages petal-like, flat.*

peruviàna, Baker. Lvs. 6–9 in. long, linear, narrowed gradually from the middle both ways, glabrous, plaited: fls. 2–3 in a solitary stalked cluster, soon withering, chiefly yellow; segms. with a distinct long claw and a proportionately shorter and broader blade and a shorter cusp, at the base spotted brown. Peru. B.M. 6213.

N. TAYLOR.†

CYPERÓRCHIS (*Cyperus* and *Orchis*, from the sedge-like appearance). *Orchidàceæ.* Epiphytic orchids, thriving in the warmhouse.

Very closely allied to Cymbidium, from which it differs in the narrower sepals and petals which are connivent to the middle or beyond, thus preventing the full expansion of the fl., and by the straight narrow lip.—There are 3 species, natives of the Himalayas and the Khasia Hills.

élegans, Blume. Fig. 1192. Pseudobulbs short, 2–3 in. long: lvs. linear, up to 20 in. long, streaked, pale yellow-green: raceme many-fld., dense, pendulous; fls. yellow, 1½–2 in. across; sepals and petals linear-oblong, the recurved tips acute; lip cuneate, 3-lobed, the middle lobe oblong, short, obtuse; disk with 2 raised orange lines. Himalayas. B.M. 7007.

Mástersii, Benth. (*Cymbídium Mástersii*, Griff.). Pseudobulbs 4–10 in. long: lvs. up to 2½ ft. long, acute: racemes 6–10-fld.; fls. about 2 in. across, almond-scented, ivory-white; sepals and petals oblong-linear; lip usually spotted rose-purple, the lateral lobes roundish-oblong, the middle lobe undulate, reflexed, oval;


1192. Cyperorchis elegans. (×⅙)

disk with 2 raised orange lines. Sikkim and Khasia Hills. B.R. 31:50. F.M. 1879:346; 1880:391. Lind. 5:222. J.F. 3:289. O. 1910:8. GEORGE V. NASH.

CYPÈRUS (ancient Greek name). *Cyperàceæ.* A large genus of the sedge family, inhabiting both tropical and temperate regions. The species in cult. are all perennials from rootstocks or tubers: lvs. grass-like: st. simple and mostly naked above: fls. perfect, without

perianth, borne in small, compressed spikes, which are variously aggregated in compound umbels, the latter surrounded by foliaceous bracts; styles and stamens 3.—A few are cult. in jardinières, aquatic gardens and aquaria. Several others are pests in cult. fields. P.3567.

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conglomeratus, 8.	gracilis, 3.	pungens, 8.
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esculentus, 12.	lucidus, 9.	variegatus, 3.

A. *Basal lvs. much reduced or wanting.*

B. *Umbel-rays nearly 100, much longer than the 3–10 involucral lvs.*

1. **Papỳrus,** Linn. (*Papỳrus Antiquòrum,* Willd.). Egyptian Paper Plant. Papyrus. Cespitose, strict, tall and stout, 4–8 ft. high: st. obtusely 3-angled, smooth: involucral lvs. only 3–10, small, 3–6 in. long, 3–12 lines wide, lanceolate, acute: primary rays of the umbel very numerous, slender, furrowed, equal and drooping, 10–20 in. long; secondary bracts prominent, filiform, 1–6 in. long; spikelets clustered and sessile, pale chestnut; scales obtuse, rachis strongly winged. Egypt, Palestine. Gn. 30, p. 348; 57, p. 105. G.M. 40:799. G.W. 2, p. 571.—For aquaria and damp soil. Not hardy N.

BB. *Umbel-rays 25 or less.*

C. *Involucral lvs. very numerous, somewhat separated, much exceeding the umbel; rachis scarcely winged.*

D. *Scales broadly ovate: lvs. scabrous throughout.*

2. **flabellifórmis,** Rottb. Rhizome horizontal, stoloniferous, stout: st. stout, spongy at base, 2–4 ft. high, obtusely angled: involucral lvs. 15–25, 2–8 lines wide, 6–16 in. long, strongly nerved or plicate: umbel lax, about a third as long as involucre; spikelets very numerous, elliptic-oblong, very flat, lustrous, 2½–3½ lines long; scales firm, lustrous, scarcely striate, carinate, barely acute, closely imbricated, pale brown with dark brown area on each side. Afr.—Rare in American trade. Tall and palm-like; used by the natives for wickerwork; very ornamental in water-gardens.

DD. *Scales lanceolate: lvs. scabrous only at apex.*

3. **alternifòlius,** Linn. Umbrella Plant. Umbrella Palm. Fig. 1193. Cespitose, strict, 1–4 ft. high: st. nearly terete, ribbed, smooth and slender: involucral lvs. about 20, spreading or slightly drooping, linear, 4–8 in. long, 2–5 lines wide, plain: umbel open; rays only 1–3 in. long; spikelets numerous, ovate-lanceolate acute, very flat, 2 lines long, pale brown suffused with darker brown, dull; scales thin, very acute, somewhat nerved. Madagascar.—Much used for aquaria and jardinieres. Gn. 35, p. 573. A.G. 17:57. V. 4:159; 5:39. Var. **variegàtus,** Hort. St. and lvs. striated with white, sometimes entirely white. Var. **grâcilis,** Hort. Plant smaller and more slender: involucral lvs. much narrower and shorter, and not so spreading.—The above description is from Boeckeler, and from a specimen from Madagascar. The plant in cult. under the name *C. alternifolius* may not be that species. The lvs. are too long, too scabrous and too veiny; and the spikelets are elliptic-oval, or oval, 2 lines long, and have broader and more closely overlapping scales than in the typical form. The illustrations cited are probably of the garden plant.

CC. *Involucral lvs. about 3, contiguous, shorter than umbel; rachis strongly winged.*

4. **natalénsis,** Hochst. Rhizome long, stout and hard, 2 lines thick, scaly: st. solitary, 2–3 ft. high, the size of a goose-quill, triangular: lvs. 2–6 in. long, often wanting; involucral lvs. 3, only 1–3 in. long: umbel rather dense; spikelets 5–9 (rarely 12) lines long, linear-lanceolate, scarcely compressed, rigid; scales obtuse, not carinate, nerved, shining, pale or brownish. Natal. —Decorative. Not hardy.

AA. *Basal lvs. well developed.*

B. *Sts. very short, 3–5 in. high: umbel-rays up to 2 ft. long, weak, decumbent.*

5. **fértilis,** Boeck. Roots fibrous: lvs. numerous, about equaling the st., 3–7 lines broad, margins strongly scabrous; involucral lvs. 6–7, short: rays flaccid, pendulous, often rooting at apex; spikelets few, ochraceous or olive, oblong or oblong-lanceolate, obtuse, slightly compressed, 8–10-fld., 3–4 lines long; scales obtuse, nerved. W. Afr. G.W. 8, p. 523.—Recently intro., and excellent for hanging-baskets. The umbel-rays often bear plantlets instead of spikelets.



1193. Cyperus alternifolius or umbrella plant.

BB. *Sts. longer than the umbel-rays.*

C. *Rachis of spikelet wingless: scales broad, much overlapping, acute or mucronate: spikelets lanceolate or lance-oblong.*

D. *Involucral bracts 2–6 lines broad, about 6–12 in number.*

6. **diffùsus,** Vahl (*C. élegans,* Hort. *C. láxus,* Hort.). Roots fibrous: st. solitary, 1–3 ft. high: basal lvs. many, equaling the st., 2–7 lines broad; margin scabrous; involucral lvs. 4–15 in. long, 2–6 lines broad, longer than the infl.: umbel diffuse; spikelets greenish yellow or pale brown, linear oblong or ovate-lanceolate, 3–8 lines long; scales loose, soft, dull; midrib deeply striate, cuspidate. Tropics. G.C. II. 1874:99; III. 13: 41.—For table decoration. As now interpreted, *C. elegans,* Linn., is a more rigid plant with narrower lvs.

DD. *Involucral bracts 1½ lines broad, or less, 3–6 in number.*

E. *Lvs. flaccid: infl. usually open; spikelets very flat; scales 1½ lines long.*

7. **compréssus,** Linn. Roots fibrous: st. cespitose, 2–16 in. high: lvs. 2–3, slightly shorter than the st., scabrous only near apex: umbel of several pedunculate, sessile heads, or reduced to 1 sessile head; spikelets lance-oblong or lance-linear, 4–12 lines long; scales soft, carinate, acuminate, striate close. Tropics.—Cult. in Eu.

EE. *Lvs. rigid: infl. congested; spikelets thicker; scales 2½ lines long.*

8. **púngens,** Boeck. Roots of coarse lanate fibers: st. 6–20 in. high, stiff, terete above: lvs. several, with conspicuous, loose, brownish sheaths, equaling the st.



1194. Cyperus esculentus.—Chufa.

or shorter, narrow, ½ to ¾ lines broad, thick and rigid: umbel congested, often simple; spikelets 5–9 lines long, lanceolate or ovate-lanceolate, pale brown; scales firm, with thin margins, obscurely carinate, inconspicuously striate, apiculate; midrib obscure, close. N. Afr. and S. W. Asia.—By some authors united with *C. conglomeratus,* Rottb., under the latter name. There is some reason to suspect that the plant in the trade under this name may not be this species.

CC. *Rachis of spikelet with scarious, winged margin; scales obtuse or obtusish, less overlapping: spikelets linear.*

D. *Lvs. thick, glossy.*

9. **lùcidus,** R. Br. Rhizomes short and thick: sts. stout, 2–3 ft. or even 4 ft. high, sharply 3-angled: lvs. equaling the st. or longer, 3–6 lines wide, margins scabrous; involucral lvs. 3–6, the lower very broad, often 1½–3 ft. long: umbel large, lax, compound; rays many, 9 in. long or less; spikelets spicate, rich deep brown, lustrous, linear, flattish, acute, 4–6 (rarely 7–8) lines long; wings of rachis narrow; scales loosely imbricated, few-nerved, 2 lines long. Austral.

DD. *Lvs. thinner, duller.*

E. *Rootstock long, stout, 2–2½ lines thick.*

10. **lóngus,** Linn. Sts. 2–4 ft. high, acutely angled, stoutish: lvs. several, with long sheaths, about equaling the culm 2–4 lines wide; margins finely scabrous; involucral bracts very long, often 8–24 in.: umbel lax, the rays 12 in. or less long; spikelets 3–15 lines long, linear, dull, dark chestnut-brown, rarely paler, slightly compressed; scales 1¼–1½ lines long, scarcely carinate, obscurely striate; midrib green. Eu.—Cult. in Eu.

EE. *Rootstock long, slender, tuber-bearing.*

F. *Scales dark reddish brown.*

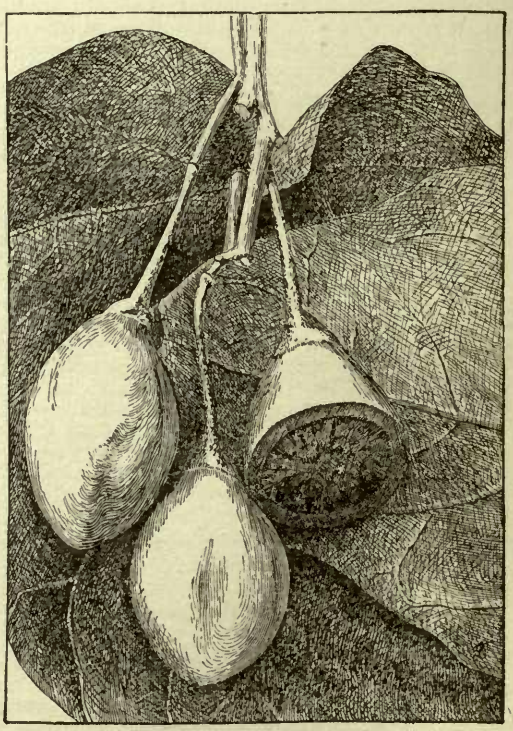
11. **rotúndus,** Linn. NUT-GRASS. COCO-GRASS. Rootstocks ¼ line thick: sts. 4–24 in. high, bulbous, thickened at the base, rather slender, 3-angled: lvs. several, usually shorter than the st., only 1–2 (rarely 3) lines wide; margins finely scabrous; involucral bracts 2–4, scarcely longer than the infl.: umbel lax; rays few, 4 in. long or less; spikelets linear, 5–12 lines long, inconspicuously spicate on the branches, few in a cluster, dull; scales 1¼ lines long, scarcely striate, obscurely carinate; midrib green: achenes linear, acute. Tropics and subtropics.—A weed southward.

FF. *Scales brownish chestnut or stramineous.*

12. **esculéntus,** Linn. CHUFA. Fig. 1194; also Fig. 959. St. 8 in. to 3 ft. high, stoutish: lvs. several, equaling the st. or slightly shorter, rarely longer, 2–4 lines wide; involucral lvs. exceeding the infl.: umbel open; rays ½–4 in. long; spikelets very numerous, spicate on the branches, crowded, divaricate, brownish stramineous, linear, 4–12 lines long, scarcely compressed; scales lax, several-nerved, dull, rarely carinate; midrib somewhat green: achenes oblong, obtuse. Tropics and subtropics.—A weed in sandy cult. fields northward and southward; rarely grown for the edible tubers.

EEE. *Rootstock globular: spikelets stramineous.*

13. **strigòsus,** Linn. Running rootstocks absent, not tuber-bearing: sts. rather stout, 1–3 ft. high, sharply 3-angled; base bulbous: lvs. numerous, usually equaling the st., 2–4 lines wide, more or less scabrous; involucral bracts 6–12 in. long, usually exceeding the infl.: umbel open, rays several, 6 in. long or less; spikelets very numerous, spicate on the branches, crowded, divaricate, linear-subulate, 5–8 lines long, scarcely compressed; scales 1½ to 2 lines long, appressed, dull, striate; midrib green. N. Amer.—Hardy perennial, used for the border of aquatic gardens. K. M. WIEGAND.



1195. Cyphomandra betacea. (×½)

CYPHOKÉNTIA (allied to Kentia, differing, among other things, in having a lateral protuberance or tumor on the fr., whence the name). *Palmàceæ*. Feather-lvd. robust spineless palms, of very few species in New Caledonia, suitable for the warmhouse but little grown. The lvs. are terminal and pinnate-parted, the segms. long-swordshaped and narrowed at apex, the margins at base recurved: spathe-valves 2, deciduous, bearing stout glabrous branching spadices; fls. diclinous, the stamens 6 or 12: fr. small, globose or ellipsoidal. Engler and Prantl combine Cyphosperma and Microkentia with this genus, comprising, about 10 species, all of New Caledonia. The original species are: *C. robústa*, Brongn., with the branches of the spadix thick and long-cylindrical, fr. reniform-ellipsoidal, stigma not prominent above the base, and seeds reniform; *C. macrostàchya*, Brongn., with long flexuose spadix branches, globose fr., lateral stigma, and usually subglobose seeds. The cyphokentias probably require the treatment given arecas. L. H. B.

CYPHOMÁNDRA (from the Greek, referring to the hump-shaped anthers). *Solanàceæ*. South American spineless shrubs or small trees, one of which is sometimes grown for its edible fruit.

The genus is distinguished from Solanum chiefly by the thickened connective of the anthers: the plants are erect and usually stout and the large lvs. are entire, 3-lobed, or pinnatisect: fls. pedicellate, in racemes, scorpioid cyme-branches, or arising below the nodes; calyx and corolla 5-lobed, the corolla somewhat rotate, the tube very short; anthers porose or acuminate at apex; ovary 2-celled: fr. an ovoid or oblong fleshy berry, many-seeded.—Some 30 or more species, of little concern to the horticulturist.

betàcea, Sendt. (*Solànum fràgrans*, Hook.). Tree Tomato. Fig. 1195. Cult. occasionally for the egg-shaped, reddish brown, faintly striped frs., and under such conditions it becomes a tree-shaped, half-woody plant 6–10 ft. high: lvs. large, soft-pubescent, cordate-ovate, more or less acuminate, entire: fls. small, pinkish, fragrant, in small axillary or super-axillary clusters: fr. about 2 in. long, on slender stalks, 2-loculed and seedy, musky-acid and tomato-like in flavor, agreeable to those who like tomatoes. Brazil. B.M. 3684. J.H. III. 31:470. G.C. III. 25:105. A.G. 11:409.—Bears the second and third year from seed, under glass (where it must be grown in the northern states). Grown mostly as a curiosity. L. H. B.

CYPHOPHŒNIX (*hump* and *Phœnix*, a palm). *Palmàceæ*, tribe *Arèceæ*. A rather unimportant genus of unarmed, stout-stemmed palms, with terminal pinnatisect leaves.

Leaflets acute at the apex, sword-shaped, the base often with a thickened and recurved margin; rachis stout and broad, a little convex on the lower side: spadix glabrous, with many long stout branches bearing short bracts and numerous monœcious fls.; sepals thick and leathery, round and a little concave: fr. elongate-ovoid or rarely ellipsoid.—There are only 2 species, both from New Caledonia. They have something the aspect of *Kentia* from which they differ in having only 6 stamens. They are almost unknown in the trade. For cult., see *Kentia* or *Howea*.

élegans, Benth. & Hook. (*Kéntia élegans*, Brongn. & Griseb.). Rachis convex below, keeled above; lfts. alternate, not close together, scaly along the mid-nerve below, 3-nerved: spadix more or less spreading or reflexed in age, simply branched: fr. oblong-elliptical, acute.

fulcìta, Benth. & Hook. (*Kéntia fulcìta*, Brongn.). St. clothed at the base with smooth aërial roots: fr. ovoid, attenuate above.—A tall graceful palm scarcely known outside of botanic garden collections.

N. Taylor.†

CYPHOSPÉRMA (Greek, *hump* and *seed*). *Palmàceæ*, tribe *Arèceæ*. Unarmed stout-stemmed palms with a crown of pinnately divided, terminal leaves.

Leaflets leathery, sword-shaped, the apex narrowly oblique, the base with a thickened recurved margin; rachis broad and stout, slightly convex beneath, channeled above: spadix smooth and much branched, the branches distichous; fls. spirally disposed on the spadix, brownish, otherwise as in Cyphophœnix: fr. globose or 4–5-angled.—Two species of New Caledonian palms, rare in cult. in U. S. and only doubtfully in the trade. See *Cyphokentia;* for cult. see *Areca*. The young plants have rather stiff petioles, but graceful, arching lf.-segms. G.C. II. 24:362.

Vieillàrdii, Benth. & Hook. (*Cyphokéntia Vieillàrdii*, Brongn.). St. medium height: lvs. pinnatisect, the lfts. thick and narrowly sword-shaped: fr. obtuse, 4–5-angled, the seed also acutely angled.—A rare palm, known also under the names *Kentia robusta* and *K. Vieillardii*. N. Taylor.

CYPRESS: *Chamæcyparis*, *Cupressus* and *Taxodium*.

CYPRESS VINE: *Ipomœa*.

CYPRIPÈDIUM (*Venus'-slipper*). Lady's Slipper. Moccasin-Flower. *Orchidàceæ*. Attractive hardy orchids, often planted in moist cool borders, bogs, and sometimes in rock-gardens.

Stems very short, with a pair of lvs. close to or near the ground, or long and leafy: lvs. commonly many-nerved: fls. terminal, 1 to few, withering on the ovary; lateral sepals free, or united nearly or to the apex, the dorsal sepal erect; petals generally narrower, spreading; lip saccate, rarely split down the front; ovary 1-celled, with 3 parietal placentæ.—Species about 30, in the north temperate zone. For the greenhouse species formerly included here, see *Paphiopedilum*, and *Phragmipedilum*.



1196. Cypripedium pubescens. (×½)

A. *Lvs. 2, opposite: lip split in front.*

acaùle, Ait. Lvs. flat on the ground, ovate to oblong-oval: scape with 1 fl.; upper sepal and petals brownish, lanceolate; labellum pink-purple, darker veined. May, June. Newfoundland to N. C., west to Ind., Mich. and Minn. A.G. 13:514; 14:405. Gng. 4:263. A.F. 11:1049. G.C. III. 46:209.

japónicum, Thunb. Lvs. above the ground roundish, undulately plicate: bract longer than the ovary: fl. terminating the scape; sepals and petals lanceolate, acuminate, greenish, dotted with red; labellum white-pink. April, May. Japan. G.C. III. 33:355.



1197. Cypripedium spectabile. (×⅔)

AA. *Lvs. several, alternate: lip not split.*

B. *Lateral sepals free.*

arietînum, R. Br. Plant about 6 in. high, slender: lvs. lanceolate: fls. small, resembling a ram's head, terminal, solitary; upper sepal ovate-lanceolate, brownish green; petals linear; labellum tapering at the apex, white veined with reddish purple, clothed with white, woolly hairs near the aperture. May. Maine to N. Y., Mich. and Minn., and northward. B. M. 1569. L.B.C. 13:1240. F.S. 20: 2095.

BB. *Lateral sepals united nearly or to the apex.*

C. *Fls. yellow.*

pubéscens, Willd. Fig. 1196. Lvs. oval, acute: petals usually twisted, much narrower than the ovate-lanceolate sepals; labellum pale yellow; staminodium triangular. Same range as the next. May, June. B.M. 911 (as *C. parviflorum*). A.G. 13:513. Mn. 7, p. 5. G.C. III. 33:379; 47:369.—The rhizomes and rootlets are employed in medicine for their antispasmodic and nervine properties. Perhaps a form of the next.

parviflòrum, Salisb. Lvs. ovate, acute: fls. smaller than in *C. pubescens;* labellum flattened from above and below, not laterally, bright yellow; staminodium triangular. May, June. Newfoundland to Ga., west to Minn. and E. Kans. A.G. 13:515. G.C. III. 46:227. —Same medicinal uses as *C. pubescens.*

CC. *Fls. white or greenish.*

D. *Number of fls. 1–3.*

cándidum, Muhl. Lvs. oblong-lanceolate: fls. terminal, solitary; sepals broader than the petals, ovate-lanceolate; petals spreading like the sepals, greenish; labellum white, striped inside with purple; staminodium lanceolate. May, June. N. Y., Pa., Minn., Mo. and Ky.

reginæ, Walt. Fig. 1197. Plants stout: lvs. oval, acute: sepals ovate, rather roundish, white; petals oblong, white; labellum white or pale pink-purple; staminodium oval-cordate. June. Maine, W. New England to Minn. and Mo., Mts. of N. C. R.H. 1868: 410. Gn. 53, p. 77; 61, p. 191; 65, p. 447. R.B. 20, p. 198. A.F. 11:1048. Gng. 4:262, 327. G.C. III. 29:21; 47: 370; 50:315. Known also as *C. hirsutum* and *C. spectabile.*

montànum, Douglas. One to 2 ft., leafy, pubescent: lvs. ovate to broad-lanceolate, 4–6 in. long: fls. 1–3, short-pedicelled, the wavy-twisted petals brownish, the inch-long lip dull white veined with purple: caps. erect or nearly so. Calif. to Wash. B.M. 7319.—Fragrant. Grows in clumps. Handsome.

DD. *Number of fls. 6–12.*

californicum, Gray. Fig. 1198. Plants either slender or stout, varying in height, sometimes exceeding 2 ft.: lvs. ovate-alternate: floral bracts very large, becoming narrowly ovate: fls. small, from 6–12 open at the same time, an inch or more apart on the st.; labellum whitish; sepals oval, yellowish green; petals narrowly oblong, colored like the sepals. Calif. B.M. 7188. G.F. 1:281 (adapted in Fig. 1198). G.C. III. 41:418; 46:211.

C. Calceòlus, Linn. Fls. single; sepals and petals deep brown; lip yellow, slightly compressed. Eu. R.H. 1892, p. 392. R.B. 21, 210. G. C. III. 46:210.—*C. débile,* Reichb. f. Lvs. 2, opposite: fls. small, the sepals and petals pale green with a dark brown basal blotch, sometimes brown-striped, the lateral sepals united; lip white, brown-streaked about the mouth. China and Japan. B.M. 8183.—*C. élegans,* Reichb. f. Sts. 4 in. tall: lvs. opposite: fl. single, the sepals and petals brown-veined, the lateral sepals united; lip brownish, corrugated. Thibet.—*C. guttàtum,* Swartz. Lvs. 2, alternate: fls. single, white, blotched with purple. N.E. Eu. to N.W. Amer. B.M. 7746.—*C. himalàicum,* Rolfe. Sts. up to a foot tall: lvs. 3: sepals and petals brownish, deeper veined; lip brown-purple, many-nerved. Bhotan.—*C. irapeànum,* Llav. & Lex. Lvs. ovate-lanceolate: fls. several, large, pale yellow, the large lip with some scarlet spots about the mouth. Mex.—*C. macránthon,* Swartz. Fls. purple, the lip contracted at the mouth. Siberia and N. Asia. R.H. 1877:310. B.M. 2938. G. C. III. 46:212.—*C. speciòsum,* Rolfe. St. leafy: fls. whitish or flesh-colored, veined with rose; lip subglobose. Japan. B.M. 8386.—*C. Thúnbergii,* Blume. Fls. pale purple. G. C. III. 46:228.—*C. tibéticum,* King. Fls. 3–4 in. across; sepals and petals white, light yellow at apex, veined with maroon-purple; lip maroon-purple. E. Thibet and W. China. B.M. 8070. G. C. III. 39:347; 46:420; 49:403, 410.—*C. ventricòsum,* Hort. Said to be a natural hybrid between C. Calceolus and C. macranthon. G.C. III. 46:229.

GEORGE V. NASH.

CYRÍLLA (after Dominico Cyrillo, professor of medicine at Naples, 1734–1799). *Cyrillàceæ.* Woody or nearly tree-like, rarely cultivated for its handsome bright green foliage and white flowers in slender racemes.

Leaves alternate, without stipules, short-petioled, entire, glabrous, deciduous or nearly persistent: fls. small, white, in narrow slender racemes, 5-merous; stamens 5–10; ovary superior with 2 short styles: fr. a small indehiscent 2-celled caps. with 2 seeds.—Probably one variable species from N. C. to Fla. west to Texas, and in W. India and S. Amer. Plant with handsome bright green foliage, and graceful racemes of white fls., hardy north to N. Y. Thrives best in humid sandy soil and shady position. Prop. by seeds and cuttings under glass, with slight bottom heat.

racemiflòra, Linn. LEATHERWOOD. Shrub, occasionally tree to 30 ft.: lvs. cuneate, oblong or oblanceolate, usually obtuse, reticulate-veined, 2–3 in. long, bright green, turning orange and scarlet in fall, but in tropical climates evergreen: racemes 4–6 in. long, erect, at length nodding. B.M. 2456. S.S. 2: 51. G.C. III. 30: 198. J.H. III. 43: 197.—The variety from W. Indies has been described as *C. antillàna,* Michx., that of Brazil as *C. racemífera,* Vandelli, and a small-lvd. form from Fla. and La. as *C. parvifòlia,* Raf.

ALFRED REHDER.



1198. Cypripedium californicum. (×⅓)

CYRTÁNDRA (name refers to the curved stamens). *Gesneriàceæ.* A large group of tropical shrubs and trees, two or three of which are more or less known in cult. for their fls.; akin to Trichosporum (Æschynanthus); warmhouse subjects. Lvs. opposite, or alternate by failure of one of the pair, membranaceous, or fleshy or leathery: fls. usually white or yellowish, in fascicles, heads or cymes; corolla-tube cylindrical, the limb more or less 2-lipped; perfect stamens 2, and 2 or 3 small staminodia. Nearly 200 species in the islands of the Indian and Pacific oceans and in China. *C. péndula,* Blume. Short and stout: lvs. long-petioled, elliptic or lance-elliptic, acute, gray-blotched above: fls. white with brown calyx, 1½ in. long, the corolla inflated, and purple-dotted on lower side. Java. *C. Pritchardii,* Seem. Lvs. petioled, elliptic, obtusely toothed, acute: fls. small, white, in 3-fld. cymes. Fiji Isls.

L. H. B.

CYRTANTHÈRA: *Jacobinia.*

CYRTÁNTHUS (Greek, *curved flowers;* from their pendulous habit). *Amaryllidàceæ.* Tender bulbs from South Africa, known only in a few American greenhouses.

Flowers umbellate, pendulous or erect, usually red or white with green stripes; stamens inserted in the tube of the corolla; ovary 3-celled, crowded with numerous ovules, the seeds flat.—Species 20. Their cult. is like that of hemanthus and many other bulbs from the same region. They are suitable for pot culture, or for planting out in summer. The following analytical key gives an idea of the group, and its 3 subgenera.

A. *Fls. many in an umbel, pendulous.*

B. *Lvs. strap-shaped.* (*Cyrtanthus proper.*)

obliquus, Ait. Bulb ovoid, 3–4 in. thick: lvs. 10–12, strap-shaped, distichous, produced after the fls., 1½–2 ft. long: scape 1–2 ft. long, stout, mottled; fls. 10–12 in an umbel, entirely drooping, odorless, bright red, with more or less yellow, and greenish tips 2–3 in. long; pedicels ½–1 in. long; style not exserted. Cape Colony. B. M. 1133. L.B.C. 10:947.

BB. *Lvs. linear.* (*Monella.*)

Máckenii, Hook. f. Bulb 1½ in. thick: lvs. 2–6, appearing with the fls., linear, 1 ft. long: scape slender, slightly glaucous; fls. 4–10 in an umbel, pure white, 2 in. long; style exserted. Natal. G.C. 1869:641. Gn. 50, p. 63.

AA. *Fls. single, or few in an umbel, erect or slightly curved downward.* (*Gastronema.*)

sanguíneus, Hook. Bulb 2 in. thick: lvs. 3–4, appearing with the fls., lanceolate, petioled, 1 ft. long: scape slender, 6–9 in. long; fls. 1–3, bright red, 3–4½ in. long, wider funnel-shaped than in the 2 preceding species, with a throat 1 in. across. Caffraria, Natal. B.M. 5218. Var. **glaucophýllus,** Hort. A form with somewhat glaucous foliage and orange-red fls.

C. Húttonii, Baker, belongs to Cyrtanthus proper, but its lvs. appear with the fls., and it has 6–8 or evèn 12 pale red fls. about 1 in. long and a much shorter style than in C. obliquus. Cape Col ny. B.M. 7488. Gn. 50:62.—*C. inæquàlis,* O'Brien. Fls. erect, coral-red, borne in umbels on scapes 1 ft. high; upper segms. of perianth overhanging. Cape Colony. G.C. III. 37: 261.—*C. Jùnodii,* Beauverd. Umbel 6–9-fld.; fls. cinnabar, yellow at apex, pendulous. Transvaal.

N. Taylor.†

CYRTOCÁRPA (Greek, *curved fruit*). Tapira. *Anacardiàceæ.* One or two Mexican trees, one of which bears a small fruit, likened to a cherry by the natives of Lower Calif.

Leaves alternate, compound: fls. axillary or terminal, paniculate, polygamous: fr. an oblique drupe, 1-seeded. Intro. into S. Calif. by Franceschi. Sometimes united with Tapiria (or Tapirira), from which it differs in its straight embryo and other characters.

procèra, HBK. Very tall tree, with slender, terete, dark purplish, resinous branches: lvs. alternate, odd-pinnate; lfts. 5–7 or 9, oblong, entire, with a very slight silkiness, especially below, very shortly stalked, 1 in. or more long, half as wide: fls. white, inconspicuous, in panicles 1–2 in. long; calyx 5-parted, villous, persistent; segms. roundish; petals 5, elliptic; stamens 10; style 1: fr. the size of an olive, edible. Mex. HBK. 6, t. 609.

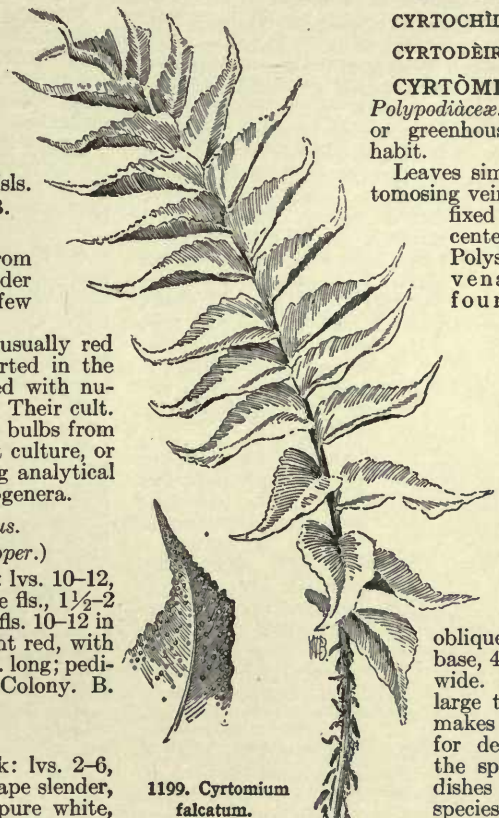
CYRTOCÈRAS: *Hoya.*

CYRTOCHÌLUM: *Oncidium.*

CYRTODÈIRA: *Episcia.*

CYRTÒMIUM (Greek, *a bow*). *Polypodiàceæ.* Asiatic half-hardy or greenhouse ferns of rigid habit.

Leaves simply pinnate, anastomosing veins and firm indusia fixed by the depressed center. It differs from Polystichum mainly in venation.—Three or four species known. Culture as for Polystichum, to which it is closely allied.



1199. Cyrtomium falcatum. (Leaf ×⅓)

A. *Margins of pinnæ entire or slightly undulate.*

falcàtum, J. Smith. Fig. 1199. Holly Fern. Pinnæ glossy, ovate, falcate; the lower rounded or obliquely truncate at the base, 4–6 in. long, 1–2 in. wide. Japan, India.—The large thick glossy foliage makes it an excellent fern for decorations. One of the species used in fern-dishes and one of the few species which can be made to thrive under ordinary house conditions. Plants from the temperate parts of Japan will do well out-of-doors in the northeastern states if given slight winter protection. For another illustration, see article on ferns. **C. Bútterfieldii,** Hort., is a form of this species differing in having the pinnæ deeply serrate. **C. Rochfordiànum,** Hort., recently advertised, is a variety of *C. falcatum* with fimbriated lfts. Superficially these two forms resemble *C. caryotideum* somewhat, but the species are entirely distinct. It has begun to replace the original form in the dealers' stocks.

Fórtunei, J. Smith. Pinnæ dull, lanceolate, opaque, 2–4 in. long, ½–1 in. wide. Japan.

AA. *Margins of pinnæ toothed or sometimes lobed.*

caryotídeum, J. Smith. Pinnæ larger, 5–7 in. long, 1½–2½ in. wide, often auricled on both sides at the base, sharply toothed. India.

R. C. Benedict.†

CYRTOPÈRA: *Eulophia.*

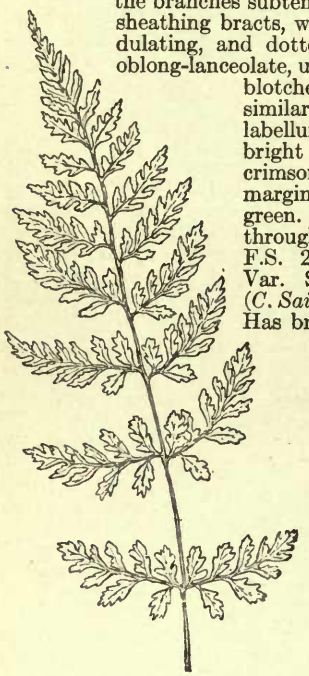
CYRTOPÒDIUM (Greek for *curved foot,* from shape of lip). *Orchidàceæ.* Epiphytes, grown in warmhouses.

Stems fusiform, bearing plicate lvs.: scapes radical, bearing numerous fls., pure yellow or spotted with crimson; sepals and petals equal, free; column semi-

terete; pollinia 2, caudicle short; gland ovate.—Species 3 or 4 in the tropics. They are large-growing plants, with large and showy fls. They need a rich, fibrous soil with manure. Grow in a warm or tropical house.

Ándersonii, R. Br. Sts. 5 ft. high: lvs. long, lanceolate, sheathing at the base: scape often 3 ft. high, branching, bearing many yellow fls.; sepals and petals broad, bright yellow, the labellum brighter, front lobe slightly concave. Specimens with over 100 fls. have been recorded. Trop. Amer. B.M. 1800.

punctàtum, Lindl. Habit as above: scape from 2–3 ft. high, branching about midway, dotted with dull purple, the branches subtended by membranaceous sheathing bracts, which are lanceolate, undulating, and dotted with crimson; sepals oblong-lanceolate, undulate, greenish yellow blotched with crimson; petals similar, spotted at the base; labellum ½in. long, fleshy, bright yellow, lateral lobes crimson, midlobe spotted and margined with crimson; column green. Extensively distributed through S. Amer. B.M. 3507. F.S. 22:2352. R.B. 30:158. Var. **Saintlegerianum,** Hort. (*C. Saintlegerianum,* Reich. f.). Has brighter markings on the bracts and fls. J.H. III. 50:91.



1200. Cystopteris fragilis. (×⅓)

Woödfordii, Sims (*Cyrtopèra Woödfordii,* Lindl.). Sts. fusiform: lvs. lanceolate: scape radical, bearing a many-fld. raceme; fls. greenish, with a purple labellum; sepals linear-lanceolate; petals oblong. Trinidad, Martinique. B.M. 1814.

C. pálmifrons, Reichb. f. & Warm. Sts. about 2 ft. tall, clothed with the lemon-yellow, purple-margined sheaths: lvs. 6–8 in. long: panicle 12–15 in. long, many-fld.; fls. about 1 in. across, lemon-colored, spotted rose-pink. Brazil. B.M. 7807.

OAKES AMES.
GEORGE V. NASH.†

CYRTOSPÉRMA (Greek, *curved seed*). *Aràceæ.* A handsome warmhouse tuberous foliage plant, with large, hastate red-veined leaves resembling an alocasia, but easily distinguished by its spiny stems.

Herbs with tubers or long rhizomes: lf.- and fl.-stalks often spiny or warty: lvs. hastate or sagittate; petioles long, sheathing at the base.—Cyrtosperma has 10–12 species, remarkably scattered in the tropics. Cult. presumably same as alocasia.

Jóhnstonii, N. E. Br. (*Alocàsia Jóhnstonii,* Hort.). Tuberous: petiole 2–2¾ ft. long, olive-green, spotted rose, covered with fleshy, spine-like warts: lvs. sagittate, depressed in the middle, 1½–2 ft. long, olive-green, with prominent and beautiful red veins above. I.H. 27:395. G.W. 15, p. 340.—Intro. from the Solomon Isls. as *Alocasia Johnstonii,* but when it flowered it became evident that the plant is a Cyrtosperma.

C. fèroz, Lind. & N. E. Br., is a second species of this genus, figured in I. H. 39:153, but not known to be in the American trade. It has narrow-sagittate lvs. on slender, very prickly petioles: spathe rather large, reflexed, greenish white. Borneo.

GEORGE V. NASH.†

CYRTÓSTACHYS (Greek for a *curved spike*). *Palmàceæ,* tribe *Arèceæ.* Three or four palms of the Malayan region of stately habit, but little known in this country.

Stem spineless, slender and tall, crowned by a graceful cluster of pinnately divided lvs.: lfts. narrowly lanceolate, a little oblique, at the apex somewhat bifid: spadix short-peduncled, the branches more or less compressed, alternate, sometimes pendulous; fls. monœcious, the two kinds in 1 spadix; stamens 6, rarely 12 or 15: fr. small, elongate-ovoid, tipped by the persistent stigma. For cult., see *Areca.* The small and young lvs. of *C. Renda* are effective but old plants are not very attractive and scarcely known. G.C. II. 24:362.

Rénda, Blume. Height 25–30 ft.: lfts. linear or ensiform, obtuse but somewhat obliquely bifid, delicate gray beneath, the petiolcs dark, brownish red: spadix 3–4 ft. long, the branches nearly alternate, about 18 in. long. Sumatra. Var. **Duvivierianum,** Pynært. Lf.-stalks brightly colored. Malay Archipelago.

Lákka, Becc. Petioles green, not over 4 in. long: lvs. broad, boldly arched, 3½–4½ ft. long, the lfts. nearly 18 in. long, 1½ in. wide, obliquely bifid at the apex, pale beneath. Borneo.

N. TAYLOR.

CYSTACÁNTHUS (Greek for *bladder Acanthus,* because the flowers are inflated). *Acanthàceæ.* Evergreen herbs of Burma and Cochin China, with showy, sessile fls. in the axils of bracts, the entire infl. more or less crowded into a terminal panicle or thyrse. Corolla-limb spreading, unequally 5-lobed, the lobes short-rotund; stamens 2; style filiform, the stigma 2-toothed: lvs. entire: caps. long and narrow, almost 4-sided, many-seeded. Doubtfully distinct from Phlogacanthus.—One species is cult. This is *C. túrgida,* Nichols. B.M. 6043 (as *Meninia turgida*). It comes from Cochin China: 2 ft. or less high, with prominently jointed sts. and opposite, elliptic-lanceolate lvs.: fls. white, yellow in the throat and pink-reticulated on the lobes. April. Cult. as other warmhouse acanthads. (See *Aphelandra* for example.) Prop. by cuttings of young wood. There are 4 or 5 species of Cystacanthus in farther India.

CYSTÓPTERIS (Greek, *bladder-fern*). *Polypodiàceæ.* Native ferns, with delicate foliage; deserve to be planted in the hardy fern garden.

Sori round, covered by a delicate indusium which is attached under one side and opens at the other, becoming hood-like in appearance and finally disappearing. The 5 species are native in the north temperate zone. Of easy cult. in shady, rich borders.

bulbífera, Bernh. Lvs. 8–24 in. long, dark green, 3–5 in. wide, widest at the base, long tapering, tripinnatifid, bearing on the under surface of the rachis a series of bulb-like bodies, which germinate and prop. new plants. Canada to N. C.—Thrives best on lime-bearing rocks. Exceptionally useful and attractive on damp rocky banks.

frágilis, Bernh. Fig. 1200. Lvs. clustered, gray-green, 4–8 in. long besides the slender stalks, tripinnatifid, widest above the base. Widely distributed over the world at all altitudes.

L. M. UNDERWOOD.

CÝTISUS (Greek name for a kind of clover). *Leguminòsæ.* BROOM. Woody subjects, chiefly grown for their profusely produced yellow or sometimes white or purple flowers.

Mostly low shrubs, rarely small trees: lvs. trifoliolate, sometimes unifoliolate, rather small, alternate, deciduous or persistent, sometimes few and minute and branches almost leafless: fls. papilionaceous, axillary or in terminal heads or racemes, yellow, white or purple; stamens 10, connate; style curved: pod flat, dehiscent, with few or many seeds; seeds with a callose appendage at the base.—About 50 species in S. and Cent. Eu., Canary Isls., N. Afr. and W. Asia. For a monograph of the genus see Briquet, Etude sur les Cytises des Alpes Maritimes (1894).

The brooms are ornamental free-flowering shrubs,

blooming most in early spring and summer. Nearly hardy North are *C. hirsutus, C. supinus, C. scoparius, C. nigricans, C. leucanthus,* while the evergreen species *C. canariensis, C. monspessulanus, C. filipes* are hardy only South. Most of the species are well adapted for borders of shrubberies, and thrive in almost any well-drained soil and in sunny position; they naturalize themselves often very quickly in dry, gravelly soil, where few other plants will grow; *C. scoparius* especially does so. The cytisus ought to be transplanted carefully and when young, as they do not bear transplanting well as older plants. Some dwarf species, like *C. Ardoinii, C. kewensis, C. emeriflorus, C. purpureus* and *C. leucanthus* are very handsome for rockeries. The evergreen *C. canariensis* and *C. racemosus* are much grown in the North as greenhouse shrubs, blooming profusely in early spring; also the white *C. multiflorus* and *C. filipes* make handsome pot-plants, and may be had in bloom in February with gentle forcing. For pot-plants, a light sandy loam with peat added forms a suitable compost. After flowering the plants should be cut back and repotted as soon as they start into new growth. After repotting, they are kept close and often syringed until they are established; then they ought to have plenty of air and only slight shade. When the new growth has been finished they may be put in the open air until frost is threatening. During the winter they should be kept in a cool greenhouse with plenty of light and carefully and moderately watered. From January they may be transferred gradually in a warmer house for forcing. Cuttings started in early spring, transplanted several times and then gradually hardened off, can be grown into flowering specimens for the following spring. Propagated by seeds sown in spring and by greenwood cuttings under glass; they are also sometimes increased by layers or by grafting. As stock *C. nigricans* is much used, or *Laburnum vulgare* for small standard trees; for plants grown in the greenhouse or South, *C. canariensis* is a good stock.

Of cytisus, the young growths root readily in December and January in the ordinary way. They should be shifted on as they grow. Good-sized plants can be produced if shifting and pinching is not neglected. By the following winter, the winter-propagated plants should be in 5-inch pots, in which size they are most useful. Keep very cool during winter, and withhold any forcing. They flower in March, or, if kept at a night temperature of 45°, as late as April. Syringe at all times to prevent red spider. To produce good-sized plants in one year, it is best to keep them plunged on a bench under the glass the entire summer, with little shade. Older plants can be plunged out-of-doors during July, August and September. (William Scott.)

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A. *Calyx tubular, much longer than wide: lvs. always 3-foliolate: branches terete.* (*Tubocytisus.*)

B. *Fls. in terminal heads with bracts at the base, yellow to white.*

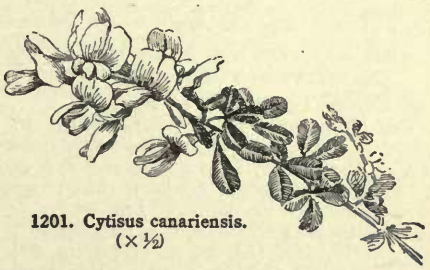
1. **supìnus,** Linn. (*C. capitàtus,* Scop.). Shrub to 3 ft., with erect, or sometimes decumbent, villous branches: lfts. obovate or oblong-obovate, sparingly appressed pubescent above, villous pubescent beneath, ¾–1 in. long: fls. yellow, brownish when fading, nearly 1 in. long; standard pubescent outside or nearly glabrous: pod villous, 1–1½ in. long. July, Aug. Cent. and S. Eu. L.B.C. 5:497. J.H.III. 31:161 (as *Genista*).

2. **leucánthus,** Waldst. & Kit. (*C. álbus,* Hacq.). Upright shrub, to 3 ft., with villous branches: lfts. 3, oblong-obovate, obtuse or acutish, appressed pubescent, sometimes glabrous above, ciliate, ⅓–¾in. long: fls. 3–6, yellowish white; calyx appressed-villous; standard pubescent outside: pod about 1 in. long, appressed pubescent. June, July. S. E. Eu. Var. **pállidus,** Schrad. (*C. pállidus,* Kerner). Fls. pale yellow. Var. **schipkaénsis,** Dipp. Low shrub, about 1 ft. high: fls. white. Bulgaria.—The oldest name for this species is *C. albus,* but as the same combination has been used by many writers for *C. multiflorus,* the name *C. leucanthus* is here used to avoid possible confusion.

BB. *Fls. axillary, distributed along the branches.*

C. *Color of fls. yellow.*

3. **hirsùtus,** Linn. (*C. elongàtus,* Hort., not Waldst. & Kit. *C. polýtrichus,* Bieb. *C. ruthénicus,* Hort., not Fisch.). Shrub, to 3 ft., with erect or procumbent, villous, terete branches: lfts. obovate or obovate-oblong, villous pubescent beneath, ½–¾in. long: fls.



1201. Cytisus canariensis. (×½)

2–3, short-petioled; calyx villous pubescent; standard glabrous on back: pod 1 in. long, villous. May, June. Cent. and S. Eu. Orient. B.M. 6819 (lfts. erroneously shown as serrate). L.B.C. 6:520 (as *C. falcatus*). B.R. 14:1191 (as *C. multiflorus*).

CC. *Color of fls. white or purple.*

4. **prolíferus,** Linn. Shrub, to 12 ft., with long and slender pubescent branches: lfts. oblanceolate, silky pubescent beneath, green and sparsely pubescent above, 1–1¾ in. long: fls. white, 3–8; pedicels rather long, tomentose; calyx tomentose; standard pubescent outside: pod densely tomentose-villous, 1½–2 in. long. May, June. Canary Isls. B.R. 2:121. L.B.C. 8:761. G. 32:291.—Recommended as a fodder plant for Calif.

5. **purpùreus,** Scop. Procumbent or erect shrub, to 2 ft., quite glabrous: lvs. rather long-petioled; lfts. oval or obovate, dark green above, ½–1 in. long: fls. 1–3, purple; calyx reddish: pod black, 1–1½ in. long. May, June. S. Austria, N. Italy. B.M. 1176. L.B.C. 9:892. G.C. III. 36:217; 50:163. Gn. 21, p. 421. J.H. III. 49:399. Var. **álbus,** Kirchn. Fls. white. G. 6:433. Var. **álbo-cárneus,** Kirchn. (var. *cárneus,* Hort.). Fls. light pink. Var. **atropurpùreus,** Dipp. Fls. dark purple. Var. **elongàtus,** André (var. *péndulus,* Dipp.), with slender, pendulous branches and purple fls., is sometimes grafted high on Laburnum. There exists an interesting graft hybrid of this species and *Laburnum vulgare,* for which see *Laburnum Adamii.*

AA. *Calyx campanulate, as long or only slightly longer than wide: branches grooved or angled.*

B. *Fls. axillary along the branches.*

C. *Lvs. simple: fls. yellow: procumbent shrubs.* (*Corothamnus.*)

6. **decúmbens,** Spach. Prostrate shrub, 4–8 in. high: branchlets 5-angled, glabrescent: lvs. oblong-obovate,

obtuse or acutish, pilose on both surfaces, ciliate, ⅓–¾in. long: fls. yellow, 1–3; calyx sparingly pilose; standard broadly obovate, ⅓in. broad: pod ½–¾in. long, pilose, with 3–4 seeds. May, June. S. Eu. B.M. 8230. L.B.C. 8:718.

CC. *Lvs. 3-foliolate (in Nos. 9 and 10 partly simple).*

D. *Plant a prostrate shrub: fls. yellow or yellowish white. (Trianthocytisus.)*

7. **Ardoìnii,** Fournier. Prostrate shrub, about 1 ft. high: branchlets grooved, pubescent: lvs. long-petioled; lfts. 3, linear-oblong, acute, covered with spreading hairs, ¼–⅓in. long: fls. golden yellow, 1–3, crowded at the end of short lateral branchlets, nearly ½in. long: pod very villous, ¾in. long. April, May. S. France. Moggridge, Flora of Mentone 58.—Very handsome, but tender.

8. **kewénsis,** Bean (*C. Ardoinii* × *C. multiflorus*). Prostrate shrub: lfts. 3, linear-oblong, clothed with short soft pubescence, ⅓–½in. long: fls. yellowish white, 1–3, along slender branches, ½in. long. May. Originated at Kew. Gn. 60, p. 348; 69, p. 282; 73, p. 228; 75, p. 273. G.M. 44:579; 51:355. G.W. 16, p. 610.—Like the preceding well adapted for rockeries or for forming a close covering to the ground.

DD. *Plant an upright shrub: foliage scarce.*

E. *Style slightly curved, shorter than keel: fls. white or yellowish white. (Spartothamnus.)*

9. **multiflòrus,** Sweet (*C. álbus,* Link, *C. Línkii,* Janka. *Spártium multiflòrum,* Ait.). Shrub, to 3 ft., with slender, erect, grooved branches pubescent at first: lvs. short-petioled, 1- to 3-foliolate; lfts. obovate-oblong to linear-oblong, ¼–½in. long, sparingly appressed-pubescent: fls. axillary, 1–3, white, ⅓–½in. long: pod appressed-pubescent, usually 2-seeded. May, June. Spain, N. Afr. Gn. 64, p. 251; 69, p. 92; 72, p. 276. G.M. 49:579. G.W. 5, p. 111. Var. **incarnàtus,** Sweet. Fls. white, slightly blushed. L.B.C. 11:1052 (as Spartium).

10. **præcox,** Bean (*C. multiflorus* × *C. purgans*). Shrub, to 10 ft., with slender upright or arching branches: branchlets grooved, pubescent at first: lfts. usually 1, sometimes 3, short-petioled, oblanceolate or linear-spatulate, silky pubescent, ⅓–¾in. long: fls. 1–2, yellowish white, very numerous along the slender branches, nearly ½in. long: pod appressed-pubescent, about 1 in. long, usually 2-seeded. May. Of garden origin. G.C. III. 29:41. Gn. 56, p. 37; 65, p. 438; 69, p. 318. G.M. 44:581; 52:183. M.D.G. 1903:265. G.W. 3, p. 221. Var. **álbus,** Smith. Dwarfer, more pendulous: fls. white. Gn. 75, p. 192. Var. **lùteus,** Smith. Dwarf: fls. yellow.—This hybrid is one of the most floriferous of all brooms.

11. **fílipes,** Webb (*Spartocýtisus filipes,* Webb). Shrub, with slender, angulate, thread-like branches: lvs. slender-petioled, 3-foliolate, nearly glabrous; lfts. linear-lanceolate: fls. axillary, 1–2, fragrant, pure white; wings much longer than the keel. Feb.–May. Teneriffa.—As *C. palmensis,* Hort., in the American trade.

EE. *Style longer than keel, spirally incurved: fls. bright yellow or partly crimson, rarely pale, large. (Sarothamnus.)*

12. **scopàrius,** Link (*Sarothámnus scopàrius,* Wimm. *Spártium scopàrium,* Linn.). Scotch Broom. Shrub, to 10 ft., with erect, slender branches: lvs. short-petioled, 1–3-foliolate; lfts. obovate or oblanceolate, sparingly appressed-pubescent, ¼–½in. long: fls. usually solitary, ¾in. long; calyx and pedicels nearly glabrous: pod brownish black, glabrous, villous only at the margin. May, June. Cent. and S. Eu. G. 25:169.—The tops are used for their sedative and diuretic properties. In Germany the fls. also are used medicinally. Var. **Andreànus,** Dipp. (*Genista Andreàna,* Puissant). Fls. yellow with dark crimson wings. R.H. 1886:373. Gt. 40:1342. R.B. 19:129. J.H. III. 32:462.—A beautiful and striking variety. Var. **álbus,** Loud. (var. *pállidus,* Hort. var. *ochroleùcus,* Zabel., var. *sulphùreus,* Arb. Kew). With yellowish white or pale yellow fls. Gn. 61, p. 299; 65, p. 375. G.M. 44:580. Var. **péndulus,** Arb. Kew (*C. grandiflòrus,* Hort., not DC. ! *C. cantábricus,* Hort., not Willd.). With slender pendulous branches. There is also a variety with double fls.—All the vars. are more tender than the type. The Scotch broom, *C. scoparius,* has become established in this country, as a naturalized plant, in waste places from Nova Scotia to Va.; and it is also reported from Vancouver Isl. It is also recommended by landscape gardeners for covering raw and broken places. Its yellow fls. and nearly bare sts. make a unique combination in the American landscape. Even when it kills to the ground in winter, it throws up its sts. again in the spring.

BB. *Fls. in terminal racemes, sometimes umbel-like, yellow: branches very leafy.*

C. *Foliage deciduous: branches terete: racemes very long and slender. (Phyllocytisus.)*

13. **nígricans,** Linn. (*Lembótropis nígricans,* Griseb.). Shrub, 2–4 ft., with erect, appressed-pubescent branches: lvs. long-petioled; lfts. obovate or oblong-obovate, glabrous above, appressed-pubescent beneath, ⅓–1 in. long: racemes very long and slender, 3–8 in. long. June, July. Germany, N. Italy, Hungary. L.B.C. 6:570. B.R. 10:802. B.M. 8479. R.B. 26:3. Var. **elongàtus,** Borkh. (var. *longespicàtus,* Hort.). Blooming again in fall at the top of the elongated fruiting racemes. R.H. 1891, p. 149 (as var. *Carlieri*).

CC. *Foliage persistent: branches grooved. (Teline.)*

D. *Lvs. distinctly petioled, obovate or obovate-oblong.*

E. *Racemes nearly capitate, 3–9-fld., at the end of short lateral branchlets.*

14. **monspessulànus,** Linn. (*C. cándicans,* DC. *Genista cándicans,* Linn.). Shrub, to 10 ft.: branches villous-pubescent when young: lvs. short-petioled, usually glabrous above, pubescent beneath; lfts. obovate or obovate-oblong, mucronulate, ⅓–¾in. long: racemes 3–9-fld., short, leafy at the base; fls. fragrant, bright yellow: pod rufous-villous. May, June. Medit. region, Canary Isls. W.D.B. 1:80 (not good).

EE. *Racemes longer, 6- to many-fld., secund, terminal and lateral.*

F. *Petioles ⅓in. long or shorter; lfts. usually obovate, less than ½in. long.*

15. **canariénsis,** Kuntze (*Genista canariénsis,* Linn.). Genista of florists. Fig. 1201. Much-branched shrub, to 6 ft., with villous-pubescent branches: lfts. cuneate, obovate or oblong-obovate, rounded at the apex, pubescent on both sides, ¼–½in. long: racemes usually many-fld., dense and rather short; fls. fragrant, bright yellow. May–July. Canary Isls. A.F. 6:802. R.B. 26:229. Var. **ramosíssimus,** Briquet (*C. ramosíssimus,* Poir. *C. Attleyànus,* Hort.). Lfts. very small, glabrous above: racemes short, but numerous. L.B.C. 13:1201. B.R. 3:217.

16. **racemòsus,** Nichols., not Marn. (*Genista formòsa,* Hort.). Fig. 1202. Shrub, to 6 ft.: branches pubescent: lvs. rather long-petioled; lfts. oblong-obovate, mucronulate, ⅓–¾in. long, silky pubescent on both sides: racemes elongated, many-fld., secund and rather loose, 2–4 in. long. Probably of garden origin and hybrid between *C. canariensis* and *C. maderensis* var. *magnifoliosus.* A. F. 6:802; 13:1136. F-E. 9:431.—Better florists' plant than the last; much grown as a pot-plant and forced for early spring and Easter. Var. **Everestiànus,** Rehd. Fls. of a deeper shade of yellow, very free-flowering. R.H. 1873:390.

FF. *Petioles ½in. long or longer; lfts. oblong-obovate, about ½in. long or longer.*

17. **maderénsis,** Masferrer (*Teline maderénsis,* Webb). Shrub or small tree, to 20 ft.: lvs. slender-petioled, crowded; lfts. oblong-obovate, silky pubescent on both sides, or smooth above, acute or acutish, ⅓–¾in. long: racemes 6–12-fld., rather short, fulvous or silky pubescent; fls. bright yellow, slightly fragrant: pod 5–7-seeded. May, June. Madera. Var. **magnifoliòsus,** Briquet (*Teline stenopétala,* Webb. *C. stenopétalus,* Christ. *C. racemòsus,* Marnock). Lvs. larger, ½–1½ in. long: racemes elongated, 10–20-fld. Madera. Marnock, Floricult. Mag. 2:19. B.R. 26:23 (as *Genista bracteolata*). Webb & Berthelot, Phytogr. Canar. 45.—Sometimes cult. as *C. splendens,* but less desirable as a greenhouse plant than the two preceding species.

DD. *Lvs. nearly sessile, linear or linear-lanceolate.*

18. **linifòlius,** Lam. Shrub, to 3 ft., with erect, appressed-silky tomentose branches: lfts. linear or linear-lanceolate, acute, revolute at the margin, nearly glabrous and shining above, silvery pubescent beneath, ½–1 in. long: racemes short and compact; fls. bright yellow: pod torulose. April–June. Spain, N. Afr., Canary Isls. B.M. 442.

C. Ádamii, Poir.=Laburnum Adamii.—*C. alpìnus,* Mill.=Laburnum alpinum.—*C. austrìacus,* Linn. Allied to C. supinus. Lfts. narrow, oblanceolate, silky pubescent on both sides: fls. yellow; calyx densely villous. S.E. Eu., Caucasus.—*C. Beánii,* Nichols. (C. Ardoinii×C. purgans). Low shrub with golden yellow fls., and narrow mostly simple lvs. G. 30:207.—*C. biflòrus,* L'Her. =C. ratisbonensis.—*C. cantábricus,* Willd. Allied to C. scoparius, but prostrate, with silky lvs. and large bright yellow fls.: pod villous. May. Spain.—*C. congéstus,* Ball (Teline congesta, Webb). Allied to C. linifolius. Densely villous-tomentose, small-lvd.: lvs. short-petioled: racemes short. Teneriffa.—*C. Dallimòrei,* Rolfe (C. multiflorus × C. scoparius var. Andreanus). Upright shrub with pale purple fls. G.C. III. 51:198. Gn. 74, p. 291. G.M. 55:11. B.M. 8482. There are forms with sulfur-yellow and one with orange-yellow fls.—*C. elongàto-purpùreus,* Hort.=C. versicolor.—*C. elongátus,* Waldst. & Kit.=C. ratisbonensis var. elongatus.—*C. emeriflòrus,* Reichb. (C. glabrescens, Sartor. not Schrank). Allied to C. Ardoini: Sparingly appressed-pubescent: branchlets angled: fls. yellow: pod glabrous. N. Italy. G.W. 15, p. 557.—*C. fràgrans,* Lam. Allied to C. filipes. Petioles short: lfts. densely pubescent: fls. fragrant, white. Spring. Teneriffa. J.H. III. 50:448.—*C. glabréscens,* Sartor., not Schrank=C. emeriflorus.—*C. handsworthénsis,* Paul & Sons. "A white-fld. plant suitable for the rockery."—*C. Hillebrandtii,* Briquet (Genista Hillebrandtii, Christ). A suffruticose species, with long, slender hairy sts. and trifoliate hairy lvs. Canary Isls.—*C. incarnàtus,* Hort. = C. versicolor.—*C. Labúrnum,* Linn.= Laburnum vulgare.—*C. nubígenus,* Link=C. fragrans.—*C. púrgans,* Willd. Shrub, to 3 ft., appressed-pubescent: branches striped: lvs. 1–3-foliolate, oblong or linear-lanceolate: fls. axillary, yellow, fragrant: pod glabrous. May–July. Spain, S. France.—*C. ramentàceus,* Sieb.=Petteria ramentacea.—*C. ratisbonénsis,* Schaeff. Allied to C. hirsutus. To 3 ft.: branches slender, appressed-pubescent: lfts. glabrous above, silky beneath: fls. 1–2, yellow; calyx with appressed, yellowish, silky hairs. April–June. M. Eu., W. Asia. Var. *elongàtus,* Koch. More erect: fls. larger, 3–5; calyx with somewhat spreading hairs. B.R. 4:308 (as C. biflorus).—*C. sessilifòlius,* Linn. Allied to C. nigricans. Quite glabrous: lvs. nearly sessile, with roundish-obovate lfts.: racemes short, 4–11-fld. May, June. S. Eu. B.M. 255.—*C. Spachiànus,* Kuntze (Genista Spachiana, Webb). Closely related to C. canariensis. Taller: lfts. obovate, acuminate: racemes somewhat elongated. Canary Isls. B.M. 4195.—*C. triflòrus,* L'Her. Similar to C. hirsutus. Fls. long-pedicelled, yellow; calyx-tube short, not tubular. April, May. S. Eu., N. Afr. Tender. F.C. 3:102.—*C. versícolor,* Dipp. (C. hirsutus×C. purpureus). Low shrub, with sparingly villous lvs.: fls. yellowish white and pale purple. Sometimes cult. as C. incarnatus.—*C. Wéldenii,* Vis.=Petteria ramentacea.

ALFRED REHDER.



1202. Cytisus racemosus.
(×½)

D

DABŒCIA (after its Irish name, St. Dabeoc's Heath). More commonly spelled Daboëcia, and sometimes Dabeocia. Syn., *Borétta*. *Ericàceæ*. Shrub cultivated for its purple flowers appearing in summer.

Low evergreen with alternate entire lvs. and drooping pedicelled fls. in long terminal racemes: corolla ovoid, contracted at the mouth and shortly 4-lobed, with recurved lobes; stamens 8, included: caps. 4-celled, dehiscent.—One species in W. Eu.

This is a very pretty heath-like plant, with purple or white flowers in elegant loose racemes, well adapted for rockeries or borders of evergreen shrubberies. Requires protection North during the winter, and thrives best in a peaty, sandy soil. Propagated by seeds treated like those of Erica, and by cuttings of half-ripened wood under glass.

cantábrica, Koch (*D. polifòlia,* Don. *Borétta cantábrica,* Kuntze. *Menzièsia polifòlia,* Juss.). IRISH HEATH. To 2 ft.: branchlets glandular pubescent: lvs. elliptic, the uppermost narrower, revolute at the margin, whitish tomentose beneath, shining and dark green above, ¼–½in. long: racemes many-fld.; corolla ⅓–½in. long, purple in the type. June–Oct. Ireland, W. France, N. Spain, Azores. Gn. 52:344; 71, p. 442; 76, p. 490. Gn. M. 3:336. R.B. 3:121. Gt. 47:1450. S.B.F.G. 2:276.—There are many varieties, as **álba,** Dipp., with white fls. (Gn. 22, p. 302); **bícolor,** Dipp. (var. *striàta,* Hort.), with white- and purple-striped fls.; **ròsea,** Rehd. (*Borétta cantábrica ròsea,* Koopmann), with pink fls.; **atropurpùrea,** Dipp., with dark purple fls.; **nàna,** Rehd. (*Menzièsia polifòlia nàna,* Lodd. *M. polifòlia pýgmæa,* Arb. Kew). Dwarf; with small and narrow lvs. L.B.C. 20:1907.

ALFRED REHDER.

DACRÝDIUM (Greek-made name, referring to the tear-like exudations). *Taxàceæ*. About 16 species of New Zeal., Austral., Malaya and Chile, being trees or shrubs with closely imbricated scale-like lvs. on old trees and linear or linear-subulate spreading lvs. on young trees and lower branches, none apparently in the trade in this country but more or less grown in European arboreta; allied to Podocarpus, from which it differs in having dimorphic lvs., peduncle of fr. dry or fleshy (fleshy and enlarged in Podocarpus), and the ovule becoming erect; and to Phyllocladus, which differs in having cladophylla and the true lvs. reduced to minute scales. Dacrydium is dicœcious or rarely monœcious, the fls. not in cone-like structures; male fls. solitary at tips of branchlets and with the uppermost lvs., females nearly or quite terminal under the lf.-like scales: seeds nut-like, ovoid, borne in a cup-like fleshy or thin aril.—These more or less spruce-like trees sometimes attain a height in their native regions of 75–100 ft. Some of the species may be expected to thrive in the southern areas.

DÁCTYLIS (Greek *daktulos,* a finger). *Gramíneæ*. A perennial tufted grass with flat blades, thin prominent ligules and sheaths closed nearly to the throat, grown for forage and one form for ornament.

Panicles glomerate; spikelets 2–5-fld., nearly sessile in dense 1-sided fascicles, these arranged in a panicle; lemmas hispid-ciliate on the keels, awn-tipped, compressed.—Species 1, north temperate regions of the Old World.

glomeràta, Linn. ORCHARD-GRASS. Fig. 1203. A coarse grass, 2–3 ft., forming large tussocks: panicle a few stiff branches, expanding in fl., afterwards appressed. Dept. Agric., Div. Agrost. 20:145.—Commonly cult. as a pasture and meadow grass and useful for lawns under trees. Var. **variegàta,** Hort., is a dwarf form of compact habit with foliage variegated silver and green; used for borders. Prop. by division; of easy cultivation.

A. S. HITCHCOCK.



1203. Orchard-grass.—Dactylis glomerata. (plant × ½)

DACTYLOCTÈNIUM (Greek, *daktulos,* finger, and *ktenion,* a little comb). *Gramíneæ*. FINGER-COMB GRASS. Annual grasses with spreading or creeping stems, one of which has been offered as an ornamental subject.

Spikelets several-fld., sessile, crowded in 2–6 digitate 1-sided, rather broad, flattened spikes; axis of spike extending beyond the spikelets as a naked point. Species 2, warm regions of the Old World. One species, **D. ægýptium,** Richt. (*D. ægyptìacum,* Willd. *Eleusìne ægýptica,* Desf. *Cynosùrus ægýptius,* Linn.), CROW-FOOT, is a common weed in Trop. Amer. The 3–5 short spikes are divaricate at the summit of the culms, about 2 in. long.—It has been offered as an ornamental grass for garden cult., but has little value. Mojave Indians of S. Calif. use the grain for food. In Afr. a decoction is prepared from the seeds for inflammation of the kidneys.

A. S. HITCHCOCK.

DÆDALACÁNTHUS (Greek words, signifying an *acanthad of curious structure*). *Acanthàceæ*. Tropical shrubs or sub-shrubs, with blue or rose-colored flowers, sometimes grown under glass and in the open in warm countries.

Leaves entire or scarcely dentate: fls. in bracted spikes which are sometimes paniculate, the bracts usually much exceeding the calyx; calyx deeply 5-lobed or -parted; corolla-tube elongated and slender, more or less curved, bearing an oblique spreading 5-lobed limb; perfect stamens 2, affixed in the throat, included; style slender and recurved: fr. an ovate or oblong caps., the seeds 4 or fewer.—Some 15 to 20 species in E. India and Malay Archipelago; by some authors the name Eranthemum is applied to these plants

and what are known as Eranthemum in this work then become Pseuderanthemum.

This genus contains some tender shrubs of rather difficult culture under glass, but great favorites in the tropics, particularly in India. *D. nervosus* is a popular winter- and spring-blooming shrub in southern Florida. It has blue flowers an inch across, five-lobed, and shaded purple at the mouth of the tube. For culture, see *Justicia*.

nervòsus, T. Anders. (*Eránthemum nervòsum,* R. Br. *E. pulchéllum,* Andr., and some dealers, while that of others is *E. bicolor,* and that of Roxburgh is *D. purpurascens*). Fig. 1204. Glabrous or very nearly so: lvs. ovate or elliptical, acuminate at both ends, somewhat crenate or entire: spikes axillary, opposite, overlapping and interrupted: bracts elliptical, acute, nervose: limb of the corolla as wide as the tube is long. India. B.M. 1358 (as *Justicia nervosa*). Gn. 51:352. G.C. II. 21:415.—A very pretty shrub for the warmhouse, 2–6 ft., its fls. being of a color that is not very common in winter-blooming plants. It is an easy subject to manage, requiring a light, rich soil, full sunlight and plenty of water. Cuttings of young growth root readily in a warmhouse.

macrophýllus, T. Anders. St. pubescent toward top: lvs. elliptic-lanceolate, ovate-acuminate, attenuate at base: spikes linear, somewhat interrupted: bracts elliptic, rather obtuse, nervose: fls. pale violet-blue. India. B.M. 6686.—Differs from *D. nervosus* in laxer infl., hairy lvs. which are scabrid-pubescent on the nerves beneath, and more pubescent shoots.

Wâttii, Bedd. (*D. párvus,* C. B. Clarke). Slender, 2 ft.: lvs. deep green with a light metallic shade, very broad-ovate: fls. 1 in. across, blue or violet-blue, the corolla-lobes broad-obovate and narrowed abruptly to a point, the white stigma protruding from the narrow throat. India. G.M. 44:645. G.C. III. 32:311. A.F. 17:382.—A good dwarf species with fls. in dense clusters, blooming in pots when 1 ft. high and flowering in Sept. Requires a warmhouse treatment; grows well in sandy loam; prop. by cuttings. L. H. B.†

DÆMÓNOROPS (probably means *God-like, of divine appearance*). *Palmàceæ,* tribe *Lepidocárpeæ.* Slender pinnate palms grown for their graceful foliage, but little known in Amer. outside of botanic gardens. Differs from Calamus (with which it is by some united) only in having the outer sheaths or spathes boat-shaped, deciduous, at first inclosing the inner sheaths; its more longly stalked fls. also separate it from Calamus.—About 85 species, all Trop. Asiatic. Only a very few are in cult. Treatment and general cultural conditions of Calamus. *D. Draco* produces some of the "dragon's blood" of commerce. See page 3568.

A. *Young lvs. green.*

B. *Sts. erect or climbing, sometimes both in one plant.*

calicárpus, Mart. (*Cálamus calicárpus,* Griff.). St. erect or climbing, 1 in. diam.: lvs. 6–8 ft. long, upper small with long flagella; lfts. numerous, 12–13 in. long, ⅛–½in. wide; petiole 1 ft., the base not gibbous or puckered: fr. about ¾in. diam., tawny. Malacca.

melanochætes, Blume. St. erect: lvs. pinnate, 10–12 ft. long in nature, the pinnæ long and narrow, dark green and drooping, furnished with many cirrhi, the petioles sharp-spined at the sheathing base: fr. yellow-green. Malaya.—Very decorative. A small form is var. **microcárpus.** Little known in U. S.

BB. *Sts. always climbing.*

Lewisiànus, Mart. (*Cálamus Lewisiànus,* Griff.). St. climbing, 1 in. diam.: petiole 1 ft., base much swollen, armed below with scattered, short, deflexed spines, and above with straight and hooked spines 1¼ in. long; lfts. 13–15 in. long, ¾–1 in. wide; sheath armed with solitary or seriate flat-back spines: fr. pale yellowish. Penang.

intermèdius, Mart. St. 15–20 ft., ¾in. diam.: lvs. long-petioled, 4–6 ft. long; lfts. opposite or scattered, 18–20 in. long, 1–1½ in. wide, linear-lanceolate, acuminate, margins and 3–5 costæ bristly above and below; rachis semi-cylindrical, sparingly armed; petiole 1 ft. long, with flattened spines. Malaya.



1204. Dædalacanthus nervosus. (×⅛)

AA. *Young lvs. brownish or straw-colored.*

palembánicus, Blume. St. erect: lvs. pinnate, broadly ovate, bright cinnamon-brown when young, and lfts. many, long, narrow, 1½ ft. long, about ½in. wide; petioles erect, with stout spines on the back, which are deflexed and not thickened at the base and are arranged singly or in series. Sumatra. F. 1873, p. 136.

periacánthus, Miq. Height 15 ft.: resembles *D. palembanicus,* but the young lvs. are nearly straw-colored, and the spines are placed in irregular rings. Sumatra.—A most graceful species.

D. plumòsus, Hort. Graceful plume-like lvs., with pinnæ 4 ft. or less long; petioles with rigid black spines with white bases. India. F. 1871, p. 39.—Not in cult. in N. Amer.

JARED G. SMITH.
N. TAYLOR.†

DAFFODIL: *Narcissus.* **Daffodil, Sea:** *Pancratium.*

DÁHLIA (named after Professor Andreas Dahl, a Swedish pupil of Linnæus, and author of "Observationes Botanicæ"). Syn. *Georgìna. Compósitæ.* Stout perennial herbs, sometimes somewhat woody, much grown out-of-doors for the rich and profuse autumn bloom. Plate XXXIV.

Tuberous-rooted (Fig. 1205): st. mostly erect, branching, glabrous or scabrous: lvs. opposite, 1–3-pinnate: heads long-peduncled, large, with yellow disk and rays in a single series and mostly in shades of red and purple and also in white (in cult.); ray-fls. neutral or pistillate, disk-fls. perfect and fertile; involucre double, the inner series of thin scales that are slightly united at base, the exterior series smaller and somewhat leafy;

receptacle plane, bearing chaffy scales; rays spreading, entire or minutely 3–5-dentate: fr. oblong or obovate, strongly compressed on the back, rounded at the apex, obscurely 2-toothed or entirely bald.—Probably 10 or 12 species, in the higher parts of Mex., some of them now much modified by cult., and the domesticated forms often difficult of systematic study. The nomenclature of the group is confused because systematists are not agreed on the rank to be given to forms that have received independent names. Voss (Blumengärtnerei) combines the three species of Cavanilles, *D. pinnata*, *D. coccinea*, and *D. rosea*, all under the name *D. pinnata*. His arrangement is as follows: *D. pinnata*, Cav.; var. *coccinea*, Voss (*D. coccinea*, Cav. *D. rosea*, Cav., in part. *D. frustranea*, DC. *D. crocea*, Poir. *D. bidentifolia* and *D. mexicana*, Hort.); var. *gracilis*, Voss (*D. gracilis*, Ort.); var. *Cervantesii*, Voss (*D. Cervantesii*, Lag.); var. *variabilis*, Voss (*D. variabilis*, Desf. *D. rosea*, Cav., in part. *D. sambucifolia*, Salisb. *D. superflua*, Ait. *D. purpurea*, Poir.). It seems to be well, however, to keep *D. rosea* and *D. coccinea* distinct, and perhaps also *D. pinnata;* and this is the method adopted for the present treatment. Of the three Cavanillesian names, *D. pinnata* has priority.

A. *Plant very tall, tree-like.*

B. *Fls. nodding, bell-shaped.*

imperiàlis, Roezl. Height 6–18 ft.: sts. usually many from one base, mostly unbranched, knotty, 4–6-angled, usually dying to the ground in winter in S. Calif.: lvs. 2–3-pinnately parted; lfts. ovate, narrowed at the base, acuminate, toothed, with a few short scattered soft hairs: fls. nodding, 4–7 in. across, white, more or less tinged with blood-red, especially at the base; rays sterile or pistillate, lanceolate, sharp-pointed, not 3-toothed at the apex. Gt. 1863:407; 56, p. 22. G.C. 1870:459; II. 12:437; III. 34:178. B.M. 5813. Gn. 12:352; 33, p. 527; 61, p. 40. R.H. 1872:170; 1911, pp. 62–3. A.G. 15:313. Mn. 8, p. 61.—As few conservatories can make room for so large a plant, it is common to graft this species on dwarf varieties of *D. rosea*. The inflated and pointed fl.-buds (3–4 in. long) are very characteristic. It is not known whether the original plant collected by Roezl was found in wild or cult. surroundings. This species and the next are mostly cult. under glass if cult. at the N., but this species thrives in the open in Cent. Calif.; the others are grown outdoors in summer, and the roots stored in winter. Hybrids are reported between this species and *D. excelsa*.

BB. *Fls. erect, not bell-shaped, but opening out flat.*

excélsa, Benth. (*D. arbòrea*, Regel). Height to 20 ft. or more: sts. several from same base, usually unbranched, glaucous, marked with horizontal rings made by the stem-clasping base of the petioles as the lower lvs. fall away, becoming woody for several feet in mild climates: lvs. bipinnate, as much as 2½ ft. long, 2 ft. wide; lfts. as many as 25, ovate, those of the upper lvs. often contracted at the base, acuminate, toothed, pale green beneath, with a few short scattered hairs or none: fls. 4½ in. across, dilute purple, crimson-pink. G.C. II. 19:80; III. 27:85.—This species was described from a cult. plant with 8 rays in a single row, but with considerably elongated disk-fls. It was almost an anemone-fld. type, and all the florets were sterile. *D. arborea* has never been sufficiently described as a botanical species, but plants have been cult. for many years under this name. Var. **anemonæflòra,** Hort. Disk of lilac or yellow tubular florets; rays flat.



1205. Clustered roots of the garden dahlia.

AA. *Plant medium, averaging 3 ft., commonly from 2–5 ft., rarely exceeding these extremes.*

B. *Lvs. once pinnate: st. not branching from the base: habit erect.*

C. *St. usually not glaucous: rays fertile.*

D. *Rays of the single fls. not recurved at the margins; of the double fls. never flat, but cupped.*

rôsea, Cav. (*D. variábilis*, Desf. *D. Bárkeriæ* and *D. Royleàna*, Knowl. & Westc.? *D. supérflua*, Ait.



1206. Dahlia rosea (or D. variabilis). (×⅛)

D. purpùrea, Poir. *D. nàna*, Andr. *D. crocàta*, Lag. *D. coronàta*, Hort.). Fig. 1206. Lvs. typically once pinnate, sometimes bipinnate; lfts. ovate, toothed, broader and coarser than in the other species. B.R. 55. B.M. 1885.—The original of practically all the old-fashioned dahlias, particularly the Single, Pompon, Show and Fancy types. It is therefore the parent of the vast majority of the horticultural varieties. This is a wonderfully variable species. Some plants are densely hairy, others scarcely at all. The lvs. are sometimes bipinnate in parts of plants or throughout an entire plant. In double forms the rays usually have abortive pistils. Many garden forms have glaucous sts. Some authors have doubted whether this species is distinct from *D. coccinea*, but the two types are very different in the garden, although there are intermediate forms in nature.

DD. *Rays of the single fls. with recurved margins; of the double fls. not cupped, but long, flat and pointed, and some at least with recurved margins.*

Juarézii, Hort. (*D. Yuarézii*, Hort.). Cactus Dahlia. Fig. 1207. Distinct in the bloom: heads bril-



XXXIV. Dahlia.—Jeanne Charmet, one of the most beautiful Decorative dahlias

liant scarlet; fls. irregular in length and overlapping, the rays narrow. The Cactus dahlias all originated from one plant, which was flowered in Eu. for the first time in 1864, and first pictured in G.C. II. 12:433 (1879). F.M. 1879:383. Gn. 18, p. 589; 19:742; 50, p. 236. G.Z. 26:49.

cc. *St. glaucous: rays not fertile.*

coccínea, Cav. (*D. bidentifòlia,* Salisb. *D. Cervántesii,* Lag. *D. Cròcea,* Poir.). Fig. 1208, redrawn from B.M. 762 (1804). Always more slender than *D. rosea,* with narrower lfts., and in the wild, at least, dwarfer than that species. The color range is much smaller, and does not include white or any shade of purple or crimson. The colors vary from scarlet, through orange to yellow. There are no double forms, and it has been said that this species will not hybridize with *D. rosea.* The named varieties pictured in I.H. 31:515 and 533 (1881), which are emphatically declared to be varieties of *D. coccinea,* are probably garden forms of *D. rosea.* The only characters that certainly distinguish *D. coccinea* from *D. rosea* are the glaucous sts. and infertile rays of the former, but these characters break down in garden forms. B.M. 762. Gn. 19:154. G.C. II. 12:525.

bb. *Lvs. twice pinnate: sts. branched from the base: habit spreading.*

Mérckii, Lehm. (*D. glabràta,* Lindl.). Fig. 1209, redrawn from B.M. 3878 (1841). Height 2–3 ft.: roots much more slender than those of *D. rosea:* st. and lvs. wholly devoid of hairs; lvs. bipinnate: floral bracts linear; fls. typically lilac; rays pistillate; outer involucral bracts linear. B.R. 26:29 (1840). Gn. 19:154 (1881).—This is a very distinct garden dahlia, and is worth growing merely as a foliage plant. The fine-cut character of the foliage makes it more attractive than the coarse foliage of most of the varieties of *D. rosea.* The plants are much dwarfer and wider spreading than most florists' dahlias, and show no st. while growing. The branched flowering sts. are remarkably long, slender and wiry, often rising 2–3 ft. above the foliage. The rays are very short and often roundish, with a short sharp point instead of 3 minute teeth. There are no red, yellow or white forms in nature. The roots of this and *D. coccinea,* being slenderer than those of *D. rosea,* must be preserved with greater care in winter.

D. grácilis, Ort. Lvs. bipinnate and ternately divided, glabrous, the lfts. small, ovate and coarsely toothed: fls. brilliant orange-scarlet; outer bracts of involucre almost orbicular: 4–5 ft., making a dense bush with very slender growths, bearing heads 2½–3 in. across. Apparently not in general cult.—*D. pinnàta,* Cav. Plant scarcely 3 ft. high, glabrous: lvs. 5-foliolate; lfts. ovate, crenate-dentate, glaucous beneath, sessile; rachis winged: fls. large, solitary; female corolla large, blue-red, exterior involucre with 6-7 bracts, ovate, narrowed toward the base, spreading and reflexed-incurved, the interior with coriaceous lobes. The plate of Cavanilles shows semi-double fls., i.e. with several rows of rays, with the rays incurved at the margin and becoming at the base nearly tubular.—*D. Zimapánii,* Roezl, is by some retained in Dahlia and by others referred to Bidens; in this work it is described under Cosmos (C. diversifolius).

WILHELM MILLER.
L. H. B.†

Types and varieties of the dahlia.

Practically all of the named varieties of dahlias have come from one immensely variable species, usually known as *D. variabilis,* but more properly as *D. rosea.* For garden purposes, however, a second form of great importance, *D. Juarezii,* the parent of the Cactus forms, must be kept distinct. There are other species cultivated to a slight extent. It is curious that these showy plants should be closely related to a common weed, the beggar's tick, of the genus Bidens; but other species of Dahlia have leaves whose forms pass gradually into those of Bidens. Other close allies are Cosmos and Coreopsis. Cosmos flowers are some shade of purple, rarely white in wild nature, and only one species has yellow flowers; Coreopsis has yellow flowers only; Bidens, yellow or white; and none of these genera has produced double-flowered forms of the first importance. Dahlia has all these colors and more, being far richer in bright reds, and lacking only sky-blue and its closely related hues, which are seen to perfection in the China asters.

Although dahlias are popular plants, especially in old gardens, they are destined to still greater popularity from the new "Cactus," "Decorative," "Peony-flowered," and "Collarette" types. There exists a prejudice against dahlias in many localities in which these new types have never been seen. This prejudice is part of a reaction against formal and artificial flowers in general. The old-time dahlias were round hard and stiff like a ball. The new-time dahlias are flatter, and tend toward loose, free, fluffy chrysanthemum-like forms. The dahlia has now become immensely variable.

Of the important and very variable florists' flowers, the dahlia was one of the latest to come into cultivation. The first break of considerable importance in the wild type occurred about 1814. Up to that time there were perhaps a dozen well-marked colors in good single-flowered varieties. Dahlias had been cultivated in Europe since 1789, and it is a curious fact that they showed signs of doubling the very first year of their European residence; but it was not until twenty-five years later that a marked gain in doubling was made. The dahlia seemed to be undeveloped until 1814, when the era of doubling began. Before another twenty-five years had passed, the dahlia had sprung into the front ranks of garden plants. In 1826 there were already sixty varieties cultivated by the Royal Horticultural Society. In 1841, one English dealer had over 1,200 varieties. Today it is not uncommon for the leading tradesmen to keep 500 to 1,000 distinct varieties. In the absence of good records, it is conjectured that over 3,000 different names of varieties have been published in the catalogues. Most of the varieties are the Show and Fancy types, which are as spherical and regular as possible, and differ only in color. At first the distinction between the two types



1207. The original Cactus dahlia.—D. Jaurezii.
Reduced from the Gardeners' Chronicle, where it was first pictured

seems to have been the same as that between "self-colored" and "variegated" flowers in general. Lately, for purposes of exhibition in prize competitions, the following arbitrary distinction has been adopted: A Show dahlia (Fig. 1210) is often of one color; but if the edges of the rays are darker than the ground-color, the variety may be exhibited in the Show section. A Fancy dahlia (Fig. 1211) always has two or more colors, and if the rays are striped or if the edges are lighter than the ground-color, the variety must be exhibited in the Fancy section. The two types reached full perfection certainly by 1840, and after that date the improvements were mostly in matters of secondary importance. Most of the longest-lived varieties belong to the Show and Fancy type. These types held full popularity until about 1879, when the first Cactus dahlia appeared in England with a promise of new and freer forms. This form is the one which is perhaps farthest removed from nature, and it is probably so highly esteemed largely because the most work has been spent on it.



1208. Dahlia coccinea.
Redrawn from the Botanical Magazine for 1804.

A reaction against formalism in all departments of life and thought set in about the time of the American Civil War. It was in the sixties that the Japanese chrysanthemums did much to emancipate the floral world. With dahlias the reaction came much later and has proceeded more slowly. The first Cactus dahlia was so called because of its resemblance in form, but chiefly in color, to the brilliant crimson-flowered *Cereus speciosissimus*, a well-known garden plant (which is known in the present work as *Heliocerus speciosus*). The name is now highly inappropriate because the color range of the pure Cactus type has been extended to include all of the important well-defined colors of which the dahlia seems capable. The original Cactus dahlia was named *Dahlia Juarezii*, after President Juarez, the "Washington of Mexico." It was pictured for the first time in the Gardeners' Chronicle for 1879, and this interesting picture is here reproduced in a reduced size in Fig. 1207. The type is still cultivated under the same name and in all essentials seems to be unchanged. Forms of the Cactus dahlia are shown in Figs. 1212, 1213.

The origin of the Cactus type, as of all the other types of dahlias, is uncertain, and our efforts to secure full and definite information upon some of the most interesting points may perhaps always be baffled. A Dutch dealer secured a root from Mexico that produced one plant which is the parent of all the Cactus forms. It is not known whether the seed which may have produced the original root came from a wild or a cultivated flower. It has been said that seedlings of *D. Juarezii* have produced in cultivation forms approaching the Show type of *D. rosea*. The reverse process is also said to have taken place, but full, authoritative and convincing statements are wanting. In the garden, *D. Juarezii* is exceedingly distinct from the florists' forms of *D. rosea*. It is usually a slenderer, taller and longer-jointed plant, with much handsomer and more delicate foliage, the leaves being narrower than in the coarse and almost ugly foliage of the old forms. It has another peculiarity of growth, which is still one of the most serious defects in the true Cactus type: the plants tend to hide some of the flowers beneath their foliage. This comes about in a curious way. At a node between two young leaves there commonly appear, at about the same time three new growths; the middle one develops into a flower with a naked stalk only 2 or 3 inches long, while the side shoots quickly overtop it and repeat the same threefold arrangement. The other most serious objection to the true Cactus type is that it does not stand shipment well and does not last so long as a cut-flower as the Show dahlias.

The Decorative or Cactus Hybrid types are numerous, and their popularity is more modern. They have been largely seedlings from show flowers. Their rays are rarely, if ever, recurved at the margins. All the other types of dahlias are well defined, and a single picture of each one will represent its type with sufficient exactness. No one picture, however, can give any conception of the great variety of forms included in this more or less open horticultural section. The name Cactus Hybrid means practically "miscellaneous," and is analogous to the "Japanese" section of chrysanthemums. It is on this section and the pure Cactus type that the greatest hopes for the future of the dahlia are based.

Dahlias considered to be of true Decorative type are those possessing broad flat and nearly straight petals, arranged somewhat irregularly; but the flowers are not spherical in shape like the Show dahlia, but are inclined to be flat and massive, and are always full to the center. Dahlias of this character score a greater number of points at exhibitions.

The Colossal dahlia is the basis of much discussion, especially at exhibitions, the cause of debate being that these dahlias are in reality not classified; that is, the same variety is exhibited in one display as a Show dahlia, and in the next as a Decorative dahlia; but in reality there should be a Colossal class for this type of dahlia. This type, if it may be so called, has large cupped but not quilled rays or petals; the flowers are 5 inches and over in diameter, and spherical in shape; they therefore partake of both types, but are sufficiently different to spoil the harmony, when exhibited in either the Show or Decorative class. "Le Colosse" is the first of this type of dahlia, and hybridization has given a large number of seedlings, which are almost identical in form, shape, and size, the most prominent being at present American Beauty, Giant Purple or Royal Purple, J. K. Alexander, Surpasse Colosse, and Janne (Yellow) Colosse.

The Pompon type is a small form of the Show and Fancy types. It has the same colors and the same form, but the flowers are smaller and more abundant. As a rule, the smaller the flowers the prettier and more individual they are. The larger they are, the more they suffer by comparison with the Show type. Perhaps their greatest point is their productiveness. When profusion is the main idea, not great size and quality, the Pompons are the favorite type of dahlia for cut-flowers.

The Single dahlias may be freely produced, but they are not so lasting for cut-flowers. The Single type has had many ups and downs. In the reaction against formalism, it came to the front about 1881, and for several years thereafter several hundred forms were kept distinct and they were made the chief feature of the European shows. When the dahlia first came into cultivation, its rays were relatively long, slender, acuminate, notched at the end, and with such wide spaces between the tips of the rays as to give the flower a stellate appearance. In the course of the evolution of the single type, the gardeners retained the most regular and symmetrical forms. Single dahlias with always and only eight rays were preserved. The rays of dahlias became broader and rounder, as in Fig. 1214, until finally in pedigree varieties the vacant spaces were closed up. The same mental ideals have produced the rose-petaled geraniums and the shouldered tulips. In a high-bred single dahlia there are no minute teeth or notches at the tips of the rays.



1209. Dahlia Merckii.
Redrawn from the Botanical Magazine, for 1841.

Most of the single dahlias of high pedigree have rays of uniform coloration with no secondary color at the base, but a few have a distinct ring of color at the base, often called an "eye or crown," which is sometimes yellow and rarely red or some other color. Usually the rays of a single dahlia are spread out horizontally, sometimes they bend back, and rarely they bend inwards and form a cup-shaped flower. These three forms can doubtless be separated and fixed during those periods when the interest in the Single type warrants it. Semi-double forms are frequent (Fig. 1215).

Single dahlias are likely to lose some of their rays after a day or two in a vase. In cutting them it is well to choose the younger flowers. A vigorous shake often makes the older ones drop their rays. It is an easy matter to keep the seeds from forming, simply by removing the flowers as they mature, and by so doing save the strength of the plant for the production of flowers.

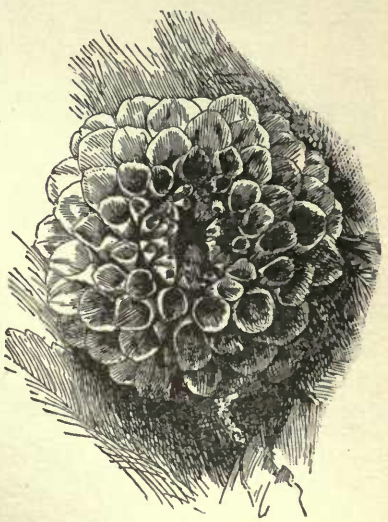
There are three other dahlia types of minor importance,—the Single Cactus, the Pompon Cactus and Tom Thumb. The Single Cactus type differs from the common Single type in having rays with recurved margins, which give a free and spirited appearance to the flowers. Instead of spreading out horizontally, the rays often curve inward, forming a cup-shaped flower. This type originated with E. J. Lowe, Chepstow, England, was developed by Dobbie & Co. about 1891, and was first disseminated in 1894. The Single Cactus dahlias are very interesting and pretty. The Tom Thumb type is a miniature race of round-rayed single dahlias, which grow from 12 to 18 inches high, and are used for bedding. The type originated in England with T. W. Girdlestone, and was developed and introduced by Cheal & Sons.

The "green" dahlia (*Dahlia viridiflora*, Hort.) is an interesting abnormal form in which the rays are partially or wholly suppressed, and the chief feature of interest is a confused mass of green, not resembling petals at all, but evidently a multiplication of the outer involucral scales, which, in the dahlia, are green, leafy bracts. The "green" dahlia is not unhealthy; it is as strong and vigorous as any of the other forms, but very unstable and variable, producing flowers of solid green color, others of green with small cup-shaped crimson-scarlet petals intermingled, and others of solid crimson-scarlet color, and all on the same plant. This freak was pictured as long ago as 1845 in G.C., p. 626; and again in G.C. III. 30: 294.

Another interesting variation which hardly ranks in present importance with the eleven types contrasted below is the laciniated form, which makes a very pretty though rather formal effect. Examples are Germania Nova, Mrs. A. W. Tait and its yellow variety among large double forms, and White Aster among the Pompons. In these cases, the notches at the tips of the rays, instead of being minute and inconspicuous, are deepened so much that they give the laciniated effect. At present this form is available in a very narrow range of colors. It is not probable that it will be an important factor in producing chrysanthemum-like forms.

Another form which baffles description, but is nevertheless very distinct, is that of Grand Duke Alexis. It is nearer the Show type than any other, but is perhaps best classed with the Cactus Hybrid section, simply because it seems advisable to keep the Show type the most sharply defined of all. It is a very flat flower, and the rays are remarkably folded, leaving a round hole at the top of each one. Up to 1909 the variety of colors of the type of Grand Duke Alexis has been increased, including the varieties Dreer White, Mrs. Roosevelt, Purple Duke, Pythias, W. W. Rawson, and Yellow Duke.

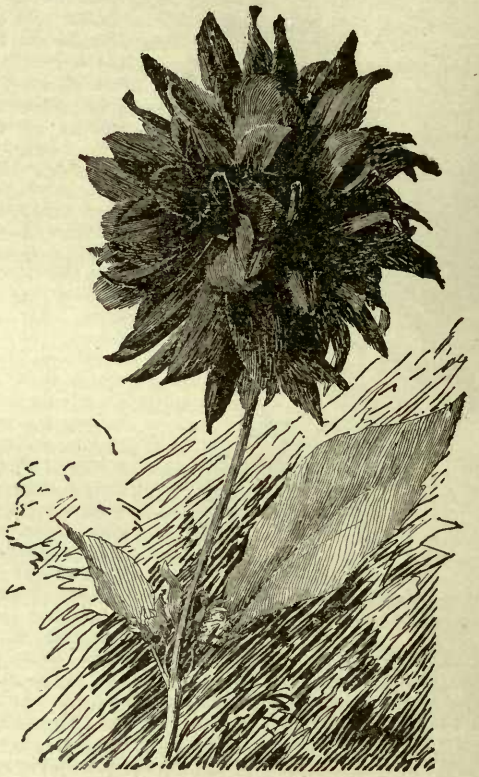
About midway between Grand Duke Alexis and the Show or cupped type is an interesting form, the "quilled" dahlia, a name which is perhaps necessary, though unfortunate. In A. D. Livoni the rays are rather tightly folded for about two-thirds of their length, leaving a round hole at the tip as in Grand Duke Alexis, but giving a peculiar whorled effect, which plainly shows the spiral arrangement of the successive tiers of rays. Among Pompons, Blumenfalter is an example of this rosette-like or quilled form, and many colors are procurable. However, the word "quilled" usually suggests a long tube with a flared opening, whereas in the form described above the margins of the ray are merely rolled tightly together, but not grown together into a thin seamless tube. Perhaps the most important variation that has not yet appeared in the dahlia is the wonderful elongation of the disk florets



1210. A Show dahlia.

into long, thin, variously colored tubes which have produced such charming effects in the China aster and have culminated in the marvelous grace of many chrysanthemums. The dahlia may not be denied such possibilities, for in G.C. III. 20:339 (1896) a new dahlia was described in which the quills are really tubes for two-thirds of their length.

The Collarette dahlia is a very novel and distinct type. The flowers are single, with an additional row of short petals around the disk, which forms a frill or collar usually of a different color from the remainder of the flower. The same method obtained in the development of the Collarette dahlia as in the development of the Single dahlia. Varieties having only eight rays or petals, with the additional collar, and presenting a symmetrical and concentrated impression, were preserved. The collar consists principally of three or four smaller and more gracefully curved rays, produced at the disk, at the center of each of the eight larger rays or petals, and taking the same direction as the large rays, thus showing distinctly the golden yellow center, so pronounced in the Single dahlia. The first Collarette dahlia was President Viger, and was originated at Parc de la Tete d'Or, or in the gardens of the City of Lyons, France, then under the supervision of Professor Gerard, who was succeeded by M. Chabannes. President Viger was first shown in 1900 at the Universal Exposition, and offered for sale in 1901 by Rivorie Pere & Fils of Lyon. In 1902 appeared the variety Joseph Goujon also obtained at the Parc de la Tete d'Or, Lyon; then in 1903 Rivorie offered Etendard de Lyon and Gallia, which figured with honor for that firm. During the next ten years, from 1903 until 1913, all the known varieties of the Collarette dahlia were developed by Rivorie Pere & Fils, and appeared in the following order: 1903, Etendard de Lyon, and Gallia; 1904, Mme. LePage Viger, La Fusee, Duchesse J. Melsi D'Ehril-Barbo, Prince Galitzine, Comte Cheremeteff, and Maurice Rivoire; 1905, Exposition de Lyon Orphee, and Prince de Venosa; 1906, Merveille de Lyon, Mme. Georges Bernard, Comte Nodler, Deuil de Brazza, Princesse Olga Altieri, Corbeille de Feu, and Signorina Rosa Esengrini; 1907, Comtesse Dugon, Ami Cachat, and Volcan; 1908, Jupiter, Pluton, Pan, Etoile de Moidiere, and Mme. Chamrion; 1909, M. Mery de Montigny;



1212. A Cactus dahlia. (×⅛)

1910, Abbe Hugonnard, Comte de Vezet, Mme. Pile, Souvenir de Bel-Accueil, and Vicomtesse des Mons; 1911, General de Sonis, and Deuil du Docteur Ogier; 1912, Cocarde Espagnole, Etincelant, and Stella; 1913, Geant de Lyon, Maroc, and Etoile de Monplaisir. In 1912, J. K. Alexander, a dahlia specialist in East Bridgewater, Massachusetts, succeeded in developing the first Collarette dahlia of American origin, the variety Champion; this added the red and yellow coloring to the type. Previous to 1912, three other foreign varieties, Directeur Rene Gerard, Mme. E. Poirier, and Souv. de Chabanne, found their way to America, and were offered the following year in the leading seedsmen's catalogues. The year 1913 gave a collection of nearly fifty distinct named varieties of the Collarette dahlia, including every known color in the dahlia world.

The Holland Peony-flowered dahlia is now the most popular dahlia, possessing an entirely original form, resembling the semi-double peonies; the flowers are broad, flat, somewhat irregular in form, and are produced with remarkable freedom on long stems. This type of dahlia has proved the most satisfactory for garden purposes, the plants being covered with flowers the entire season. The origin of the Holland Peony-flowered dahlia, like all other types, is uncertain, and all efforts to secure full and definite information are unfruitful. Originally the Holland Peony-flowered dahlia was grown for some years in Germany, in a mixture known as "Half-double Giant Dahlias." A Dutch grower, H. Hornsveld of Baarn, Holland, was



1211. A Fancy dahlia of the Pompon type. (×⅛)

the first to note their possibilities, and selected from these "mixed dahlias" the best varieties, from which he propagated; then he drew the attention of the public to his new varieties, which he named and offered for sale. Other growers in Holland followed his example with great success. The Holland Peony-flowered dahlia was imported to America in 1908, and simultaneously appeared in the catalogues of the leading growers and seedmen. The number increased rapidly, and in 1910 appeared new varieties of American origin, notably the new varieties originated by the W. W. Rawson Co., of Boston, Massachusetts. The most prominent varieties are the following: Andrew Carnegie (1908), Bertha Von Suttner (1908), Caesar (1911), Cecilia (1911), Dr. K. W. van Gorkum (1906), Dr. Peary (1911), Duke Henry (1906), Geisha (1908), Germania (1906), Glory of Baarn (1906), Glory of Groenekan (1907), H. Hornsveld (1907), Hugo de Vries (1907), H. J. Lovink (1911), Kaiscrin Augusta Victoria (1907), King Edward (1909), King Leopold (1906), La Rainte (1907), Mannheim (1908), Merveille (1907), Miss Gladys Dawson (1908), Paul Kruger (1906), P. W. Jansen (1907), Queen Alexandra (1909), Queen Emma (1906), Queen Wilhelmina (1906), Snow Queen (1907), and Sherlock Holmes (1912).



1213. Single cactus dahlia. (×⅓)

The fragrant dahlia is the pride of the true Peony-flowered type, possessing a pleasing and agreeable odor, so long desired. The fragrant dahlia was first detected by J. Herbert Alexander, in the year 1912, on the trial-grounds of J. K. Alexander of East Bridgewater, Massachusetts; hybridization and propagation was begun immediately with the new variety, and in 1913 a collection of five fragrant dahlias appeared in Alexander's catalogue.

The main types of dahlias may perhaps be distinguished more clearly by the following scheme:

A. *Plants very dwarf.*

1. The Tom Thumb Types.

AA. *Plants not very dwarf.*

B. *Fls. single.*

C. *Rays flat, not recurved at the margins.*

2. The Single Type. Fig. 1214.

CC. *Rays with recurved margins.*

3. The Single Cactus Type. Fig. 1213.

BB. *Fls. double.*

C. *Size of fls. small, 1–2 in. across.*

D. *Rays cupped.*

4. The Pompon Type. Fig. 1211. Also called "Bouquet" and "Lilliputian."

DD. *Rays flat.*

5. The Pompon Cactus Type.

CC. *Size of fls. large, 3–5 in. across, averaging 4 in.*

D. *Rays cupped.*

E. *Colors single, or the edges darker than the ground-color.*

6. The Show Type. Fig. 1210.

EE. *Colors 2 or more, striped, or with edges lighter than the ground-color.*

7. The Fancy Type.

DD. *Rays not cupped, but long and flat, or with recurved margins.*

8. The Cactus Type. Figs. 1207, 1212.

DDD. *Rays various in form.*

9. The Decorative Type.

10. The Collarette Type.

11. The Peony-flowered Type; including the fragrant dahlia. Fig. 1215.

Useful dahlias for various purposes, as they exist in North America in 1913:

Cactus dahlias, for cut-flower purposes.—Alexander, Alight, Alfred Vasey, Clara G. Stedwick, Countess of Lonsdale, Dainty, Effective, Eureka, Floradora, Forbes Robertson, Flame, Glory of Wilts, Golden Gem, Gazelle, Gabriel, Gen. Buller, Helene, Henri Cayenx Hereward, Ivernia, Jeannette, J. H. Jackson, J. Weir Fife, Killarney, Lightship Lady Fair, Lady Colin Campbell, Lord of the Manor, Mary Service, Mrs. DeLuca, Mrs. H. L. Brouson, Mrs. Winchester, Mrs. Mortimer, Mrs. Geo. Caselton, Mme. Henri Cayeux, Mrs. MacMullan, Reine Cayeux, Rosa Starr, Reliable, Stella, Sirus, Sandy, Thomas Wilson, and Yonne Cayeux.

Cactus dahlias for exhibition purposes.—Amazon, Clincher, Diavolo, Master Carl, Mercury, Mrs. S. T. Wright, Rev. Dr. Baker, Rev. T. W. Jamieson, Royal Scarlet, Schneewitchen, Snowstorm, T. G. Baker, Wellington, Whirlwind, White Swan, Wm. Marshall, W. B. Childs.

Decorative dahlias for cut-flower purposes.—Delice, Himmlische, Jack Rose, Jeanne Charmet, John R. Baldwin, Minos, Maid of Kent, Mme. A. Lumiere, Mme. Victor Vassier, Mme. Van den Dael, Perle de la Tete D'or, Reggie, Souv. de Gustave Douzon, Wilhelm Miller.

Decorative dahlias for exhibition purposes.—American Beauty, A. E. Johnson, Blue Oban, Gigantea, Grand Duke Alexis, Gettysburg, Le Grand Manito, Le Mont Blanc, Les Alliees, Mme. Helene Charvet, Mme. Augusta Lumiere, Mademoiselle Galy Miquel, Madame Devinat, Mme. Marze, Morocco, Peerless, Perle de Ocean, Papa Charmet, Ville de Lyon, Yellow Colosse.

Peony-flowered dahlias for cut-flower purposes.—Admiration, Bertha Von Suttner, Goddess of Fame, Geisha, Marie Studholme, Mrs. A. Platt, Mrs. Jacques Futrelle, Queen Wilhelmina, and Sunrise.

Peony-flowered dahlias for exhibition purposes.—Hampton Court, King Leopold, Priscilla, Snow Queen, Solfatara, Duke Henry, and Hollandia.

Collarette dahlias for massing.—Exposition de Lyon, Maurice Rivoire, and President Viger.

Show dahlias for exhibition purposes.—Acquisition, Alice Emily, Acme of Perfection, Brown Bess, Dreer's White, Dr. Keynes, David Johnson, Emperor, Ivanhoe, Harrison Weir, Mrs. Susan Wilson, Mme. Heine Furtado, Mme. Marika Anagnostaki, Mme. Alfred Mareau, Merlin, Muriel, Norma, Nugget, Queen of Autumn, Rosebud, Stradella, Standard, W. P. Laird, and Wm. Dodds.

Among the Show dahlias that are the best for flowering are: A. D. Livoni, Arabella, Ansonia, Dr. J. P. Kirkland or Cuban Giant, Dorothy Peacock, Imperial, Miss Fox, Perfection, Storm King, and White Queen.

Show dahlia for bedding purposes.—White Bedder.

Fancy dahlias of merit.—Chorister, Chas. Turner, Dazzler, Dorothy, Distinction, Duchess of Albany, English Dandy, Erio Fisher, Gloire de Guiscard, Frank Smith, Frederick Smith, General Grant, Gold Medal, Goldsmith, Geo. Barnes, Hercules, Les Amours de Madame, Lucy Faucett, Mme. Lily Large, Polly Sandall, Rebecca, Rev. J. B. McCamm, S. Mortimer, Sunset, and Wizard.

Pompon dahlias for borders or hedges.—Achilles, Crusoe, Darkness, Fascination, Mabel, Pure Love, Rosalie, Red Indian, Snow Clad, Vivid, and Winifred.

Pompon dahlias for exhibition purposes.—Amber Queen, Ideal, Harry, Little Mary, Rosebud, Shalii, and Spy.

Pompon dahlias for flowering purposes.—Klein Domitea, Darkest of All, Fairy Queen, Star of the East, and Spy.



1214. A broad-rayed single dahlia. (×⅓)

Societies and shows.—The dahlia is one of about a dozen

genera of plants whose horticultural value has been attested by permanently successful special societies. There are national dahlia societies in England and America. Dahlia shows are usually held the second or third week in September. On December 21, 1906, the New England Dahlia Society was chartered; this Society led to great advancement in the dahlia, holding an annual exhibition in Boston, and issuing monthly a paper known as the "Dahlia News." Great interest was fostered, and in 1913 its membership list included nearly every state in the Union, and six foreign countries. At the present date of writing the New England Dahlia Society is considering the adoption of a new charter, whereby it can become the National Society. Other societies devoted to the welfare of the dahlia have been recently formed; principally "The Dahlia Association of Seattle," "Tacoma Dahlia Society," "Inter-town Dahlia Association" in Connecticut.

Literature.—As in many other cases, the magazine literature of the dahlia is the most bulky, and, in some respects, more important than the books on the subject. C. Harman Payne published a bibliography in G.C. III. 21:329 (1897). There had been about twenty-five books devoted to the dahlia, many of them pamphlets and cheap cultural manuals. These books were mostly published from 1828 to 1857, with none in North America for nearly forty years after that date until 1896, when Lawrence K. Peacock's book, "The Dahlia," appeared. The first American treatise was by E. Sayers, published at Boston, 1839. Many interesting facts came out in 1889, the centennial year of the dahlia. A report of the National Dahlia Conference is reprinted from the Journal of the Royal Horticultural Society for 1890, but Shirley Hibberd's statements therein regarding the botany of the dahlia agree very poorly with Hemsley's revision of the genus in G.C. II. 12:437, 524, 557 (1879). In 1906 W. W. Wilmore published "The Dahlia," a handsomely illustrated American manual, valuable to both amateur and professional. The annual catalogues of the leading dahlia specialists furnish much valuable matter, and cultural hints, and are the most up-to-date issues in the dahlia line.

WILHELM MILLER.
J. K. ALEXANDER.

Cultivation of the dahlia.

The dahlia has no very special or particular requirements, and yet many growers fail of the best success because the few demands are not well met.

Propagation.

There are four methods by which dahlias are propagated: by cuttings (the commercial method), by division of roots (the amateur's method), by grafting to perpetuate rare kinds, and by seeds, to produce new varieties.

Cuttings.—Propagation by cuttings is employed mainly by commercial growers, and though the amateur may propagate plants successfully, the attention a few cuttings would probably require is so great that it would be cheaper to buy plants. The roots are planted closely in benches in the greenhouse early in January, and cuttings are made from the young shoots as fast as they form the third or fourth set of leaves. These cuttings are carefully trimmed and placed in pure sand in the propagating-bench, using a dibble and putting the cuttings in rows about 3 inches apart and ½–1 inch between the cuttings.

The propagating-bench is made by running a flue, hot-water or steam pipes beneath an ordinary bench, and boarding up the side to confine the heat. Although there may be a difference of opinion among propagators, yet a bottom of sand heat of 65°, with the temperature of the house from 5° to 10° less, will give the best practical results. With this temperature, the cuttings will root in about two weeks, and will be far stronger than if rooted in less time with greater heat. As soon as cuttings are rooted, they are potted off into small pots and grown in a cool greenhouse until danger of frost is over, when they are planted out in the open ground. Cuttings made too far below a joint, or too late in summer, will produce flowering plants but no tubers.

Division of roots.—This is the easiest and most satisfactory way for amateurs. As the eyes are not on the tubers, but on the crown to which the tubers are attached, care must be taken that each division has at least one eye, otherwise the roots will never grow. It is, therefore, best to start the eyes by placing the roots in a warm, moist place a short time before dividing. The roots are sometimes placed in a hotbed, and shoots grown to considerable size, then set out as plants; but this plan has many drawbacks, and is not advised.

Grafting.—A very interesting, though not profitable mode of propagation is by means of grafting. The top of the tuber is cut slantingly upward, and the cutting slantingly downward, placed together and tied with raffia or any soft, handy material. They are then planted in a pot deep enough to cover the lower part of the graft with earth, and they will soon adhere if placed under a hand-glass or in a frame. Grafting is practised only for the preservation of rare and weak-growing sorts.

Seeds.—The chief use of seeds is the production of new varieties. Seeds are also used by those who chiefly desire a mass of color, and are not particularly desirous of finely formed blooms. If planted early enough indoors and transplanted to the open as soon as safe, fine masses of color can be secured before frost, and the roots of the more desirable kinds can be saved, and will give even better results the next season.

Field or garden requirements.

Dahlias are easily destroyed by high winds unless they are given a protected position, and they need plenty of air and sunlight for best results. In shaded, close, airless quarters the growth is sappy, and the flowers are poorly colored.

The soil is not so important, except in its ability to hold moisture during severe droughts. Any rich soil that will grow corn will also grow dahlias to perfection, if all other conditions are favorable. They will grow equally well in clear sand, clay or gravel, if the proper kinds and quantities of plant-food are added and well and thoroughly worked in. It is, however, unreasonable to expect dahlias or any garden plants to succeed in a hard clay, devoid of humus, easily baked and never tilled.

Feeding.—It is always best to broadcast the manure and plow or spade it into the soil; thorough spading is absolutely necessary if the manure is not well decomposed. On heavy clay or gravelly soils, loose coarse manure may be used, but on light or sandy soils, manure should always be fine and well rotted. Commercial fertilizers are also largely used, and are most valuable when used in connection with manure. Any good fertilizer, rich in ammonia and phosphoric acid, with a liberal amount of potash, will answer at the time of planting, but as a top-dressing later, nothing equals pure bone-meal and nitrate of soda, four parts bone-meal to one part soda.

Kinds of stock.—Dahlias are offered in five forms: large clumps, ordinary field-roots, pot-roots, green plants and seeds. The clumps give the best satisfaction the first year, but are entirely too large and unwieldy for anything but a local trade and exchange among amateurs. The ordinary field-roots are the most valuable, as they can be handled easily and safely, and always give satisfactory results. Pot-roots are largely used in the mailing trade, and, while they will not give as good results the first year, are valuable for shipping

long distances where larger roots could not be profitably used, owing to heavy transportation charges. Green plants are mainly used to make up any deficiency in the field-crops, owing to unfavorable seasons, or an unusual demand for certain varieties.

Planting.—There is diversity of opinion as to the proper time to plant dahlias, but the writer has always found it best to plant early, and would advise planting large strong roots about two weeks before danger of frost is over. This would be, in the vicinity of Philadelphia, about April 15; and as it requires from two to three weeks for the plants to get up through the ground, there will be no danger, while the plants will bloom that much earlier. It is best, however, not to plant small roots or green plants until danger of frost is over—in the vicinity of Philadelphia, about May 1 to 10, according to the season. A good rule to follow everywhere would be to plant small roots and green plants as soon as danger of frost is past, and large roots about three weeks earlier.

Tillage.—The first requisite of successful garden cultivation is thoroughly to stir the soil to considerable depth and enrich it, if it is not already rich, by broad-casting and plowing or spading in a good coat of well-rotted manure. Too much stress cannot be placed upon the thorough preparation of the land, as it not only allows the roots to go down deep after the moisture more readily during dry weather, but affords good drainage during excessive rains. Having prepared the land as above, mark out rows 4 feet apart and 6 to 8 inches deep, and plant the roots from 18 inches to 3 feet apart in the row, according as solid rows or specimen plants are desired.

In its early stage of development, the dahlia grows very rapidly, and should be kept thoroughly tilled. But while deep tillage is beneficial during its early stages of development, it is almost fatal to the production of flowers if practised after the plants come into bloom. Therefore, when the plants begin to bloom, cease deep tillage, and stir the soil to the depth of 1 to 3 inches only, but stir it often, and never allow the surface to become hard and baked. This will not only prevent excessive evaporation of moisture and keep the under soil cool and moist, but will also prevent the destruction of immense quantities of feeding-roots.



1215. A semi-double form of dahlia.

As long as the roots supply more nourishment than is needed to support the plant, both the plant and the flowers increase in size and beauty; but as the supply gradually becomes exhausted, the plants cease growing and the flowers become much smaller. This condition is what is generally called "bloomed out," but what is really "starved out," and can easily be prevented if the proper attention is given to the plants. As soon as the flowers begin to grow smaller, broadcast around each plant a small handful of pure bone-meal, and nitrate of soda, in proportion of four parts bone to one part soda, and carefully work it into the soil.

Watering.—This is a debatable subject, and, although a judicious application of water during a severe dry spell is very beneficial, yet in nine cases out of every ten in which water is applied, a thorough stirring of the surface soil would give better results.

Many persons think Dahlias should be watered every evening, and as soon as they are up begin watering them daily unless it rains. This practice is very injurious, as it causes a rapid but soft growth, and as the soil is seldom stirred, the roots become so enfeebled that they are unable to supply the needs of the plant; as a consequence, but few buds are formed, and they generally blast before developing into flowers. In other cases, as the enthusiasm wears off, watering is stopped, probably right at the beginning of a severe drought, and the weak, pampered plants are fortunate to survive, much less bloom.

If large, strong roots are planted and the soil is kept thoroughly stirred, there will be little need of artificial watering until after the plants come out in full bloom. However, if it should become hot and dry after the dahlias come into bloom, it would be very beneficial to give them a thorough watering once each week or ten days during the continuance of the drought. But care should be taken to stir the soil to the depth of 1 to 2 inches the next day, carefully pulverizing it later in order to break the natural capillarity by which the moisture is evaporated.

The best rule to follow is not to allow the plants to suffer for want of moisture, not to water them except when they need it, but to water them thoroughly when necessary, and not to allow excessive evaporation for want of frequent stirring of the soil.

Training.—In planting the roots or tubers, place them on their sides with the eye as near the bottom as possible, and cover only 2 to 3 inches deep. As soon as the shoots appear, remove all but the strongest one, and pinch out the center of that one as soon as two or three pairs of leaves have formed, thus forcing it to branch below the level of the ground. As the plants develop, the soil is filled in gradually by subsequent hoeings. By this method the entire strength of the root and the soil is concentrated on the one shoot, causing it to grow vigorously; while the pinching back not only causes it to branch below the surface of the soil, and thus brace it against all storms, but also removes all of those imperfect, short-stemmed flowers that appear on some varieties. If the plants are pinched back low, as described, there is no danger of the branches splitting down, as the soil around them will hold them securely in place. However, when they branch above ground and are inclined to split down, drive a short stout stake near the stem and tie the branches to it. These short stakes are not to hold the plants up, but to prevent the branches splitting down when the above directions have not been followed closely.

By this method it is possible to grow dahlia blooms on stems from 18 inches to 2 feet long. It has always been thought necessary to tie dahlias to stakes to prevent them from being blown down by heavy winds. The system of staking is not only unsightly during the early stage of their growth, but is attended with considerable labor and expense. Staking, however, is unnecessary, if the directions already given are followed, as the plants will branch out below the surface of the ground, and the stems will become so heavy as to resist the strongest winds. The plants are one-third dwarfer, compact and regular in form, and produce much finer flowers on long stems well supplied with buds and foliage.

Storing the roots.—As soon as the plants are killed by frost, lift the roots, and, after removing all the soil possible from them, allow them to dry in the air for a few hours, when they should be stored in the cellar or

some other cool place secure from frost. If the cellar is very dry or is not frostproof, put the roots in a barrel or box and cover completely with dry sand or some other suitable and convenient material, such as sawdust or tanbark, to prevent freezing or loss of vitality by drying or shriveling. LAWRENCE K. PEACOCK.

DAHOON HOLLY: *Ilex Dahoon.*

DÀIS (Greek, *pine torch;* application not obvious). *Thymelæàceæ.* Contains a woody plant that yields a strong fiber, and is also rarely cultivated for ornament, especially in Florida and southern California, and possibly in a few northern conservatories.

Tender deciduous shrubs: lvs. opposite, often crowded at the ends of branches: fls. in terminal heads; perianth-tube cylindrical, often curved; stamens 10, in a double series, the alternate ones shorter, upper or all exserted; style exserted. The plants are prop. with difficulty by cuttings of half-ripened wood. The single cult. species has lvs. resembling the smoke tree, or Cotinus, and bears long-stalked umbel-like heads of starry pink fls., with floral parts in 5's. The genus has 2 species, 1 from S. Afr. and 1 from Madagascar.

cotinifòlia, Linn. Lvs. opposite and alternate, oblong or obovate, acute at both ends: involucre a half shorter than the fls.: head about 15-fld.; fls. ½in. across, fragrant. S. Afr. B.M. 147. G.W. 8, p. 313.—Said to bloom profusely at Santa Barbara but not to produce seed. L. H. B.

DAISY (i. e., *day's eye,* in allusion to the sun-like form of the flower). A name applied to the flowers of many Compositæ, but it properly belongs to the *Bellis perennis* of Europe, a low early-flowering plant, which, in its double forms (Fig. 535, Vol. I), is widely known as a garden subject (see *Bellis*). The American congener is *B. integrifolia,* Michx., an annual or biennial, very like the Old World species, ranging southwestward from Kentucky; it is not domesticated. In North America, the word daisy is applied to many field composites, particularly to those of comparatively low growth and large flower-heads. Unqualified, the word is commonly understood to mean *Chrysanthemum Leucanthemum* (Fig. 937), an Old World plant that has become an abundant field weed in the eastern part of the country. This plant is also frequently known as the ox-eye daisy, although in parts of New England it is called whiteweed, and the term ox-eye is applied to *Rubdeckia hirta,* which has a yellow-rayed head. Kin to the *Chrysanthemum Leucanthemum* are the Paris daisies, or marguerites, of the conservatories (see *Chrysanthemum*). The wild asters (Fig. 1216) are called daisies, especially Michælmas daisies, in many parts of the country, particularly west of New York. Spring-flowering erigerons also are called daisies. The Swan River daisy is *Brachycome iberidifolia* (Figs. 621, 622, Vol. I). The African daisy of gardens is Dimorphotheca. L. H. B.



1216. Wild aster, or Michaelmas daisy. (×½)

DALBÉRGIA (N. Dalberg, a Swedish botanist, 1730 to 1820). *Leguminòsæ.* Nearly 100 species of trees, shrubs, or climbers, belonging to tropical regions all over the world, a few of which have been introduced to North America, one for timber.

Leaves alternate, odd-pinnate (rarely 1-foliolate) without stipules: fls. small, numerous, purple, violet or white, in forking cymes or irregular cyme-like panicles, which are axillary or terminal, papilionaceous, with ovate or orbicular standard: fr. an indehiscent narrow pod, 1-seeded at middle and with few seeds toward the ends, the seeds compressed and reniform.

Síssoo, Roxbg. A good-sized tree, 80 ft. high in India: lvs. pinnate; lfts. 5, alternate, stalked, obovate, abruptly acuminate, pubescent beneath: fls. white, in short, axillary panicles.—In India considered one of the best timbers, whenever elasticity and durability are required. Intro. at Santa Barbara, where it is hardy but growth said to be very slow. The Sissoo tree is worth trial in nearly frostless districts, especially along sandy river banks. It improves sterile lands. Experiments in Egypt have shown its most remarkable property of standing severe droughts, as well as submersion for a long period. The wood is very elastic, seasons well, does not warp or split, is easily worked, and takes a fine polish. It is also a durable wood for boats. The tree is raised easily from seeds or cuttings, and is of quick growth. Other species of Dalbergia are of economic value and have been sparingly planted.

DÀLEA (Samuel Dale, 1659–1739, English botanist and author on pharmacology). Syn. *Parosèla. Leguminòsæ.* More than 100 herbs and small shrubs bearing purple, blue, white or even yellow fls. in terminal or lateral spikes or heads, odd-pinnate lvs., and usually glandular-dotted, a very few of which have been cult.; probably none is now in the American trade. Fls. papilionaceous, the standard mostly cordate or eared and clawed and attached in the bottom of the calyx, the wings and keel attached or adnate to the stamen-tube and usually exceeding the standard; stamens 10 or 9, monadelphous: fr. a small usually 1-seeded mostly indehiscent pod inclosed in the calyx. The species occur from the N. U. S. to Chile and the Galapagos Isls. They grow in the U. S., mostly on prairies and in dry soil; some of these species might make acceptable border plants. Those that have received most attention are tropical species, as *D. mutábilis,* Willd., of Mex., with fls. white changing to violet, (B. M. 2486) and *D. Mutísii,* Kunth (properly *Psoràlea Mutísii,* HBK.), of the northern Andes, with deep blue fls. in cylindrical heads; these are to be regarded as greenhouse perennials. L. H. B.

DALECHÁMPIA (from J. Dalechamps, French savant of sixteenth century). *Euphorbiàceæ.* Climbing or rarely erect tropical shrubs; one rarely cultivated in warmhouses for its ornamental bracts.

Leaves alternate, simple; stipules large: fls. small, monœcious, apetalous, in dense clusters, with 2 conspicuous, colored involucral bracts; calyx valvate; styles united; ovules 1 in each of the 3–4 cells.—About 60 species scattered through the tropics. Plukenetia, a related genus, is without the large involucre.

Dalechampia Roezliana was described by Hooker in 1867 as one of the noblest plants introduced for many years, comparable with the bougainvilleas and surpassing them in size of bracts and brilliancy of color. It is not so fine a florists' plant as the poinsettia, but is worth trial in the finer conservatories. It requires well-drained sandy, peat soil, and is propagated by cuttings.

Roezliàna, Muell. Arg. (var. *ròsea,* Authors). Erect shrub, 3–4 ft. high, much branched, leafy: lvs. 6 in. long, sessile, obovate-oblanceolate, acuminate, entire, or with coarse, obtuse teeth above the middle, narrowed to a small cordate base: bracts 2–2½ in. long, broadly cordate, nearly sessile, toothed, membranaceous, distinctly nerved, rose-red, other smaller bracts among the small yellow fls.; stamens united. Mex. B.M. 5640. H.F. II. 11:234, pl. 8. Gt. 16:532. F.W. 1867, p. 318. F.M. 7:373, 374. F.S. 16:1701–2. G.C. 1867:236, desc. Var. **álba,** Hort., has white bracts.

J. B. S. NORTON.

DALIBÁRDA (after Thomas François Dalibard, French botanist). *Rosàceæ*. A low-growing native hardy herbaceous perennial, with foliage resembling violet and flowers like those of a strawberry, sometimes grown in borders and rock-gardens.

This monotypic genus has lately been referred to Rubus, but it differs in habit, in the carpels being usually well defined instead of indefinite and the achenes dry instead of drupaceous: fls. 1 or 2 on a scape-like peduncle, white, and also others that are



1217. Dalibarda repens. (×½)

cleistogamous and apetalous on short curved peduncles; calyx 5–6-parted, 3 of the parts larger; petals 5; stamens many; ovaries 5–10.

rèpens, Linn. (*Rùbus Dalibárda,* Linn.). Fig. 1217. Tufted, creeping: lvs. heart-shaped, wavy-toothed: fls. white, 1 or 2 on each scape; calyx 5–6-parted, 3 of the divisions larger and toothed; petals 5; stamens numerous; pistils 5–10. Common in woods in New Brunswick, Ont. and south and west to N. J., Pa., Ohio and Minn.—It blooms June–Aug. It is a slow-growing plant, thriving in a deep fibrous soil and sheltered position; little grown. In Fig. 1217, *a* shows the perfect flower; *b*, *c*, achenes of the cleistogamous fls.

L. H. B.

DAMASK ROSE: *Rosa Damascena.*

DAMASK VIOLET: *Hesperis matronalis.*

DAME'S ROCKET and DAME'S VIOLET: *Hesperis matronalis.*

DAMMÁRA: *Agathis.*

DAMNACÁNTHUS (Greek, referring to the powerful spines). *Rubiàceæ*. A tender evergreen shrub, chiefly valued for its coral-red berries, which remain on the bush until the flowers of the next season are produced.

Divaricately branched, strongly spiny woody plants: lvs. small, opposite, leathery, nearly sessile, broadly ovate, acuminate: fls. small, axillary, in 1's or 2's, white, fragrant; calyx-tube obovoid, limb 4–5-cut; corolla funnel-shaped. Prop. by cuttings; sometimes grown in greenhouses and perhaps adaptable for planting in the southern parts.

índicus, Gaertn. Described above, being the only species as understood by some authors; but others keep *D. màjor*, Sieb. & Zucc. (which is sometimes nearly spineless), distinct, distinguishing it by the 2–3-times larger lvs. and the larger fls.; others combine the two as species and variety, as **D. índicus** var. **màjor,** Makino. Gt. 17:570. The species occurs from E. India to Japan, the var. *major* being Japanese. The species is a low thick bush, densely dichotomously branched: lvs. ovate-acute, shining green above, light green beneath, in var. *major* 1½ in. long. The shining lvs. and showy berries commend the plant to cult. L. H. B.

DAMPING-OFF. A gardeners' phrase for a disastrous rotting of plants, especially of seedlings and cuttings, and commonly at the surface of the ground. It is usually associated with excessive moisture in the soil and air, with high and close temperatures, and sometimes poor light. Such conditions weaken the plants and allow them to fall a prey to the minute parasitic fungi which live upon the decaying vegetable matter in the soil, and can remain alive for months, even if the soil is thoroughly dry or frozen. A whole bench of cuttings may be ruined in a night. The skilful propagator takes every possible precaution. His benches have perfect drainage, he uses fresh sharp sand, and sometimes sterilizes it with steam heat for several hours. Damping-off is one of the most trying experiences of the beginner, and nothing can prevent it but a thorough grasp of the principles of greenhouse management in general, and watering in particular. (Consult articles on these subjects.) As soon as the disease is noticed, the healthy plants should be removed to fresh soil, as the disease spreads rapidly. If the disease appears in the entire bed, the organisms causing the trouble almost certainly are distributed generally in the sand, and sterilization either with formaldehyde solution (40 per cent strength diluted one part to fifty parts water) or with steam should be employed in all future work. If only a spot here and there shows the trouble, saturate the affected area at once with formaldehyde solution, as above, or with copper-sulfate solution (one part by weight to one hundred parts of water). One of the commonest occasions of damping-off is the sudden flooding of a bed or bench after leaving it too dry for a long time.

The terms damping-off and burning are also used for ruined flowers. Burning is often caused by sunlight or by imperfections in glass, but a flower spoiled by dripping cold water, or by some unknown cause, is said to have a burned look.

D. REDDICK.†

DAMSON: *Plum.*

DÀNAË (name of a daughter of King Acrisius of Argos). *Liliàceæ*. ALEXANDRIAN LAUREL. An evergreen erect much-branched shrub with thick unarmed alternate cladophylla and terminal racemes of small whitish fls., often referred to *Ruscus*. It is one of the Asparagus tribe of the lily family: fls. nearly globular, the lobes short and erect, with a crown at the throat; stamens affixed in the tube beneath the crown, the filaments united, the anthers 6: fr. a pulpy indehiscent red berry. **D. racemòsa,** Moench (*Rúscus racemòsus,* Linn. *D. Laùrus,* Medikus), occurs from Greece to Persia, making a bush 4 ft. high, with ovate-lanceolate, nearly sessile, about 5–7-nerved leaf-like cladodes. Recently intro. in S. Calif., but is little known in this country. Ornamental for porches, vases, and similar uses.

L. H. B.

DANÆA (a personal name). *Marattiàceæ*. A small genus of tropical American fern-like plants, with synangia sessile, arranged in rows, and covering the entire under surface of the leaf. They are apparently not in cultivation in America.

DANDELION (i. e., *dent de lion,* French for *lion's tooth;* referring to the teeth on the lvs.). The vernacular of *Taráxacum officinàle,* Weber, a stemless perennial or biennial plant of the *Compósitæ*, a common weed, much collected in spring for "greens" and in improved forms sometimes grown for that purpose.

Dandelion is native to Europe and Asia, but is naturalized in all temperate countries. On the Rocky Mountains and in the high North are forms that are apparently indigenous. A floret from the head of a dandelion is shown in Fig. 1218. The ovary is at *e;* pappus (answering to calyx) at *a;* ray of corolla at *c;* ring of anthers at *b;* styles at *d*. The constricted part

at *e* elongates in fruit, raising the pappus on a long stalk, as shown in Fig. 1219; and thus is the balloon of the dandelion formed. A dandelion plant, with its scattering fruits, is shown in Fig. 1220. Another species of dandelion is also naturalized in this country, but is not so common; it is the red-seeded dandelion (*T. erythrospérmum*, Andrz.), with red fruits, not reflexed involucral scales, and shorter beak.



1218. Floret of Dandelion.

The dandelion is much prized for "greens." For this purpose it is cultivated in parts of Europe; also about Boston and in some other localities in this country. There are several improved large-leaved varieties, mostly of French origin. Some of these named forms have beautiful curled leaves. Seeds are sown in the spring, and the crop is gathered the same fall or the following spring,—usually in the spring in this country. Commonly the seeds are sown where the plants are to stand, although the plantlets may be transplanted. The plants should stand about 1 foot apart each way, and a good crop will cover the land completely when a year old. Sandy or light loamy soil is preferred. The crop is harvested and marketed like spinach. The leaves or heads are often blanched by tying them up, covering with sand or a flower-pot. The plants are sometimes grown more closely in beds, and frames are put over them to force them. Roots are sometimes removed from the field to the hotbed or house for forcing. When treated like chicory (which see), the roots will produce a winter salad very like *barbe de capucin*. Roots of dandelion dug in fall and dried are sold for medicinal purposes in drug-stores under the name of Taraxacum.

L. H. B.

DANGLEBERRY: *Gaylussacia frondosa.*

DÁPHNE (Greek name of *Laurus nobilis*). *Thymelæàceæ*. Ornamental woody plants, chiefly grown for their handsome foliage and sweet-scented, white, purple, lilac or rarely greenish flowers, which, with some species, in warmer climates, often appear in the winter.

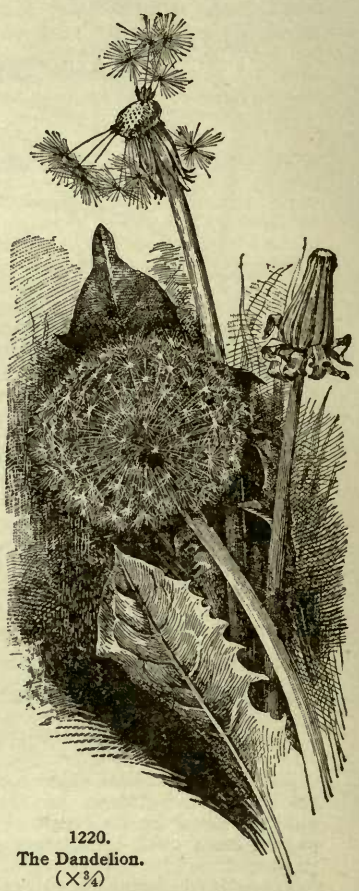
Low deciduous or evergreen shrubs: lvs. alternate, rarely opposite, entire, short-petioled: fls. in clusters, short racemes or umbels, apetalous, mostly fragrant; calyx-tube cylindric or campanulate, 4-lobed, corolla-like, usually clothed with silky hairs outside; stamens 8, in two rows, included; stigma capitate, sessile or nearly so: fr. a fleshy or leathery 1-seeded drupe. —About 50 species in Eu. and Asia. For a monograph of the section *Daphnanthes* see Keissler in Engler Bot. Jahrb. 25:29–124 (1898); see also Nitsche, Beiträge zur Kenntnis der Gattung Daphne (1907).


1219. Mature fruit of dandelion.

Only *D. Mezereum*, with very early lilac fragrant flowers and decorative scarlet fruit, and some low evergreen species, like *D. Cneorum* and *D. Blagayana*, are hardy North, while most of the evergreen species can be recommended only for warmer climates. *D. Genkwa* with lilac flowers appearing before the leaves, and *D. pontica* and *D. Laureola*, with large evergreen leaves, are hardy as far north as New York. *D. odora* is fairly hardy in Washington, D. C.

In California, according to Franceschi, the species most commonly grown is *D. odora*, the plants being mostly imported from Japan. Many plants are also sent from Japan for eastern greenhouse culture. A decoction of the bark of *D. Mezereum* is sold in drug-stores under the name of mezereum. It is stimulant and diuretic. It is also known as olive spurge.

Daphnes thrive best in a well-drained light soil and in a partly shaded position, but some, as *D. Cneorum* and *D. Blagayana*, which are exceedingly pretty plants for rockeries, do better in sunny situations. In the North, *D. odora* and its varieties are often grown in pots for their sweet-scented and handsome flowers appearing during the winter. A sandy compost of peat and loam in equal proportions will suit them; they require a good drainage and careful watering during the winter, and pots not larger than just necessary should be given; they may also be planted out in a cool greenhouse and trained as a wall plant. *D. Genkwa*, with abundant lilac flowers before the leaves, is sometimes forced.


1220. The Dandelion. (×¾)

Propagation is by seeds, sown after maturity or stratified, but germinating very slowly; also by layers put down in spring and taken off the following year. The evergreen species may be increased by cuttings of mature wood in fall under glass, and kept in a cool greenhouse during the winter. If gentle bottom heat can be given in early spring, it will be of advantage to the development of the roots; softwood cuttings taken from forced plants may also be used. *D. odora* is often veneer-grafted on seedling stock of *D. Laureola* in winter, or on roots of *D. Mezereum;* also other species are grafted on roots of *D. Mezereum*. *D. Cneorum* and probably its allies are readily increased in spring by removing the earth around the plant, pegging down the branches and filling with fine compost almost to the tops of the branches. Next spring, if the compost is carefully removed, a large number of little buds, each supplied with a white root, are found along the branches; they are easily detached and planted in pans or boxes.

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A. *Foliage deciduous: fls. axillary along the branches of the previous year, appearing before the lvs.*

B. *Lvs. alternate, glabrous.* (*Mezereum.*)

1. **Mezèreum,** Linn. Erect shrub, with stout branches, to 4 ft.: lvs. alternate, cuneate, oblong or oblanceolate, glabrous, grayish beneath, 1–3 in. long: fls. usually 3, sessile, silky outside, fragrant, lilac-purple, appearing long before the lvs.: fr. roundish ovoid, scarlet. Feb.–April. Eu. to Altai and Caucasus. Gn. 29:602; 33, p. 514; 69, p. 131. V. 2:206. Var. **álba,** Ait., has white fls. and yellow fr. Gn. 29:602; 69, p. 131; 74, p. 255. G.C. III. 21:183, 185; 38:153. R.H. 1905, p. 532. Var. **plèna,** Schneid. (var. *álba-plèna,* Hort.), has double white fls. Gn. 29:602. Var. **grandiflòra,** Dipp. (var. *autumnàlis,* Hort.). With larger brighter purple very early fls., sometimes blooming in fall.

2. **Houtteàna,** Planch. (*D. Mezèreum* var. *atropurpùrea,* Dipp.). Shrub, to 4 ft., with erect, stout branches: lvs. alternate, cuneate, oblong-lanceolate, glabrous, coriaceous and often persistent, purple: fls. appearing before the lvs., lilac-violet, 2–4, in short-peduncled clusters. April. F.S. 6:592.—Of garden origin, supposed to be a hybrid between *D. Laureola* and *D. Mezereum.*

BB. *Lvs. opposite, silky below.* (*Genkwa.*)

3. **Génkwa,** Sieb. & Zucc. (*D. Jénkwa,* Hort.). Shrub, to 3 ft., with slender branches: lvs. opposite, oblong-elliptic, appressed-pubescent on the veins beneath, 1¼–2 in. long: fls. lilac, 3–7, in short-stalked clusters, scentless, densely silky-villous outside. March, April. Japan. S.Z. 75. Gt. 15:499. F.S. 3:208. G.M. 35:292. Gn. 42:91; 76, p. 105. R.B. 10:73. Var. **Fórtunei,** Franch. (*D. Fórtunei,* Lindl.), has larger fls. and larger less regularly opposite lvs.

AA. *Foliage evergreen, alternate* (*see also No. 2*). (*Daphnanthes.*)

B. *Fls. in terminal heads, rarely axillary and pinkish.*

C. *Habit low, procumbent or trailing.*

4. **Cneòrum,** Linn. Fig. 1221. With long, trailing, pubescent branches: lvs. crowded, cuneate, oblanceolate, mucronulate, finally glabrous, dark green and glossy above, glaucescent beneath, ½–1 in. long: fls. in sessile, many-fld. heads, pink, fragrant. Apr., May, and often again in summer. Mts. of Cent. Eu. B.M. 313. L.B.C. 18:1800. Gn. 33, p. 514; 45, p. 237; 62, p. 83. G.C. III. 47:21. G.M. 47:117. M.D.G. 1900:417, 418; 1906:75. G.W. 14, p. 625. V. 2:342; 4:168. Var. **màjor,** Dipp. Of more vigorous growth, with larger fls. Gn. 51, p. 358; 65, p. 457. Var. **Vérlotii,** Meissn. (*D. Vérlotii,* Gren. & Godr.). Lvs. longer, mucronate: fls. 2 weeks later than the type. R. H. 1901, pp. 304, 305; 1902:552. Var. *máximus* of European nurseries =*D. neapolitana.*

5. **Blagayàna,** Freyer. Branches often ascending, glabrous: lvs. cuneate, obovate or oblong, glabrous, 1–1½ in. long: heads many-fld.; fls. white or yellowish white, fragrant, nearly glabrous outside, almost 1 in. long. April, May. Mts. of S. E. Eu. B.M. 7579. F.S. 22:2313. Gt. 29:1020. Gn. 14:200; 35, p. 540; 42, p. 95; 50, p. 26; 67, pp. 287; 71, pp. 7, 247; 73, p. 241. G.C. II. 13:245; 17:505; III. 11:491; 32:300, 301; 38:171.

CC. *Habit erect, 1–4 ft. high.*

D. *Lvs. less than 2 in. long, usually pubescent: perianth densely pubescent outside.*

E. *Lobes of perianth lanceolate, acute; heads without bracts.*

6. **oleoìdes,** Schreb. (*D. buxifòlia,* Vahl). Shrub, to 3 ft.: branches pubescent: lvs. obovate-elliptic to obovate-lanceolate, usually mucronulate or acute, villous-pubescent on both sides or finally glabrous above, punctulate with whitish dots, 1–1½ in. long: fls. in few-fld. heads without bracts, white or pale lilac, with ovate-lanceolate, pointed lobes, ½in. long. S. E. Eu. L.B.C. 3:299. B.M. 1917.—Very variable in shape and pubescence of lvs. Var. **Fioniàna,** Hort., with obovate-lanceolate, obtuse lvs. and lilac fls., is said to be a hybrid between this species and *D. collina.*

EE. *Lobes of perianth ovate, obtusish; heads with bracts at the base.*

7. **collìna,** Smith (*D. austràlis,* Cyrill. *D. sericea,* Hort., not Vahl). Shrub, 1–3 ft.: branchlets villous: lvs. scattered, oblong-ovate to oblanceolate, obtusish, glabrous and shining above, tomentose below, 1–1¾ in. long: fls. rosy purple, fragrant, ¾in. long, in 10–15-fld. heads, lobes broad-ovate, obtuse, about as long as tube; bracts broadly oval, tomentose, about half as long as the fls., persistent for some time. April–June. Italy, Crete, Asia Minor. B.M. 428. B.R. 24:56. Var. **neapolitàna,** Lindl. (*D. neapolitàna,* Lodd. *D. Delahayàna,* Hort.). Lvs. glabrous or nearly so. L.B.C. 8:719. B.R. 822. By some supposed to be a hybrid of *D. collina* and *D. Cneorum.*

8. **serícea,** Vahl (*D. oleifòlia,* Lam.). Shrub, 1–2 ft.: branchlets short, puberulous or nearly glabrous: lvs. crowded at the end of the branchlets, lanceolate or oblanceolate, acute or acuminate, glabrous above, appressed pubescent beneath, sometimes nearly glabrous, ½–¾ in. long: fls. in 3–8-fld. heads, rose-colored, ¾in. long, lobes broadly ovate, obtuse, a third shorter than tube: bracts obovate, silky, soon drooping. May, June. Sicily, Crete, Asia Minor. Ann. Mus. Hist. Nat. Paris 10: 20.—Rare in cult.; usually confused with the preceding species.



1221. Daphne Cneorum.

DD. *Lvs. usually longer than 2 in., glabrous* (*or slightly pubescent beneath in No. 9.*): *perianth glabrous or pubescent.*

E. *Apex of lvs. obtuse or acutish.*

F. *Heads of fls. all terminal, usually many-fld.; bracts persistent.*

9. **hýbrida,** Lindl. (*D. Daùphinii,* Hort. *D. Dêlphinii,* Lodd.). Garden hybrid of *D. collina* × *D. odora.* Similar to *D. odora,* but hardier. Erect shrub, to 4 ft.: lvs. cuneate, oblong-elliptic, dark green and shining above, glabrous or slightly hairy along the veins beneath when young, 2–3 in. long: fls. reddish purple, pubescent outside, very fragrant, rather large, in few-fld. heads. B.R. 1177.

10. **odòra,** Thunbg. (*D. sinénsis,* Lam. *D. índica,* Loisel., not Linn.). Shrub, to 4 ft., with glabrous branches: lvs. oblong-elliptic, acute at both ends, bluntly pointed, glabrous, 2–3 in. long: fls. in dense, terminal heads, very fragrant, white to purple; ovary glabrous; bracts 6–10, lanceolate, persistent. Winter and spring. China, Japan. Gn. 28:8. J.H. III. 50:367. V. 4:318. Gng. 2:211. Var. **álba,** Hemsl. Fls. white. Gn. 28:8; 37, p. 10; 76, p. 240. G. 8:45; 22:9. Var. **punctàta,** Hemsl. Fls. in dense heads, white, spotted outside with red. B.M. 1587. Var. **marginàta,** Hort. Lvs. bordered yellow: fls. red. P.M. 8:175 and R.H. 1866:252 (as *D. japonica*). A.G. 22:843. Var. **rùbra,** Sweet. Fls. purple. S.B.F.G. II. 4:320. G.C. III. 21:173.—By some botanists *D. odora* and *D. sinensis,* Lam. (*D. índica,* Loisel.), are considered distinct species: *D. odora* has larger fls. about ¾in. long, glabrous outside, the bracts shorter than the fls., and

usually oval lvs., while *D. sinensis* has fls. about ½in. long, slightly silky outside, the bracts longer than the fls., and usually oblong-elliptic lvs.; but it is doubtful whether these characters are constant.—*D. odoràta*, Hort., is a common misprint in catalogues for *D. odora*. *D. odoràta*, Lam.= *D. Cneorum*.

FF. *Heads of fls. axillary and terminal, few-fld.; bracts caducous; perianth glabrous.*

11. **japónica,** Sieb. & Zucc. (*D. Mazélii*, Carr.). Shrub, to 4 ft.: branches glabrous: lvs. oblong-deltoid, gradually narrowed at the base, nearly sessile, 2–4 in. long: heads axillary and terminal, short-peduncled, 3–4-fld.; fls. pink, short-pedicelled, ½in. long; lobes ovate, obtuse, as long as tube; bracts ovate-lanceolate, ciliate, slightly shorter than fls.; peduncles and pedicels silky. Spring. Japan, China. Gn. 14:442.

EE. *Apex of lvs. usually emarginate.*

12. **retùsa,** Hemsl. Shrub, 2–3 ft.: branchlets pubescent at first, soon glabrous: lvs. oblong or oblanceolate-oblong, obtuse and usually emarginate, narrowed at the base into a short petiole, glabrous, 1–3 in. long, ⅓–⅔in. wide: fls. white, tinged outside rose or violet, glabrous, fragrant, ¾in. long, in many-fld. terminal heads; lobes slightly shorter than tube; bracts 3–4, oval or obovate, ciliate, deciduous, shorter than fls.: fr. red. May. W. China. B.M. 8430.—Recently intro. and apparently fairly hardy; a very desirable plant.

BB. *Fls. axillary, yellowish or greenish white, glabrous outside.*

13. **Laurèola,** Linn. Shrub, to 4 ft.: lvs. cuneate, obovate-lanceolate, acute, shining and dark green above, glabrous, 2–3½ in. long: fls. in 5–10-fld., nearly sessile racemes, yellowish green, scentless: fr. black. March–May. S. Eu., W. Asia. Gn. 29, p. 602 (poor). Var. **Philíppii,** Arb. Kew (*D. Philíppii*, Gren. & Godr.). Lower: lvs. obovate: fls. often violet outside; bracts as long or longer than the fls. Pyrenees.—Var. *purpùrea* of the Kew Arboretum=*D. Houtteana*.

14. **póntica,** Linn. Shrub, to 5 ft.: lvs. cuneate, obovate or obovate-lanceolate, acute, shining, glabrous, 2–3 in. long: fls. in long-peduncled, 1–3-fld. clusters, greenish yellow, fragrant, with linear-lanceolate lobes. April, May. S. E. Eu., W. Asia. B.M. 1282. G.C. II. 14:209. G.W. 5, p. 261.

D. alpina, Linn. Erect shrub, to 2 ft.: lvs. deciduous, cuneate-lanceolate, sparingly silky: fls. white or blushed, terminal, fragrant. May, June. S. Eu. L.B.C. 1:66. Gn. 29, p. 603.—*D. altàica*, Pall. Shrub, to 4 ft.: lvs. deciduous, cuneate, oblong-lanceolate, glabrous: fls. white, in terminal, 1–5-fld. heads, fragrant. May, June. Altai, Songaria, Mongolia. B.M. 1875. L.B.C. 4:399.—*D. arbúscula*, Celak. Evergreen dwarf shrub: branchlets red: lvs. crowded at end of branchlets, linear-oblanceolate, obtuse, pubescent or glabrous beneath, ¾in. long: fls. pink, in 3–8-fld. heads. June. Hungary.—*D. caucásica*, Pall. Allied to D. altaica. Lvs. narrower: fls. in 3–20-fld. heads. Caucasus. B.M. 7388.—*D. glomeràta*, Lam. Allied to D. pontica. Low: fls. light pink, fragrant, the clusters crowded at the ends of the branches. May. W. Asia.—*D. Gnídium*, Linn. Evergreen shrub, to 2 ft.: lvs. linear-lanceolate, acute, glabrous: fls. yellowish white, fragrant, in terminal racemes or panicles. S. Eu. L.B.C. 2:150. Gn. 29, p. 603.—*D. jezoénsis*, Maxim. Upright shrub, 2 ft.: lvs. oblong-obovate, persistent, obtuse, 1½–3 in. long: fls. axillary, yellow. March, Apr. Gt. 15:496.—*D. kamtschática*, Maxim. Low upright shrub, sparsely branched: lvs. oblong-lanceolate, acutish: fls. fascicled, yellowish. Kamchatka, Manchuria.—*D. papyrífera*, Sieb.=Edgeworthia papyrifera.—*D. petræa*, Leyb. Dwarf evergreen shrub: lvs. linear-lanceolate, small, obtuse: fls. light pink, in terminal, 3–6-fld. heads, fragrant. June, July. S. Tyrol. Gn. 69, p. 327.—*D. pseudo-mezèreum*, Gray. Low, almost decumbent shrub: lvs. lanceolate-oblong, acutish: fls. fascicled, axillary, greenish yellow, scentless. March, Apr. Japan.—*D. rupéstris*, Facch.=D. petræa.—*D. salicifòlia*, Lam.=D. caucasica.—*D. Sòphia*, Kalen. Allied to D. caucasica: lvs. obovate-oblong, glaucous below: heads few-fld. S. Russia.—*D. striàta*, Tratt. Dwarf evergreen shrub: lvs. small, cuneate, linear-lanceolate, glabrous: fls. in terminal, many-fld. heads, pink. June, July. Switzerland and Carpathian Mts.—*D. Vàhlii*, Keissler. Allied to D. collina. Branchlets thick, puberulous: lvs. obovate or oblong-obovate, appressed-pubescent below: heads 8–10-fld.: bracts obovate, silky, deciduous. Crete, Asia Minor.—*D. yezoénsis*, Hort. =D. jezoensis.

ALFRED REHDER.

DAPHNÍDIUM: *Benzoin.*

DAPHNIPHÝLLUM (Greek, *laurel leaf*, from the similarity of the leaves). *Euphorbiàceæ*. Broad-leaved evergreen hardy or semi-tropical shrubs or small trees, sometimes cultivated for their handsome large foliage.

Leaves large, without stipules, leathery, smooth, more or less glaucous, alternate, entire, petioled, pinnately veined: fls. dicœcious, in axillary racemes or panicles, apetalous; calyx 3–8-parted, small, imbricate; stamens 5–18; pistil 2-celled, 4-ovuled: fr. a small, olive-like drupe, usually 1-seeded.—Twelve to 20 species, mostly in Trop. Asia, etc. The one, or possibly two, species, rarely seen in cult. in Amer., are from Japan. The large evergreen lvs. distinguish it from other hardy euphorbiacous shrubs. They are somewhat rhododendron- or laurel-like, hardy as far north as the Middle Atlantic States, and make very handsome broad-spreading shrubs with inconspicuous fls.

Daphniphyllum can be propagated by cuttings, but roots rather slowly, and if seed could be secured it would no doubt give better results. The plants need protection from frost in winter till well established. They are strong growers in rich soil.

macrópodum, Miq. (*D. glaucéscens*, Hort.). A shrub or small tree, broad and compact, 5–10 ft. high, or more in native land, smooth, twigs red: lvs. oblong, 2 x 8 in., bluish glaucous below; petiole 1–2 in. long, red; lateral veins, ⅖–⅗in. apart: fls. small, in short racemes: fr. oblong, not over ½in., black. Japan and China. G. 18:478; 31:16. S.I.F. 1:54.

Two other names, *D. glaucéscens*, Blume, and *D. jezoénse*, Hort., occur occasionally in horticultural literature. The first has scarcely glaucous lvs. with lateral veins ⅓–½in. apart and is probably not in cult.; the latter is a more dwarf form than the others.

J. B. S. NORTON.

DÁRBYA: *Nestronia.*

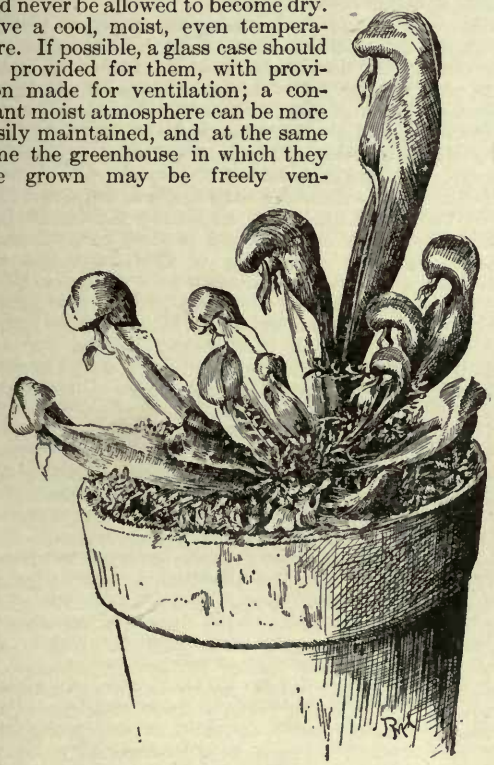
DARLINGTÒNIA (after William Darlington, of West Chester, Pa., author of "Memorials of John Bartram and Humphrey Marshall," and of "Florula Cestrica.") *Sarraceniàceæ*. A monotypic genus of American pitcher-plants which, apart from their striking aspect and beautiful coloring, have acquired celebrity from their insectivorous habits.

The short rhizomes grow in fine muddy soil, and produce annually a terminal rosette of lvs., all of which are modified into upright pitchers: each pitchered lf. is 3–30 in. long by ½–3 in. wide, is somewhat spirally twisted, hollow throughout and with a median crest or flap in front; the tube represents the hollowed lf.-midrib, the flap is formed by the fused halves of the lf. that have united by their upper faces in front of the midrib; the top part of the tube curves over in rounded fashion to form a down-directed pitcher orifice, from which depends a bilobed unusually crimson and green appendage of attractive aspect; the rounded top is also beautifully mottled by white translucent areas; the pitcher exterior and the appendage bear many honey-glands, the excretion from which tempts insects toward the orifice. The rounded hood is lighted within through the white areas, and bears many attractive honey-glands interspersed with down-directed hairs. Tempted by the former, and impelled by the latter, insects step or drop on to the upper interior of the tube. This is extremely smooth, affords no foothold, and so they soon tumble into the lower part. This is covered by down-directed hairs which prevent egress of the caught prey. Disintegration of the insects, amid a neutral liquid that is excreted by the pitcher-wall, then takes place and the products are gradually absorbed through thin areas of the lower cavity. Honey-secretion and insect-catching proceed most actively in May and June; by midsummer, therefore, each pitcher is filled to a depth of 4–8 in. by a decaying mass of insect-remains, amid which at times centipedes or a slug may be found. The genus is native from N. Cen. Calif. to S. Ore. It occurs there on the Sierras by the edge of mountain swamps or "deer-licks" at an elevation of 2,000–8,000

ft. Specimens were first hurriedly collected by W. D. Brackenridge of the Wilkes Exploring Expedition, on the southern slopes of Mt. Shasta, when the explorers were retreating before attacking Indians. The specimens were described and named by Torrey.

Darlingtonias have been grown outdoors in the East the year round in a few special localities. Edward Gillett at Southwick, Massachusetts, grows them in a favored spot without artificial protection. F. H. Horsford can preserve them at Charlotte, Vermont, with the aid of a winter mulch.

As greenhouse plants, darlingtonias require the same treatment as their allies, sarracenias, dioneas and droseras. A well-grown collection of these plants is not only very interesting and curious, but also very beautiful. To succeed, they must occupy a shaded position, and never be allowed to become dry. Give a cool, moist, even temperature. If possible, a glass case should be provided for them, with provision made for ventilation; a constant moist atmosphere can be more easily maintained, and at the same time the greenhouse in which they are grown may be freely ventilated without injury to these plants. The material in which they grow best is two-thirds fern-root fiber with the dust shaken out, and one-third chopped sphagnum moss and silver sand, with a few nodules of charcoal added. About the first week in July is perhaps the best time for potting, though one must be guided by the condition of the plants, choosing a time when they are the least active. When well established they will require potting only once in two years. The pots should be placed in pot-saucers as a safeguard against their ever becoming dry, and all the space between the pots should be filled with sphagnum moss up to the rims of the pots. A temperature of 40° to 45° during winter, with a gradual rise as the days lengthen in spring, will suit them admirably. During the summer they should be kept well shaded, or they may be removed to a well-shaded frame outside in some secluded position free from hot drying winds. Propagation of these plants is effected by division of the roots, or by seeds sown on live sphagnum moss in pans, the moss being made very even and the pans placed either under a bell-jar or glass case in a cool moist atmosphere. (Edward J. Canning.)



1222. Young plant of Darlingtonia.

califórnica, Torr. Fig. 1222. Rootstock horizontal: lvs. 5–8 in annual rosettes, long-tubular, somewhat twisted, with median anterior flap, green below, green mottled with white over the arched hood, orifice down-directed with bilobed red and green appendage in front: fl.-stalk 10–30 in., bearing scattered bracts; fl. solitary, inverted; sepals 5, pale green; petals 5, yellowish to brown-red with red veins; stamens 15–12, inserted below ovary; ovary obconic with depressed apex, style 5-lobed with radial stigmas: caps. obovate, surrounded by the persistent sepals. Flowers from May to July, according to elevation. B.H. 5:113. F.S. 14:1440. F.M. 1869:457. B.M. 5920. I.H. 18:75. G.C. III. 7:84; 17:304; 24:339.—Intro. into cult. in 1861. Var. **rùbra,** Hort. Differs from type in being a reddish hue.

D. Coùrtii=Sarracenia Courtii.

J. M. MACFARLANE.

DARNEL: *Lolium perenne.*

DARWÍNIA (Dr. Erasmus Darwin, an English nature-student). *Myrtàceæ.* About 40 Australian evergreen shrubs, a very few of which are sometimes grown for the colored flower-like campanulate involucres that hold their condition 3–5 months; not in the American trade. Lvs. few and usually heath-like: fls. small, inclosed in petal-like bracts at the summit of the branches; calyx-lobes 5; petals 5; stamens 10, alternating with staminodia; ovary 1-celled, the fr. 1-seeded. The darwinias prop. from well-ripened tips of side shoots taken in early autumn or in spring. They require greenhouse or intermediate temperatures. **D. Hookeriàna,** Benth. (*Genètyllis fuchsioìdes,* Hort.). Lvs. linear-oblong, ½in. long, scattered: sts. red: inner bracts of hanging involucre 1 in. long, bright red, the outer ones shorter and greenish and passing into the st.-lvs.: fls. small, greenish white, usually about 6 in each involucre. B.M. 4860 (as *Genetyllis macrostegia*). G.C. III. 43:243. F.S. 10; 1009. **D. macrostègia,** Benth. Lvs. elliptic-oblong, ¾in. or less long, scattered: inner bracts 1½ in. long, creamy white with red splashes and stripes, the outer ones shorter and more colored, the lowest ones passing into the foliage. B.M. 4858 (as *Genetyllis tulipifera*). I.H. 2:73. F.S. 10:1064.

L. H. B.

DASHEEN. Edible crown-tubers of Colocasia, lately cult. in the U. S. to some extent. See p. 830; also *Taro.*

DASYLÍRION (Greek, *tufted lily*). *Liliàceæ.* Stiff short-trunked desert plants, with crowded leaves and elevated panicles of small mostly white or whitish flowers.

Caudex or trunk erect and woody: lvs. numerous, near the top of the trunk, long and rigid, usually prickly-margined: fls. dicœcious, in dense racemes which are crowded into a narrow compound panicle; perianth campanulate, the segms. toothed, distinct and nearly equal, obtuse; stamens 6, exserted, style short; stigmas 3: fr. dry and indehiscent, 3-winged, 1-celled and 1-seeded.—About 15 species. Mex., to Texas and Ariz. Monograph in Proc. Amer. Phil. Soc. 50, p. 404 (1911).

Dasylirions are highly ornamental plants, well adapted for rockeries, for isolated specimens on lawns, decoration of conservatories, staircases and similar uses, and eminently suitable for terraces and vases, in the formal style of gardening. The leaves are in large number, inserted in a symmetrical way, so as to form a dome or globe-shaped, regular head, more or less serrulated, and in some species ending in a brush-like tuft of dried fibers. The tall panicles of numberless whitish green minute flowers are also a striking feature, standing far above the crest or crown of leaves. They are of the easiest possible culture, and will stand some degrees of frost, particularly if kept dry. Easily propagated from seeds and from cuttings of the branches when produced, as they do not sucker as a rule. These plants are inferior to *Yucca filamentosa*

in hardiness, showiness and regularity of flowering, but they have an individuality of their own. They are especially esteemed in California, where the great flower-stalks, 8 to 10 feet high, give a strong impression of the desert. The individual flowers are not highly colored, but the spikes are several feet long. These and related plants have been the subject of recent revision. Beaucarnea is now considered to be distinct, and a new genus, Calibanus, is erected by Rose on *D. cæspitosum*. These new treatments are explained under Nolina.

A. *Lvs. flat, prickly-margined.*

B. *Lvs. usually green, splitting into fibers at tip, narrow.*

texànum, Scheele. Lvs. ½in. x 2–3 ft., glossy green: prickles yellow, turning brown: infl. 9–15 ft. high: fr. elliptical, $\frac{5}{16}$ x $\frac{5}{16}$ in., shallow-notched. S. Cent. Texas.

acrótriche, Zucc. (*D. acrótrichum*, Baker. *D. grácile*, Planch. *Bonapártea grácilis*, Otto. *Roulínia grácilis*, Brongn. *Yúcca grácilis*, Otto. *Y. acrótricha*, Schiede. *Barbacènia grácilis*, Brongn. *Littæa grácilis*, Hort.). Lvs. very narrow, ⅜in. x 2–3 ft., sometimes dull or pale: prickles pale yellow, brown at tip: infl. 9–15 ft. high: fr. round-cordate, $\frac{3}{16}$ x ¼in., shallow-notched. E. Cent. Mex. Abhandl. Akad. Muench. Cl. 2, 3:1. B.M. 5030. F.S. 1448; 7, p. 10. G.C. III. 19, p. 204.

graminifòlium, Zucc. (*Yúcca graminifòlia*, Zucc.). Lvs. ½in. x 3 ft., glossy green: prickles very short, yellowish white: fr. elliptical, ¼ x ⅜in. E. Cent. Mex. Abhandl. Akad. Muench., Cl. 2, 3:1. Allgem. Gartenz. 9:1.

BB. *Lvs. glaucous and dull.*

C. *The lvs. not shredded at tip, narrow.*

glaucophýllum, Hook. (*D. glaùcum*, Carr. *Bonapártea glaùca*, Hort.). Lvs. ½in. x 3–4 ft: prickles yellowish white: infl. 12–18 ft. high: fr. elliptical, ¼ x ⅜in. E. Cent. Mex. B.M. 5041. G.C. II. 13, p. 205; III. 40, p. 247. Rep. Mo. Bot. Gard. 14, p. 12.

CC. *The lvs. splitting into fibers at tip, wider.*

serratifòlium, Zucc. (*D. laxiflòrum*, Baker. *Yúcca serratifòlia*, Schultes. *Roulinia serratifòlia*, Brongn.). Lvs. 1–1½ in. x 2–3 ft., rough: prickles rather long, sometimes ¾in. apart. S. E. Mex. Abhandl. Akad. Muench., Cl. 2, 3:1.

Wheèleri, Wats. With distinct short trunk: lvs. nearly 1 in. x 2–3 ft., nearly smooth: prickles yellow, browning at tip: infl. 9–15 ft. high: fr. round obovate, ¼ x $\frac{5}{16}$in., openly notched. S. E. Ariz. and adjacent region. Pl. World, 10, p. 254. Publ. Carnegie Inst. 99:58. Icones Sel. Hort. Thenensis, 225.

AA. *Lvs. 4-sided, neither prickly nor usually brush-tipped.*

longíssimum, Lem. (*D. quadrangulàtum*, Wats. *D. juncifòlium*, Rehnelt). Trunk 3–6 ft. high: lvs. very numerous, ¼in. x 4–6 ft., dull green: infl. 6–18 ft. high: fr. $\frac{5}{16}$ x ⅜in., scarcely notched. E. Mex. B.M. 7749. G.F. 36, p. 280. Bull. Soc. Tosc. Ort. 9, p. 236; 35:6. Die Natur, 34, p. 340. R.H. 86, p. 66.

D. Hookeri, Lem.=Calibanus Hookeri, Trel. (see Nolina). —*D. júnceum*, Zucc.=Nolina Hartwegiana.—*D. longifòlium*, Zucc.=Nolina longifolia.

WILLIAM TRELEASE.†

DATE. A palm, *Phœnix dactylifera*, Linn., native to North Africa or Arabia and extensively planted in countries inhabited by Arabs, and having arid or desert conditions. Figs. 1223–1226. It is also grown to some extent in southern Asia and southern Europe and in other tropical and subtropical countries. It is of very ancient cultivation, having been grown along the Tigris and Euphrates Rivers for four thousand years or more. It has long been planted casually in parts of Mexico and the southwestern parts of the United States, and is now becoming a fruit of commercial promise in some of these regions.

The date palm reaches a height of 100 feet, making a nearly straight, shaggy trunk, and it continues to bear for one or two centuries. It is dicœcious, the males usually equaling the females in a batch of seedlings, this constituting one of the great disadvantages of raising seedling dates. The Arabs practise artificial pollination by tying male flowers on the pistillate clusters. The flowers are produced early in the spring, from six to twenty clusters appearing on a mature tree. The female or fertile clusters of good size will produce as much as twenty to forty pounds of dates. As with apples and other fruits, there are many varieties differing in quality; seedlings do not reproduce the variety, so that propagation of named varieties must be accomplished by other means.

The date is the fruit, being essentially a drupe, measuring 1 to 3 inches long. The date of commerce is the cured and dried natural fruit. The sweet nutritious pulp of the fruit constitutes one of the most important foods of the Arabs. The leaves and other parts of the plant afford materials for dwellings and many domestic uses. The wood or trunk is used for timber. The importation of dates into the United States amounts to about $500,000 worth annually. No doubt the consumption will be greatly increased when a home-grown and clean-packed product is obtainable.

Aside from the direct uses of the plants and the fruits, the date palm is valuable as a cover for other crops in the hot and dry regions. Beneath the palms, other fruits, vegetables and many crops may be grown with more safety than in the open blazing sun. It is probable, therefore, that the date palm will become a feature of the farming in all the regions of the Southwest in which it thrives.

The general situation.

In Florida, California, and restricted areas of a few other states, the date has been grown for decorative purposes for more than a century. At the missions founded by the Spaniards at St. Augustine, and other places in Florida, and that long line of missions extending from far into Mexico northward and westward through southern New Mexico, Arizona and California, it is likely the date was planted wherever the climatic conditions were favorable to its growth. Within the borders of the United States the greater number of these early plantings were in Florida or along the coast of southern California, regions where the sum total of summer heat is not sufficient to develop the date fruit perfectly. The date, as a fruit-producer, being indigenous to a desert environment, does not take kindly to humid regions, even where it is not sufficiently cold to prohibit the growth of the tree. It is not only a question of maturing the tree or even of producing the fruit but also of bringing the fruit to perfect ripeness. For this reason the greater number of the early plantings in this country matured little fruit, while that produced was of poor quality, although in many instances the trees grew luxuriantly and to large size. In the more arid parts of Lower California and Sonora, where there is sufficient water for irrigation, the early plantings have been continued down to the present time, and dates of fair quality have been grown for many years. Moreover, each year the area devoted to dates is increasing, and with the recent studies of the life-history of the plant by Swingle and others the adaptation of regions is now better understood and undoubtedly the future plantings will be made with much better assurance of success. Modern date culture in this country may be said to have begun with the planting of imported Egyptian and Algerian palms and seedlings principally in Salt River Valley, Arizona, in the years 1890–1900. Toumey's studies of these early plantings resulted in Bulletin No. 29 of the

Arizona Station. Studies of conditions in the Saharan region and the importation of varieties by the United States Department of Agriculture, were made in 1899 and 1900. These results were set forth in Bulletin No. 53 of the Bureau of Plant Industry, by Swingle. Stations for testing the introductions were provided by Arizona in 1899, by California in 1904, and by Texas in 1907. Subsequent large importations were made by Fairchild and Kearney, as described in Bulletins Nos. 54 and 92 of the Bureau of Plant Industry of the national Department of Agriculture.

Dates unquestionably can be grown profitably in many of the hot dry irrigated valleys in the southwestern parts of the United States. The Salton Basin in southern California promises particularly well for date-culture because of the high temperature, and here even the famous Deglet Noor date of the Sahara will ripen fully, even in cool seasons. Considerable attention is also being given to dates in the newly developing Imperial Valley. In northern California, the date can undoubtedly be grown for home use in many regions, even north of San Francisco; it finds good conditions for commercial culture in parts of Arizona; and there are probably adaptable regions in Texas. The date can endure more alkali than any other profitable fruit crop, and this fact will extend the range of its usefulness. When once well established, brief temperatures as low as 10° F. do not do serious harm to date palms.

While date trees have been grown in the United States and Mexico for certainly more than a century, and while much fruit has been produced incidentally here and there, largely as a by-product, nevertheless date-growing on a commercial scale is yet a new and experimental industry in this country. Although it promises well, the business requires experience and skill, and it must be established only in those regions which are particularly adapted to it, especially those that have an extremely hot summer climate. As yet, the returns from date-culture are almost impossible of determination. As nearly always happens with new and promising industries, doubtful claims have been made for profits of date-culture by interested parties. It must be borne in mind that practically all the varieties now recommended for commercial cultivation in this country are of Old World origin. Although many seedlings are being raised, it is yet too early to designate any one of them as superior for general orchard planting. It is advisable that in the regions in California and Arizona, and elsewhere, that are adapted to dates, numbers of seedlings should be raised from the best varieties, care being taken that they have been pollinated from the best males; in this way the chance will be increased of originating varieties that are especially adapted to the region. The business must be developed by residents and those who study the conditions closely from year to year.

According to Swingle, at present less than a dozen varieties among the 200 or more on trial at the government date-gardens in the Southwest can be said to be well enough known to warrant planting on a commercial scale. The Deglet Noor and the Tazizaoot can be recommended for orchard planting in the Coachella and Imperial Valleys of California; the Halawy, the Khadrawy, the Maktoom, and the Hayany are promising for cooler regions, such as the Salt River Valley of Arizona, and may be planted in the California date regions on a scale not too large for the early markets; the Rhars is excellent for home use as a fresh date, but is of little commercial value; the Thoory is a dry date of great promise, but it is as yet doubtful whether dry dates can be marketed advantageously on a large scale without an expensive publicity campaign. To plant other varieties that are new or inadequately tested, involves a considerable element of risk. The fact that they appear satisfactory in the Old World deserts is no guarantee that they will grow, bear, and ripen fruit properly in the Southwest or that their fruit will prove acceptable to American buyers. Any planting of a variety on a large scale before it has been thoroughly tested must be considered as a speculation. It would be much safer for those who expect to grow dates on a commercial scale to limit themselves at first to those varieties that have been tested by public and private agencies, and to learn all phases of the culture, curing, packing, and marketing of the fruit of one or more of the standard varieties. This is the best possible preparation for the efficient culture of new sorts when they have been sufficiently tested in the government or other adequately supervised testing-gardens to render it desirable to test them on a commercial scale



1223. Young date palm, with growing suckers or offshoots.

in private culture. The government, through the Department of Agriculture, has taken special pains to safeguard the young industry.

Propagation.

It is always preferable to propagate dates from suckers unless one desires to originate new varieties, not only on account of the knowledge of the sex (it being hardly necessary to state that the sex of a sucker is the same as that of the plant from which it is taken), but on account of the ability to make a selection in the variety and quality of the fruit.

Dates are easily grown from seed if the ovules have been properly pollinated. Seeds may be planted in any month immediately after they are taken from the fruit, particularly in the mild climates of the Salton Basin, Lower Colorado Valley, and Salt River Valley. Unless the conditions are good, however, it is better to stratify them in a box between layers of moist sand and allow them to remain for three to six weeks in order that the seed-coats may be softened. It is important, however, that in the stratifying-box the seeds do not sprout, as they are easily damaged after sprouting takes place. The seed may be sown in nursery rows and the young seedlings transplanted after one, two or three years; or if the field is well prepared, and has good irrigation, the seed may be planted directly in the fields where the palms are permanently to remain. If they are placed directly in the field, it is well to plant them in rows 25 to 30 feet apart and to allow the young plants to stand

3 to 5 or 6 feet apart in the row. When the dates come into bearing, the undersirable ones and the males may be removed and the probability is that a sufficient number of good varieties will remain to make the row properly continuous; and the rows will be far enough apart for the regular or permanent plantation.

Suckers or offshoots are taken from the base of the young palm (Figs. 1223, 1224). One to several suckers may be removed each year, averaging two to four for the productive period, and when they are three to six years old and have begun to develop roots of their own. All species belonging to the genus Phœnix are difficult to transplant with uniform success. Frequently as high as 50 per cent of transplanted dates die even when watered daily and given the best of care. In planting suckers with the best of attention, a percentage die; while without care not one in a hundred will grow. It is due not so much to the lack of experience in removing the suckers as to lack of proper care after removal, that so large a percentage fail.

Suckers may be removed at any time during the spring or early summer, or even in the winter, if proper care be given them after removal. If they are to be planted in the open ground it is advisable to remove them in spring or early summer, April probably being the best month. In winter, when the plants are at a standstill, the suckers may be removed with comparatively small loss, if the "bulbs" or bottoms be not less than 4 inches in diameter. It is necessary, when suckers are removed at this season, to set them in rather small pots, so that the earth, which should be given a daily soaking, may have a chance to get warm quickly. The pots should be kept in a dry greenhouse, or, better yet, imbedded in a hotbed of manure, covered with the customary frame and glass. In all cases the leaves should be cut back to 6 to 12 inches in length, and sometimes they are removed. Transplant only when the ground is warm.

If proper attention can be given it is best to plant large suckers where they are to remain, as a second chance for loss occurs when they are transplanted from a nursery to the position that they are finally to occupy. An iron bar weighing thirty to forty pounds, and flattened to a 4–6-inch cutting end, may be used to cleave the offshoots from the tree. The leaf-stalks should be cut away, exposing the bulb of the sucker, care being taken not to injure the bulb in removing. One should cut in rather deeply at either side, not being afraid of injuring the old plant, cutting out a V-shaped portion extending from the base of the bulb downward for a few inches. Wounds may be painted with coal-tar to prevent bleeding and evaporation. It is important, when planting the suckers in the field, to set them so high that the crown-bud will not be covered with water during irrigation, in order to avoid decay and death.

A successful method of rooting the suckers is to bank up earth about the base of the parent tree and above the base of the suckers, and keep moist by watering daily to induce formation of roots. Suckers may be partially severed from the old stock before the banking is done, or after the roots have started. When the roots are well grown, the suckers may be transplanted with little loss.

The suckers will grow perfectly well, however, if no roots are left attached. The offshoots may be cut away from the parent plant, with all the leaves removed, and leaving only the bud in the center or at the apex surrounded by the leaf-stalks. Such offshoots will stand very much exposure and may be shipped long distances without being packed in moist material, care being taken that the boxes are so filled with packing that they will not be jammed or bruised in transportation. After they are planted, they should be kept constantly moist about the bottom and should not be allowed to suffer any check. The Arabs apply water every day for thirty or forty days and then continue to irrigate each week until the following winter, care being taken not to water too much. If these precautions are taken and if the offshoots are planted in warm ground, there need be very little loss. They should never be set in the open ground when the soil is cold, as in fall or winter. If the offshoots are to be taken off at that time, they must be grown in pots or in some similar way, as described above.



1224. Deglet Noor date palm about eight years old, with offshoots and ripe fruit.

The growing of dates.

The date palm grows in nearly all kinds of soil, if only the climatic conditions are right. If it be sufficiently irrigated and have the requisite amount of heat, the soil seems to be a secondary consideration. In general it may be said, however, that sandy-loam soils of the desert, with a small percentage of clay and slightly charged with salts, are preferable to rich and heavy soils, suitable for growing ordinary crops. The question of water is of great importance in the culture of dates, as it is necessary that the roots of the date palm be in moist earth throughout the year. In general, the amount of water required for successful culture is considerable. If sufficient water cannot be supplied by natural methods, one must resort to irrigation. Water should be supplied at frequent intervals throughout the year. However, the most should be supplied in the spring before blooming, and in the fall prior to the ripening of

the fruit. The amount of water for each palm depends so much upon soil and local conditions that an estimate would be worthless. Care should be taken not to irrigate to excess at the time of blooming and immediately after, as it will militate against the successful setting of the fruit. The date seems to enjoy not only a high atmospheric temperature, but a high temperature of the water supplied in irrigation as well. In irrigating small crops by flooding, it is necessary in midsummer to irrigate late in the afternoon or at night in order to prevent scalding. Care should be taken, in the hotter part of the year, that the date palm is not subjected to hot water about the roots, rising above the soil for a considerable length of time, and later left until the soil becomes exceedingly dry and baked by the sun. Such extremes sometimes seriously injure or destroy the tree.



1225. An American seedling date.

The date palm comes into bearing early, examples being known in California of fruits being produced two years after the seeds were planted. It usually requires six to eight years, however, for seedlings to bear any considerable quantity of dates. Under the best date-culture, seedlings are not used but the plants are propagated by means of suckers, as already explained; these suckers soon become established and will bear abundantly in five or six years afterwards. After ten or fifteen years, the palm may be considered to be in full bearing and should continue to produce indefinitely. It should yield 100 to 200 pounds of fruit annually, although there are cases of very much higher yields than this. To conserve the strength of the parent plant, the suckers should not be allowed to grow around the base in large numbers. Usually not more than three or four of these suckers or offshoots are allowed to remain at any one time. After the palm is in full bearing and has a trunk a few feet high, the offshoots cease to be produced. It is recommended, however, that one offshoot be left attached to the mother plant in order to replace the tree in case of an accident. If the date palm is allowed to grow as it will, it becomes a clump of many trunks, surrounded by a jungle of offshoots.

It is advised that the date palm be planted at distances of not less than 26 to 33 feet. Other crops can be grown between the trees till they come into bearing heavily, or even continuously.

Under proper cultivation, the date palm should produce from ten to fourteen leaves each year. A well-developed tree will have at one time from thirty to sixty leaves, the old ones dying away below while new ones are forming at the top. The different varieties show great variation in rapidity of growth, form and length of leaves, size of stem, and general aspect of plant. The stem of the date palm is very rigid. When the stem reaches a height of 5 or more feet it is frequently necessary to tie the growing bunches of dates securely to the lower leaf-stalks, that they be not broken and injured by the wind before maturity.

While it is possible to produce dates by depending on wind-pollination from male to female trees, this process is much too uncertain for commercial culture and requires a very large number of male trees. In commercial plantations, one male tree to 100 females is sufficient; but this requires that the pollinating shall be performed by hand. Small separate twigs or branchlets of the male inflorescence, from 4 to 6 inches long and bearing thirty to fifty flowers, are tied on the female cluster. Inasmuch as the flowers in the female cluster mature at different times, it is necessary to repeat the operation of pollination. In old plantings, persons must climb the trees in order to perform this operation, but for the first ten or fifteen years of bearing the clusters are so near the ground that little if any climbing is required. Each female flower produces three ovaries. After pollination, two of these ovaries fail and one matures into the date. In case there is no pollination, all three of the ovaries will develop but will be seedless and the fruit will be inferior.

As with other fruits, it is often necessary to thin the dates on trees, particularly on young trees that tend to overbear. Even on old trees, best results are to be secured if only eight or ten bunches are left.

Usually the dates in an entire bunch do not ripen at the same time. Picking off the dates as they ripen is a practicable operation when labor is cheap. In general, however, it probably will be found the better plan to cut the entire bunch at once. This may require some special operation in the handling and curing. Some varieties require practically no special handling or curing and are ready to ship as soon as they have ripened naturally. Usually, however, the bunch must be ripened much as a bunch of bananas is cured, by being cut off and hung in a moist and warm place. It has been found that in Arizona the best varieties of dates may not ripen naturally on the tree. Freeman's experiments at the Arizona Experiment Station show that conditions favorable for the rapid ripening of the Deglet Noor may be produced artificially in an oven. The degree of moisture and temperature may be carefully regulated. In this ripening process, there is not only a change in the sugar-content but the tissues of the date are softened, the tanin is precipitated and the astringency of the fruit is thereby relieved. Vinson found that dates may be ripened artificially by means of chemical reagents. Artificial ripening by means of heat, moisture, and chemical stimulation makes possible the production of commercial crops at altitudes too high and cool to mature many medium and late varieties. Losses by rain, insects, and birds are minimized, and greater cleanliness secured. Last year over half the crop from miscellaneous varieties at the Tempe Date Orchard (Arizona) would have been lost but for artificial methods of ripening. These methods are cheap and practicable. In connection with ripening operations, the fruit can be pasteurized at a temperature of 65° to 70° C (149°–158° F.) and then packed under cheese-cloth to secure it from contamination by flies and other insects. Recent experiments by Drummond show that fumigation with carbon bisulfide kills insect eggs, and is preferable to pasteurization with varieties inclined to be sticky. In 1910, Swingle discovered the process now in use for ripening Deglet Noor dates by



1226. Fruit clusters of date, as grown in Arizona.

keeping them in moist atmosphere in closed packing-boxes which are kept warm at night and heated to 80° or 90° F. during the day. Deglet Noor dates ripen perfectly by this process and remain light-colored while those ripened by the rapid process are darkened. Freeman's rapid process will ripen greener dates, however.

For further discussion, see *Phœnix;* also the bulletins of the United States Department of Agriculture, and of the experiment stations of Arizona and California.

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L. H. B.†

DATÍSCA (old Greek name, applied to some doubtful plant). *Datiscàceæ.* Tall perennial herbs, one of which is sometimes planted in gardens.

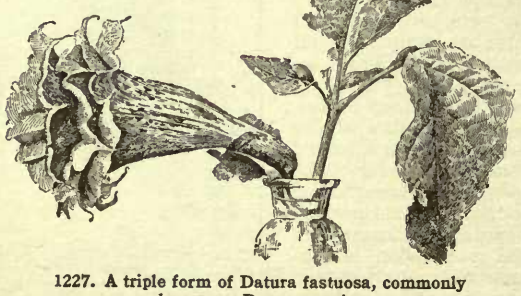
Glabrous branching hemp-like plants with pinnately compound or ternately divided alternate lvs., the lfts. or segms. lanceolate and usually serrate or toothed: fls. usually dicœcious, the staminate fascicled in the axils and short-pedicelled, the pistillate racemose on axillary branchlets; stamens in sterile fl. 8–12–25, mostly opposite the calyx-lobes; stamens sometimes present in fertile fls. but few and perhaps alternate with calyx-lobes; ovary 3-angled at top, with 3 styles which are 2-parted: fr. a narrow ribbed many-seeded caps., opening between the styles at the top.—Species 2, one in S. E. Eu. and W. Asia, and the other in Calif. and Mex.; the former is in cult. abroad, requiring no special treatment; prop. by seeds and division.

The family Datiscaceæ is placed near Begoniaceæ and Cactaceæ. It comprises two other genera of tall trees, neither of which is recorded as in cultivation; these are Octomeles, with two species in the Malayan archipelago, and Tetrameles, with one species in East India to Java.

cannabìna, Linn. Three to 7 ft.: lvs. odd-pinnate; the lfts. of 3 pairs, 2 in. long, deeply serrate, long-acuminate: fls. small, yellow, the females in long and open racemes. Eu.—Attractive bushy plants with graceful foliage; both sexes should be grown, the female being the finer for ornament.

D. glomeràta, Brew. & Wats., the American species, is apparently not in cult.: 2½–4 ft., stout, glabrous, the sts. clustered: lvs. ternately divided or lobed: staminate fls. in clusters of 3; pistillate fls. 4–7 together or scattered along short branchlets. It is the durango-root of the Coast ranges and Sierra Nevada.

L. H. B.



1227. A triple form of Datura fastuosa, commonly known as D. cornucopia.

DATÙRA (Arabic name). Syn. *Brugmànsia. Solanàceæ.* Thorn-Apple. Several large plants cultivated for their huge trumpet-like flowers, which have an odor that is very pleasant to some persons.

Annual or perennial herbs, shrubs, and trees: lvs. large, entire or wavy-toothed: fls. large, solitary, erect or pendulous, mostly white, with more or less violet, rarely red or yellow; calyx 5-toothed, sometimes breaking apart near the base or splitting lengthwise; corolla trumpet-shaped, with spreading 5–10-toothed limb; stamens 5, all perfect, slightly or not at all exserted, the filaments slender; style long, the stigma 2-lobed: fr. a large 2-celled caps., mostly prickly or spiny, usually dry and 4-valved at top but sometimes fleshy and bursting irregularly, with large seeds.—Some 15 species, mostly strong-smelling, in the warmer parts of the globe, some of them weeds.

A few daturas are grown as flower-garden subjects, or the shrubby kinds under glass or as tub specimens. The most popular kind in northern gardens is commonly called *D. cornucopia* (Fig. 1227), which is especially interesting when its flowers develop two or three well-defined trumpets, one within another. Sometimes, however, these double flowers are a confused mass of petalage. Double and triple forms are likely to occur in any of the species described below. The horn-of-plenty has been especially popular in America since about 1895, when it was found in South America by an orchid collector of the United States Nursery Company, and soon became widely distributed in "yellow, white, blue and deep carmine," all double forms. Daturas contain strong narcotics. Large doses are poisonous, small doses medicinal. Separate preparations of Stramonium seed and leaves are commonly sold in the drugstores. *D. Stramonium* (Fig. 1228) is the thorn-apple or Jamestown weed, the latter name being corrupted into jimson weed. Its foul, rank herbage and large spiny fruits are often seen in rubbish heaps. At the first successful settlement in America—Jamestown, Virginia, 1607—it is said that the men ate these thorn-apples with curious results. Capt. John Smith's account of their mad antics is very entertaining. It has been conjectured that this same plant was used by the priests at Delphi to produce oracular ravings. The seeds of *D. sanguinea* are said to have been used by Peruvian priests that were believed to have prophetic power.

Daturas are of easy culture. Some are treated as tender annuals. In the North the woody species can be grown outdoors in summer, and stored in cellars during the winter; in the South and in southern California they are almost everblooming. They are sometimes kept in cool conservatories the year round, in which case they should be planted in the border, as they rarely flower well in pots, their roots being large and spreading and requiring a constant supply of moisture. This method produces great quantities of bloom in spring. After flowering, the plants should be cut in to the main limbs.

A. *Fls. red.*

sanguínea, Ruiz & Pav. Tree-like shrub, 4–12 ft. high: branches fragile, leafy at the apex: lvs. clustered, 5–7 from the same point, ovate-lanceolate, acuminate, almost 7 in. long, 2½–2¾ in. wide, pubescent on both sides, shining green above, paler beneath, the lower lvs. wavy or angled, upper one entire; petioles 2½ in. long, channeled, pubescent: peduncles terminal; fls. pendulous, brilliant orange-red, about 8 in. long; calyx ovate, 5-angled, variegated, inflated. Peru. B.R. 1739 (as *B. bicolor*). F.S. 18:1883.—All the other species are said to be easily raised from cuttings, but this is very slow to take root.

AA. *Fls. yellow.*

chlorántha, Hook. Shrub, glabrous throughout: lvs. broadly ovate, almost triangular; margin wavy, with short, rather sharp, very distinct teeth: peduncles axillary, very short; fls. pendulous, yellow; calyx tubular, with 5 nearly uniform, short, triangular teeth. Habitat unknown. B.M. 5128. Gn. 46:429; 49, p. 379.—Datura "Golden Queen" is presumably a horticultural variety of this species. While this species is horticulturally distinct by reason of its yellow fls., it is a doubtful species botanically, being founded on a very double garden form of unknown origin. In Vilmorin's

Blumengärtnerei, by Voss, it is referred to *D. humilis*, Desf., but *D. humilis*, in turn, is perhaps a form of *D. fastuosa*.

AAA. *Fls. normally white (sometimes touched with violet) or purple.*

B. *Plants tall, 7–15 ft. high: blossoms pendulous.*

C. *Calyx tubular, with 5 obscure teeth.*

suavèolens, Humb. & Bonpl. (*D. Gárdneri*, Hook.). ANGEL'S TRUMPET. Tree-like shrub, 10–15 ft. high: lvs. ovate-oblong, 6–12 in. long, 2¼–4 in. wide, entire, glabrous, petioled, often unequal at the base: fls. 9–12 in. long; calyx inflated, angled, glabrous, with 5 obscure teeth; corolla-tube plaited, the limb with 5 short lobes; anthers crowded together. Mex. G.C. III. 11:593; 23:71. S.H. 2:433.—The double form is much commoner in the gardens than the single. This is the plant which is usually cult. as *D. arborea*. It is said to be very distinct from the true *D. arborea* of Linn., but it can be separated with certainty by the calyx.

CC. *Calyx spathe-like, not toothed.*

arbòrea, Linn. (*Brugmánsia arbòrea*, Steud.). ANGEL'S TRUMPET. Small tree: lvs. ovate-lanceolate, margin entire, never wavy or angled, pubescent, in pairs, one a third shorter than the other; petioles 1 in. or more long: fls. with a musk-like odor; calyx tubular, entire, spathe-like, acuminate; corolla-tube terete, the lobes of the limb very long; anthers distinct, not conglomerate. Peru and Chile. G.C. II. 11:141.—Most of the plants cult. under this name are presumably *D. suaveolens*. The extent to which the true *D. arborea* is cult. is undetermined.

BB. *Plants less tall, only 2–5 ft. high.*

C. *Blossoms erect; calyx not spurred.*

fastuòsa, Linn. (*D. Hummàtu*, Bernh. *D.* and *B. cornucòpia*, Hort.). Fig. 1227. Annual, 4–5 ft. high, herbaceous: lvs. ovate-lanceolate, acuminate, acute and unequal at the base, toothed or wavy, glabrous on both sides, solitary, upper ones in pairs one of which is larger, 7–8 in. long, 2½–3½ in. wide; petioles 1½–2½ in. long: fls. 6½–7 in. long, violet outside, whitish within; calyx purple, angled, 2 in. long, 5-toothed, the teeth triangular lanceolate, acuminate, 5 lines long, 2–3 lines wide: caps. spiny, subglobose, 1¼ in. diam. Native of India. Naturalized in the tropics of both worlds. F.S. 14:1457. Gn. 46:224. I.H. 42:25.—The commonest garden datura. Resembles the common *D. Stramonium*, but fls. larger. Var. **álba,** Clarke (*D. álba*, Nees), has fls. white or nearly so. (*D. álba* var. *africàna*, Fedde, is distinguished by its larger lvs., longer calyx, and corolla glabrous outside. Italian Somaliland.) Var. **dùbia,** Clarke (*D. dùbia*, Don. *D. Nilhummàtu*, Dunal), has spineless frs. Var. **Huberiàna,** Hort., is a thick bushy cult. form with large fls. of several colors, running into yellowish, blue and red; it is said to be a hybrid with *D. chlorantha*.

meteloìdes, DC. (*D. Wrìghtii*, Hort.). Perennial (cult. as an annual N.), glaucescent and puberulent: branches slender, forked: lvs. unequally ovate, almost entire, acuminate, acute at both ends, upper lvs. often in pairs, the larger 2–2¼ in. long, 8–9 lines wide; petioles thickened at the base, 4–5 lines wide: calyx tubular, the teeth mostly 5; corolla about 4–8 in. long, or twice as long as the calyx, 5-toothed, the teeth slender-subulate: caps. 2 in. diam., succulent, prickly. Texas to Calif. Gt. 1859:260. R.H. 1857, p. 571. F.S. 12:1266.—Fls. white, suffused with violet, fragrant. Occurs also in Northern Mex.

CC. *Blossoms pendulous; calyx with a long spur.*

cornígera, Hook. (*D.* and *B. Knìghtii*, Hort.). Height 3–4 ft.: branches downy: lvs. chiefly at the ends of branches, ovate, petioled, acuminate, margin entire, wavy or angled: fls. pendulous, white or creamy white, very fragrant at night, striated, 5-lobed, the lobe terminated by a long awl-shaped spreading or recurved point; stamens included. Mex. B.M. 4252. *Brugmansia Knightii* seems to be a trade name for only the double form. Gn. 45, p. 549.

Weedy annual species of Datura, intro. from the tropics or warm countries and run free in this country, are: *D. Mètel*, Linn. Pubescent: lvs. entire or slightly toothed: calyx tubular; corolla-limb 10-lobed, 4 in. across: caps. nodding, prickly: 3–5 ft.: fls. white.—*D. Stramònium*, Linn. Fig. 1228. The common stramonium or jimson-weed: glabrous, green-stemmed: lvs. ovate, sinuate or angled or even cut-toothed: caps erect, with stout prickles: 2–4 ft.: fls. white. A very similar species but with a smooth and spineless caps. is D. inermis, Jacq.—*D. Tátula*, Linn. Differs from C. Stramonium in having purple sts., and violet-purple or lavender fls., and prickles of the caps. more nearly equal.



1228. Pods of Datura Stramonium. (×⅓)

Other daturas more or less cult. abroad are: *D. ceratocaùla*, Ort. Annual, 2 ft.: branches horn-shaped: lvs. broad-lanceolate: fls. very large, inside white or light violet, outside bluish, opening late in afternoon till middle of forenoon: fr. hanging, smooth. Trop. Amer. B.M. 3352.—*D. coccínea*, Hort.=D. De Noteri.—*D. colóssea aùrea*, Hort. Garden hybrid, parentage not reported, with bright golden yellow fls.—*D. De Nòteri*, Hort. Probably annual: 3 ft.: fls. fragrant, brilliant red, freely produced. S. Afr.—*D. fèrox*, Linn. St. thick, glabrous, red at base but otherwise green- or white-punctate: lvs. rhombic-ovate, angled-toothed: calyx 5-angled and about 5-parted; corolla light blue, the limb angulate: fr. unequally spiny, with 4 large spines at top. S. Eu.—*D. quercifòlia*, HBK. Annual, with green sts., the young growth somewhat pubescent: lvs. deeply sinuate-pinnatifid.: fls. as in D. Tatula: caps. bearing large and unequal flattened prickles that are sometimes ½ in. long. Mex.

WILHELM MILLER.
L. H. B.†

DAUBENTÒNIA: *Sesbania.*

DAÙCUS (ancient Greek name). *Umbellíferæ*. Perhaps 60 annual and biennial herbs of very wide distribution. One or 2 species are native to N. Amer.; one species of Daucus is the common garden carrot, and the wild form of the same species is an abundant old-field weed in the northeastern states. Aside from the carrot, there are no horticultural members of the genus. Daucus comprises bristly or setose slender plants, with pinnately decompound and often finely divided lvs., very small fls. in compound involucrate umbels, and oblong mostly dorsally flattened frs. The species are mostly of the temperate regions of Eu., Afr. and Asia.

Caròta, Linn. Figs. 821, 822. Bristly biennial, with twice- or thrice-pinnatifid lvs., the ultimate divisions cut and pointed: fls. crowded in umbellets, mostly white but sometimes blush or even pale yellow, some of the marginal fls. larger; rays of umbel numerous; involucre of many elongated-subulate divisions: fr. (or "seed") small, greenish or brownish, somewhat convex on one side and plane on the opposite side,

grooved, bristly, aromatic. Eu. Under cult., the root has been greatly developed into many edible forms.

Var. **Boissièri,** Schweinf., from Egypt and also in Spain, has blood-red or violet-colored roots. Gt. 1904:1527. L. H. B.

DAVÁLLIA (a personal name). *Polypodiàceæ.* Ferns, some of them grown under glass, and the smaller species making good plants for hanging-baskets.

Tropical plants, usually with firm, somewhat finely divided foliage and coriaceous semi-cylindric indusia, which are attached at both the base and sides, opening toward the margin of the leaf.—Some twenty species, in many parts of the globe, some of them epiphytes.

The diverse habits of growth of the many different species of davallias, and their good lasting qualities, peculiarly fit them under ordinary care for decorative purposes, when delicate and graceful plants are desired. Among the many species, the following are most often seen and best adapted for commercial purposes: *D. bullata, D. parvula,* very dwarf; *D. pentaphylla,* young fronds of a dark bronzy green, and *D. Tyermannii* (Humata), are well adapted for hanging-baskets. *D. dissecta* and var. *elegans, D. concinna* (Loxoscaphe), *D. fijiensis* and vars. *plumosa* and *major, D. fœniculacea* (Loxoscaphe), *D. solida, D. pallida* (syn. *Mooreana*) and *D. pyxidata* are adapted for large specimen plants. *D. tenuifolia* (*Odontosoria chinensis*) and vars. *stricta* and *Veitchiana* are desirable for fern-dishes, because of their dwarfish habit of growth and the ease with which they may be raised from spores.—Old plants of davallia may be cut into a number of smaller ones with a sharp knife. Planted firmly into shallow pans and placed in a temperature of 60° to 65° F., they soon develop into symmetrical plants. The rhizomes should be firmly fastened to soil by strong copper-wire staples, where they will root in a short time. To gain a large number of small plants, the rhizomes should be detached, cleaned from all soil and roots, laid on sand and thinly covered



1229. Davallia bullata, grown as a "fern-ball."

with moss. Placed in a shaded position in a temperature of 65° to 70° F., and kept moderately moist, a number of small plants will develop from the dormant eyes, which may be separately potted as soon as of sufficient size. Spores of davallia should be sown on a fine compost of soil, leaf-mold or peat and sand in equal parts, and placed in a shaded position in a temperature of 60° to 65° F. All the operations of propagation of davallias will be most successful if conducted during the spring months. All davallias delight in a rich and open compost, an abundance of light and air, and moisture at their roots, a temperature of 60° to 65° F. and a thorough syringing every bright day. (N. N. Bruckner.)

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denticulata, 5.	Mayi, 6.	*polyantha*, 12.
dissecta, 11.	*Mooreana*, 13.	pyxidata, 9.
divaricata, 12.	*ornata*, 7.	solida, 7.
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A. *Lvs. once pinnate, with few linear segms.*

1. **pentaphýlla,** Blume. Lvs. scattered, from a stout fibrillose rootstock, 1-pinnate, with 1 terminal and 4–6 pairs of lateral pinnæ, 4–6 in. long, ½in. broad; sori in marginal rows. Java and Polynesia.

AA. *Lvs. tri- or quadri-pinnatifid, deltoid.*

B. *Length of lvs. less than 1 ft.*

2. **párvula,** Wall. A tiny fern with scaly creeping rootstocks, the lvs. sessile or with stalks 1–2 in. long, the blades ½–¾in. long, ½in. broad, triangular, 2–3 pinnatifid, the segms. threadlike, pointed. Singapore and Borneo.

3. **bullàta,** Wall. Figs. 1229, 1230. Rootstock creeping, clothed with whitish or light brown hair-like scales: lvs. scattered, 6–10 in. long, 4–6 in. wide, quadripinnatifid, with deeply incised segms.; texture firm. India to Java and Japan. F.E. 11:543.—Often sold for house cult. in the form of a fern-ball.

4. **Màriesii,** Moore. Rootstock stout, with brownish scales, which are lanceolate from a broad dilated base: lvs. deltoid, 4–6 in. each way, with the pinnæ cut away at the lower side at base; segms. short-linear, 1-nerved; sori intramarginal. Japan. G.C. III. 13:571.

BB. *Length of lvs. 1–2 ft.*

C. *Foliage commonly tri-pinnatifid.*

5. **denticulàta,** Mett. (*D. élegans,* Swartz). Rootstock clothed with woolly fibers: lvs. 9–15 in. wide, with the main rachis slightly winged toward the apex; indusia several to a segm., with the sharp teeth projecting beyond the cups. Ceylon to Austral. and Polynesia.

6. **decúrrens,** Hooker. Rootstock stout, creeping, fibrillose: lf.-blade 1–2 ft. long, 9–15 in. broad, triangular, the main rachis scarcely winged at the apex, 3-pinnate, the segms. linear-oblong, broadly toothed; sori inside the margin. Philippines. Var. **Màyi,** Hort. Graceful, much divided lvs.

7. **sólida,** Swartz (*D. ornàta,* Wall.). Rootstock clothed with appressed scales or fibers: lvs. 1–2 ft. long, 12–15 in. wide, the center of the apex broad and undivided; segms. broad and slightly cut; indusia marginal. Malaya. Var. **supérba,** Hort. Lvs. flat, in young state tinted with red.

CC. *Foliage commonly quadri-pinnatifid.*

8. **canariénsis,** Smith. Rootstock stout, densely clothed with pale brown linear scales: lf.-blades 12–18 in. long, triangular, with ovate-rhombic, deeply incised segms.; sori on entire segms., or with a horn outside. Spain, Canaries, N. Afr. Var. **élegans,** Hort. Lvs. finely divided.

9. **pyxidàta,** Cav. Rootstock clothed with pale brown linear scales: lf.-blades tri-quadri-pinnatifid, 6–9 in. broad, with oblong segms.; sori with a broad space outside, which is extended into a horn-like projection. Austral.

10. **fijiénsis,** Hook. Lvs. 6–12 in. broad, with the lower pinnæ deltoid and the segms. cut into narrow, linear divisions ⅛–¼in. long; sori on the dilated apices of the segms. with no horn. Fiji Isls. A.F. 6:900; 9:233. G.C. III. 23:323.—One of the finest species, with numerous varieties. Considered by some botanists to be a variety of *D. solida.* Var. **plumòsa,** Bull. Distinct from the species by the gracefully drooping habit and feathery nature of the pendulous lvs. Var. **màjor,**

Moore. More robust: lvs. not so fine, lighter color than the species.

11. **dissécta,** J. Smith. Rootstock stout, with dense, rusty scales: lvs. 10–12 in. broad, on straw-colored stalks; segms. oblong, cuneate at base, with simple or bifid lobes; sori minute, often with 2 projecting horns. Java. Var. **élegans,** Hort. Similar to type but with more graceful habit.

BBB. *Length of lvs. 2–3 ft.*

12. **divaricàta,** Blume (*D. polyántha,* Hook.). Rootstock with linear rusty scales: lvs. tri-pinnatifid, sometimes 2 ft. broad, with deltoid segms. cut into linear-oblong lobes; sori at some distance from the edge. India to Java and Hong Kong.

13. **pállida,** Mett. (*D. Mooreàna,* Mast.). Rootstock stout, with lanceolate dark brown scales: lvs. with straw-colored stalks 12–18 in. long, quadri-pinnatifid, with deltoid, stalked segms., the ultimate obovate-cuneate, bearing the sorus on the upper side at the base. Ancityum and Borneo. A.F. 6:901; 9:231. A. G. 13:143.

For *D. concinna* and *D. fœniculacea,* see Loxoscaphe. *D. platyphylla,* see Microlepia; *D. stricta,* see Stenoloma; *D. tenuifolia,* see Stenoloma; *D. Tyermannii,* see Humata.

Several other ferns are in trade under the name Davallia, which are properly referred to other genera. Of these, disposition should be made as follows: *D. alpina*=Humata repens; *D. angustata*=Humata heterophylla; *D. brasiliensis*=Saccoloma inæquale; *D. retusa*=Odontosoria retusa; *D. tenuifolia*=Odontosoria chinensis. *D. amœna* and *D. decora* are names of uncertain standing and application.

R. C. Benedict.†

DAVÍDIA (after Armand David, French missionary, botanized in China from 1862 to 1873). *Nyssàceæ.* Ornamental deciduous trees, cultivated for their handsome foliage and the large and showy white flowers.

Leaves alternate, slender-petioled, dentate, without stipules: fls. polygamous, in dense subglobose heads consisting of numerous staminate fls. and 1 bisexual fl., with 2 large bracts at the base; sepals and petals wanting; stamens 1–7, with slender filaments; ovary 6–10-celled, with rudimentary perianth and a circle of short stamens on top of the ovary at the base of the short and thick style, with spreading stigmas: fr. a drupe with a 3–5-seeded stone.—One species in W. China.

This is a handsome tree of pyramidal habit, with rather large and attractive bright green foliage, and an object of striking beauty when studded with the very large creamy white floral bracts. The tree has proved hardy in favorable positions as far north as Massachusetts; it seems to be somewhat tender only while young. Apparently it grows well in any good fresh soil. Propagation is by seeds sown in spring, which soon germinate, and by cuttings in summer of half-ripened wood under glass; also by layers.

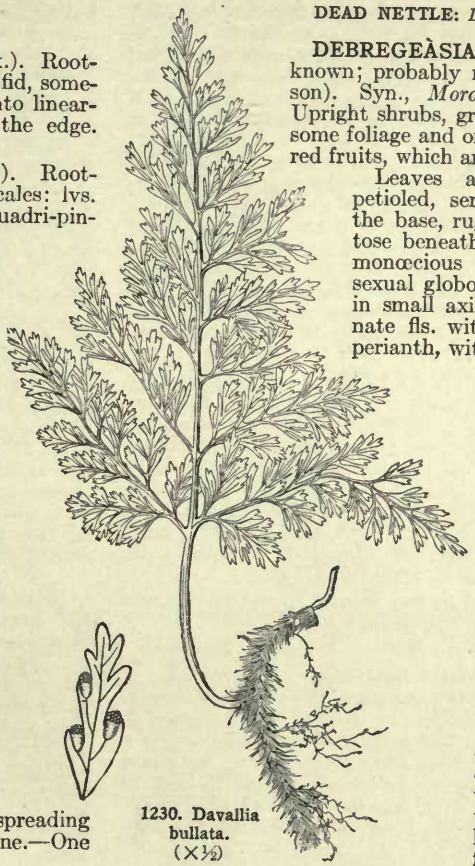
involucràta, Baill. Pyramidal tree, to 60 ft., with upright or ascending branches: lvs. cordate-ovate, acuminate, coarsely serrate, strongly veined, bright green and finally glabrous above, densely silky pubescent below, 2¼–5 in. long: heads terminal, peduncled; bracts 2, opposite, rarely 3, ovate to oblong-obovate, entire or serrate, creamy white, of unequal size, the larger to 7 in. long and to 4¼in. broad: drupe oblong-ovoid, brownish, punctulate, about 1½ in. long. May, June: fr. in Oct. W. China. Var. **Vilmoriniàna,** Hemsl. (*D. Vilmoriniàna,* Dode. *D. làeta,* Dode). Lvs. glabrous and glaucescent below, or only sparingly pubescent while young. B.M. 8432. H.I. 20:1961. G.C. III. 33:235; 39:346. J.H.S. 1903:57; 37:129, fig. 113. R.H. 1906, pp. 297–9; 1907, p. 321. R.B. 34:230. This variety is better known in cult. than the type. It was intro. in 1897 by Farges who sent seeds from which a single plant was raised by Vilmorin. Later E. H. Wilson sent seeds of the variety as well as the type, from which a large stock of plants was raised by Veitch.

Alfred Rehder.

DAY FLOWER: *Commelina.*

DAY LILY: *Funkia* and *Hemerocallis.*

DEAD NETTLE: *Lamium.*



1230. Davallia bullata. (×½)

DEBREGEÀSIA (derivation unknown; probably named after a person). Syn., *Morocárpus. Urticàceæ.* Upright shrubs, grown for their handsome foliage and ornamental yellow or red fruits, which are edible.

Leaves alternate, short-petioled, serrulate, 3-nerved at the base, rugose above, tomentose beneath; stipules bifid: fls. monœcious or dioœcious in unisexual globose clusters arranged in small axillary cymes; staminate fls. with usually 4-parted perianth, with 4 short stamens; pistillate with urceolate or obovate perianth much contracted at the mouth, with very short usually 4-toothed limb, adnate to the ovary; stigma penicillate, on a short style or sessile: fr. subglobose consisting of numerous small 1-seeded fleshy drupelets.—Five or 6 species in China, S. Asia and Abyssinia.

The two species in cultivation, neither of which is yet in trade, are spreading tender shrubs with handsome slender foliage, dark green above, whitish below, and small usually orange-red fruits resembling in shape a small mulberry and produced profusely along last year's branches. *D. longifolia* is a stove-plant; *D. edulis* is hardier, and at the Arnold Arboretum survives the winter outdoors. It is, however, killed back nearly to the ground, but sends up numerous shoots, and although it does not flower and fruit, it is an attractive bush on account of the striking contrast of the dark green lustrous upper and the white lower surface of the leaves. Propagation is by seeds and by greenwood cuttings under glass.

edùlis, Wedd. (*Morocárpus edùlis,* Sieb. & Zucc.). Shrub, to 6 ft.: branchlets appressed-pubescent, soon glabrous: lvs. oblong-lanceolate to elliptic, acuminate, serrulate, rugose and smooth above, whitish tomentose below, 3–5 in. long: fr. orange-red, globose, about ⅓in. across, in small dichotomous cymes in June. China, Japan.

longifòlia, Wedd. (*D. velùtina,* Gaud. *Conocéphalus níveus,* Wight). Shrub, to 8 ft.: branchlets villous: lvs. lanceolate to oblong-lanceolate, acuminate, serrulate, rugose and rough above, white-tomentose beneath, 4–7 in. long: fr. orange-yellow or red, ⅓in. across, in small dichotomous cymes. Subtropical Himalaya to Java. R.H. 1896, p. 321. G.C. III. 39:232, suppl.

Alfred Rehder.

DECABELÒNE: *Tavaresia.*

DECAÌSNEA (after Joseph Decaisne, French botanist, who wrote much on the botany of cultivated plants; 1809–1882). *Lardizabalàceæ.* Woody subjects grown for the large pinnate foliage and the conspicuous fruits.

Upright sparingly branched shrubs: lvs. odd-pinnate, large, with opposite entire lfts.: fls. polygamous, in axillary racemes, slender-pedicelled; sepals 6, petaloid, long-acuminate; petals wanting; stamens 6, the filaments in the staminate fl. connate into a column; pistils 3, growing into rather large oblong follicles with numerous seeds in two ranks imbedded in a white pulp.—Two species in E. Himalayas and in W. China.

These are distinct-looking shrubs, in habit resembling a large-leaved sumac, with long racemes of pendulous greenish flowers similar in shape to those of a yucca, but are smaller, and with conspicuous blue or yellow fruits which are edible, but insipid. The Chinese species has proved hardy at the Arnold Arboretum in sheltered position, while the Himalayan is tender. They prefer a sheltered situation of warm southern exposure and do not seem particular as to the soil. Propagation is by seeds.

Fárgesii, Franch. Shrub, to 15 ft.: lvs. to 3 ft. long, glabrous; lfts. 13–25, elliptic, acuminate, short-petioled, bright green above, glaucescent below, 2–5 in. long: racemes upright, many-fld.; fls. nodding, campanulate, greenish, 1–1¼ in. long; sepals lanceolate, long-acuminate, much longer than the stamens: fr. pendulous, oblong-cylindric, deep blue, 3–4 in. long, about 1 in. thick, with numerous black seeds about ⅓in. long: April, May; fr. in Sept. W. China. B.M. 7848. R.H. 1900, pp. 270, 271, 273. M.D. 1912:197.

D. insignis, Hook. f. & Thoms. In habit, lvs. and fls., very little different from the preceding species, but fr. yellow, thicker, curved. E. Himalayas. B.M. 6731. F.S. 13:1335. I.H. 3:91.

ALFRED REHDER.

DÉCODON (Greek, *ten-toothed*). *Lythràceæ.* A hardy perennial herb sometimes offered by dealers in native plants. Decodon is sometimes considered a subgenus of Nesæa, but is latterly kept distinct as a monotypic genus. It is distinguished from Lythrum by having 5 (rarely 4) petals instead of 6, and 10 stamens while Lythrum has mostly 6 or 12. It has opposite or whorled lvs., the upper with axillary, short-stalked clusters of fls.

verticillàtus, Ell. (*Nesæa verticillàta,* HBK.). SWAMP LOOSE-STRIFE. WATER-WILLOW. Smooth or downy: sts. recurved, 2–8 ft. long, 4–6-sided: lvs. lanceolate, nearly sessile: petals 5, cuneate-lanceolate, rose-purple, ½in. long; stamens 10, half of them shorter. Swampy grounds, N. E. to Fla., west to Minn. and La. —Desirable for colonizing about ponds and in very wet places. It runs into 2 or 3 varieties.

DECUMÀRIA (Latin, *decumus,* tenth, referring to the number of the parts of the flower). *Saxifragàceæ.* Climbing shrubs, cultivated for their handsome glossy foliage and clusters of attractive white flowers.

Climbing by aërial rootlets: lvs. deciduous, opposite, petioled: fls. in terminal peduncled corymbs, small, white, perfect; sepals and petals 7–10; stamens 20–30: fr. a 5–10-celled ribbed caps. opening between the ribs, with numerous minute seeds.—One species in E. N. Amer. and one in China.

These are ornamental climbing shrubs with handsome glossy foliage and fragrant white flowers, forming a corymb of feathery appearance, well adapted for covering walls, rocks, trellis work and trunks of trees; tender, but the American species survives in sheltered positions as far north as Massachusetts, while the Chinese is more tender. They thrive in almost any humid soil. Propagation is by greenwood cuttings in summer under glass, rarely by seeds.

bárbara, Linn. (*D. sarmentòsa,* Bosc). Climbing to 30 ft., but usually less high: lvs. ovate, obtuse or acute, remotely denticulate or entire, glabrous and shining above, 2–4 in. long and 1–2 in. broad: corymbs 2–3 in. broad, semiglobose. May, June. Va. to Fla., west to La. B.B. (ed. 2) 2:233. Mn. 1:41. G.C. III. 46:242, suppl.

D. sinénsis, Oliv. Very similar to the preceding; less high: lvs. generally oblong, obtuse or obtusish, 1½–3 in. long and ½–1 in. broad: pedicels appressed-pubescent. Cent. China. H.I. 18:1741.

ALFRED REHDER.

DEERBERRY: *Vaccinium stamineum.*

DEERGRASS: *Rhexia.*

DEERÍNGIA (Karl Deering, died 1749; born in Saxony, practicing physician in London and author of catalogue of plants of England). *Amarantàceæ.* About a half-dozen species of climbing herbs or subshrubs, from Madagascar to Austral., one of which is offered in Calif. Lvs. alternate: fls. dicœcious or perfect, numerous and small, in terminal spiciferous panicles; parts of fl. 5, spreading under the succulent indehiscent fr.; stamens 5, united into a ring. **D. baccàta,** Moq. (*D. celosioìdes,* R. Br.), in Austral., E. Indies and elsewhere, is a smooth woody climber, 10–12 ft.: lvs. ovate or ovate-lanceolate, acuminate, entire: fls. in slender interrupted spikes 1 ft. or less long, greenish white: berry red, nearly globular, ¼in. or less diam. B.M. 2717. The plant offered as *D. variegata,* described as a slender-growing shrub that will climb if shoots are trained up, long spikes of white fls., and lvs. margined with white, is probably a form of this species, or it may be *Bosea Amherstiana* (*D. Amherstiana,* Wall.), which has a form with variegated lvs.

L. H. B.

DEINÁNTHE (Greek *extraordinary,* referring to the flowers being large for the group). *Saxifragàceæ.* Herbs or sub-shrubs of 2 species, 1 in Japan and 1 in China, at least the Chinese species having been offered in England. Of the Hydrangea tribe, allied to Cardiandra, but lvs. opposite rather than alternate and style 1–5-forked rather than 3 and separate. *D. cærùlea,* Stapf, from China, is a perennial herb, 1–1½ ft. high, with horizontal stout rootstock, the solitary st. from the tip of the rootstock: lvs. about 4 at the top of the st., ovate or broad-elliptic, sharply toothed: fls. sterile and fertile, the former few, the fertile much larger and nodding, the petals bright blue, stamens blue, all constituting a terminal panicle. B.M. 8373. *D. bífida,* Maxim., has creamy white or pure white fls. with yellow stamens, a different infl., and lvs. deeply bifid at apex.

L. H. B.

DELABÉCHEA RUPÉSTRIS: *Sterculia rupestris.*

DELÁRBREA (after a French naturalist). *Araliàceæ.* Tall tender shrubs from New Caledonia, grown in hothouses.

Leaves alternate, decompound, gracefully arching, the lfts. leathery and entire or slightly cut: fls. falling very early, in large umbellate-paniculate clusters, not very showy. Distinguished from Aralia by its round, not angled frs.—Two species. Cult. same as Aralia.

spectábilis, Lind. & André (*Àralia concínna,* Nichols.). St. ashy gray, with brown, warty spots: lvs. odd-pinnate; lfts. in 8–10 pairs, each lft. entire or 3-toothed or twice cut, sometimes so deeply cut as to make 3 entirely free segms. I.H. 25:314.—Under the name of *Aralia spectabilis,* two different plants have been sold. One is *Aralia filicifolia.* The two plants can be distinguished at a glance. The primary division of the lf. in *A. filicifolia* is long and narrow, thrice as long as in *D. spectabilis,* and tapering to a long point, while in *D. spectabilis* the primary division of the lf. is short and has 3 well-marked segms. In *A. filicifolia* the secondary divisions are deeply and irregu-

larly cut; in *D. spectabilis* they are merely serrate. The two plants are also immediately distinguished by the black spots on the st. of *D. spectabilis*.

N. TAYLOR.†

DELAVÀYA (after J. M. Delavay, French missionary, who explored the flora of S. W. China). *Sapindàceæ*. A tree from S. W. China, allied to Xanthoceras, but differing chiefly in its 3-foliolate lvs. and in the much smaller fls. with a cupular disk. The only species, *D. toxocárpa*, Franch. (*D. yunnanénsis*, Franch.), is a small tree, to 25 ft.: lfts. lanceolate, serrate, glabrous, to 7 in. long: fls. about ½in. across, white: fr. a 2–3-lobed woody caps. with large brownish black seeds. Reported as recently intro. but probably hardy in warmer temperate regions only. ALFRED REHDER.

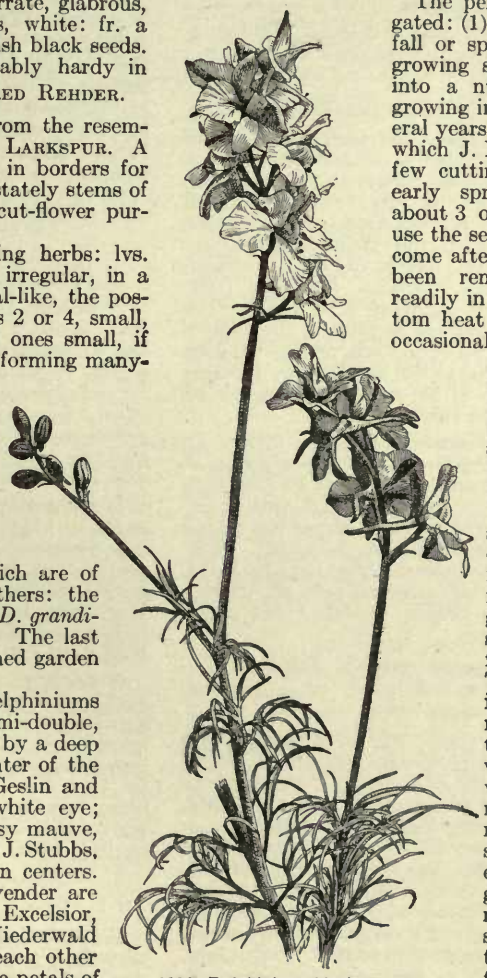
DELPHÍNIUM (Greek, *a dolphin*, from the resemblance of the flower). *Ranunculàceæ*. LARKSPUR. A group of beautiful hardy plants grown in borders for their handsome spikes of flowers and stately stems of foliage. They are of great value for cut-flower purposes as the blooms keep well.

Annual or perennial, erect, branching herbs: lvs. palmately lobed or divided: fls. large, irregular, in a showy raceme or panicle; sepals 5, petal-like, the posterior one prolonged into a spur; petals 2 or 4, small, the posterior ones spurred, the lateral ones small, if present; the few carpels always sessile, forming many-seeded follicles. Full double forms are very common in a number of the species (compare Figs. 1232, 1233). A. Gray, An attempt to distinguish between the American Delphiniums, Bot. Gaz. 12:49–54, 1887. E. Huth, Monographie der Gattung Delphinium, in Eng. Bot. Jahrb. 20:322–499, 1895. There are about 60 species, native of the north temperate zone, four of which are of much greater popularity than the others: the annual, *D. Ajacis*, and the perennials, *D. grandiflorum*, *D. hybridum* and *D. formosum*. The last three have been especially prolific in named garden varieties. See page 3568.

Some of the garden varieties of delphiniums are as follows: King of Delphiniums, semi-double, and Duke of Connaught, distinguished by a deep intense blue and conspicuous white center of the large singular flowers; Mme. Violet Geslin and Julia, cornflower-blue varieties with white eye; Amos Perry, a combination of rich rosy mauve, flushed with sky-blue; Lizzie and Rev. J. J. Stubbs, spikes of vivid azure around deep brown centers. Combinations of sky-blue, pink and lavender are striking characteristics of Diademe, Excelsior, Grille, Hallgarten, Libelle, Minerva, Niederwald and Seidenspinner, distinguished from each other by white, brown or black centers. The petals of Carmen are of deep gentian-blue and pink, surrounding a brown center; those of Lamartine and Musea, lavender-blue; and Felicite, sky-blue.—Of the perpetual-flowering Belladonna class, the trade offers the following named hybrids: Capri, clear sky-blue; Moerheimeii, pure white; Nassau, Mr. Brunton and Persimmon variations in sky-blue and azure; while the light graceful spikes of Semiplenum and Grandiflora show a clear intense cornflower-blue.—Perfect double-flowering delphiniums, though very handsome, are shy seeders and a small percentage come true to color and variety. They do not seem to share in the great popularity of the singles. Of the latter the old species *D. chinense*, *D. Davidii*, and the rather hard to handle but otherwise beautiful yellow *D. Zalil*, are well worth cultivating. (R. Rothe.)

Rocket and Candelabrum are names used to designate the forms of inflorescence in the two annual species. The "Rocket" or spike-like form is more commonly found in the Ajacis type, and the "Candelabrum," with a number of short spike-like heads of different heights, is found more often in Consolida.

Delphiniums thrive in any good garden soil, but are improved by a deep, rich sandy loam, exposed to the sun. Deep preparation of the soil is very important. The annuals are propagated from seed, which are very slow in germinating. In the warmer latitudes they may be sown in early fall and will then produce flowers early the next season; or they may be started indoors.



1231. Delphinium Ajacis. (×½)

The perennials, may be propagated: (1) By root-division in the fall or spring. The large strong-growing species may be divided into a number of plants after growing in the flower-bed for several years. (2) By cuttings, about which J. B. Keller says: "Take a few cuttings from each plant in early spring, when growth is about 3 or 4 inches long, or else use the second growth, which has come after the flower-stems have been removed. Cuttings root readily in a shaded frame, no bottom heat being required, but an occasional sprinkling during dry and hot weather is necessary. When rooted they are treated like seedlings." (3) By seeds, started in the greenhouse or hotbed in March or even earlier. The young seedlings should be given plenty of room by transplanting as they grow, and may be set in the open garden by June. If started thus early they flower the first autumn. The seed may be planted in late spring or summer, care being taken to water well during dry weather, and flowers will come the next summer. To get the best results, the perennials should be transplanted every 2 or 3 years. Two good crops of blossoms may be secured in one season by cutting away the flower-stems of the first crop as soon as the flowers have faded; of course no seeds will be produced in this way.

In most climates where they are grown the roots of the perennials are left unprotected, in the open garden, during the winter. This plan can be improved by giving the bed or border a good dressing of barnyard manure about the time the ground begins to freeze in the fall. This will greatly enrich the soil and also protect the underground buds during winter. A much better show of flowers will be the result. Because of their ability to use much fertility, it is well to spade in the manure instead of removing it in the spring. A top-dressing of manure near the plants in midsummer is used to aid in forcing the "fall" or second crop of flowers. This dressing conserves the soil-moisture, prevents weeds, and adds plant-food. Such applications of manure will make the plants more vigorous throughout. They will flower more profusely and, if desired, the roots can be divided much more freely.

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A. *Annuals: petals only 2, united: follicle 1.*

1. **Ajàcis,** Linn. Fig. 1231. An erect annual, about 18 in. high, with a few spreading branches: lvs. of st. sessile, deeply cut into fine, linear segms.; root-lvs. similar, but short-petioled: fls. showy, blue or violet, varying to white, more numerous than in *D. Consolida*, in a spicate raceme; petals 2, united; calyx-spur about equaling the rest of the fl.: follicle only 1, pubescent; seeds with wrinkled, broken ridges. May–Aug. Eu. R.H. 1893, p. 228. Same figure in S.H. 2:282.—The season of flowering is governed largely by the time of sowing the seeds. If sown in the fall, as may be done in warm climates, the plants will produce fls. by May or June. But if the seeds be sown in spring no fls. should be expected before July or Aug.

2. **Consólida,** Linn. (*Consólida arvénsis*, Opiz). An erect, hairy annual, 1–1½ ft. high: lvs. similar to *D. Ajacis:* fls. few, loosely panicled, pedicels shorter than the bracts, blue or violet or white; petals 2, united: follicle 1, glabrous; seeds with broken, transverse ridges. June–Aug. Eu. Baxter Brit. Bot. 4, t. 297. R.H. 1893, p. 228 (var. *ornatum Candelabrum*). G.Z. 15:81. Var. **imperiàlis,** Hort. (*D. imperiàlis fl. pl.*, Hort.). Fls. double. From the English gardens.—See above species for sowing of seeds.

AA. *Perennials, pure species: petals 4: follicles 3–5 (Nos. 3–27).*

B. *Sepals red.*

3. **nudicaùle,** Torr. & Gray. St. 1–1½ ft. high, glabrous, branched, few-lvd.: lvs. rather succulent, 1–3 in. across, lobed to the middle or farther 3–7 times, the secondary lobes rounded and often mucronate; petioles 3–5 in. long, dilated at the base: fls. panicled; sepals bright orange-red, obtuse, scarcely spreading, shorter than the stout spur; petals yellow, nearly as long as sepals: follicles 3, spreading and recurved, soon becoming glabrous; seeds thin-winged. Apr.–July. Along mountain streams, N. Calif. B.M. 5819. F.S. 19:1949. R.H. 1893, p. 259.—A good perennial in the E.



1232. Single larkspur. —D. grandiflorum.

4. **cardinàle,** Hook. St. erect, 2–3½ ft. high and much higher under favorable conditions, partly pubescent: lvs. smooth, fleshy, deeply 5-parted, the parts cut into long, linear lobes: raceme elongated, many-fld.; fls. bright red, with petal-limbs yellow: follicles glabrous, usually 3; seeds smooth. July, Aug. S. Calif. B.M. 4887. Gt. 6:328. F.S. 11:1105. R.B. 6:101. Gn. 19:234.

BB. *Sepals clear yellow or tipped with blue.*

5. **Przewálskii,** Huth (*D. Prsewalskiànum*, Hort.). Nearly glabrous, often branched at base, erect, varying much in height: lvs. 3–5 times deeply parted, parts divided into narrow, obtuse lobes: fls. clear yellow, or sometimes tipped with blue; spur equaling the sepals: follicles 3, densely hairy. July, Aug. Asia.—Intro. 1892.

6. **Zàlil,** Aitch. & Hemsl. (*D. sulphùreum*, Hort. *D. hýbridum* var. *sulphùreum*, Hort.). St. nearly simple, erect, 1–2 ft. high, rather glabrous, or becoming so: lvs. of several narrow, linear lobes, dark green; petioles not dilating at the base: fls. large, light yellow, in long racemes: follicles 3, longitudinally furrowed and ribbed; seeds with transverse, fibrous plates. June, July. Persia. Intro. 1892. B.M. 7049. Gn. 50:434; 54, p. 347; 71, p. 285. G. C. III. 20:247.—Seedlings from tubers and plants die down as if dead; but they make a second growth after a short period of rest.



1233. Double larkspur.—D. grandiflorum.

BBB. *Sepals blue or varying to white.*

C. *Height 1½ ft. or less.*

D. *Petioles dilating at the base.*

7. **bícolor,** Nutt. Erect, rather stout, ½–1 ft. high, from fascicled roots: lvs. small, thick, deeply parted and divisions cleft, except perhaps in the upper lvs.; segms. linear and obtuse: raceme rather few-fld., the lower pedicels ascending 1–2 in.; spur and sepals nearly equal, ½in. long or more, blue; upper petals pale yellow or white, blue-veined; lower petals blue: follicles glabrous or becoming so. May–Aug. Dry woods, Colo., west and north to Alaska.

8. **Brunoniànum,** Royle. Musk Larkspur. Sts. erect, ½–1½ ft. high: plant somewhat pubescent: upper lvs. 3-parted, lower ones reniform, 5-parted; segms. deeply cut, musk-scented: fls. large, light blue with purple margins, center black; spur very short; sepals 1 in. long, membranous and often clinging until the fr. is mature: follicles 3 or 4, villose. June, July. China. B.M. 5461. R.B. 1863:34.

9. **decòrum,** Fisch. & Mey. St. slender and weak, ½–1½ ft. high, smooth or nearly so: lvs. few, bright green; upper ones small, 3–5-parted into narrow lobes; lower and radical ones somewhat reniform in outline and deeply 3–5-parted, lobes often differing widely: fls. in a loose raceme, or somewhat panicled; sepals blue, ½in. long, equaling the spurs; upper petals at least tinged with yellow: follicles 3, thickish, glabrous. Spring. Calif. Intro. 1881 B.R. 26:64.

DD. *Petioles hardly dilating at the base.*

E. *Upper petals never yellow.*

10. **cashmeriànum,** Royle. Plant pubescent, not very leafy: st. simple, erect, slender, 10–18 in. high: root-lvs. orbicular, 2–3 in. diam., 5–7-lobed, coarsely, acutely toothed and cut; petiole 5–8 in. long; sts.-lvs. short-petioled, 3–5-lobed, cut like the radical ones, all rather thick, and bright green: infl. corymbose, the branches rather spreading; fls. 2 in. long, deep azure-blue; spur broad, obtuse, inflated, decurved, little over half as long as sepals; upper petals almost black, 2-lobed, lateral ones greenish: follicles 3–5, hairy. July–Sept. Himalayas. B.M. 6189. Gt. 32:1105. Gn. 18:568. R.H. 1893, p. 259.—Hardy in Mass., and choice.

Var. **Wálkeri,** Hook. St. very short, leafy, many-fld.: upper lvs. less lobed or almost entire, small, long-petioled: fls. very large, light blue with yellow petals. Suited to rockwork. B.M. 6830.

EE. *Upper petals yellow or striped with yellow.*

11. **tricórne,** Michx. St. succulent, about 1 ft. high: lvs. 3–5-parted, with 3–5-cleft linear lobes; petioles smooth, hardly dilating at the base: fls. large, blue, rarely whitish; upper petals sometimes yellow, with blue

veins, lower ones white-bearded; sepals nearly equaling the spur: follicles 3–4, very long, becoming glabrous, strongly diverging; seeds smooth. May. Northern states. L.B.C. 4:306.—Very beautiful and much used. Best for rockwork. The foliage dies down in midsummer and the plant appears as if dead.

12. **Ménziesii**, DC. Plant sparingly pubescent: st. simple, slender, ½–1½ ft. high, few-lvd.: lvs. small, 3–5-parted, the divisions mainly cleft into linear or lanceolate lobes; petioles hardly dilating at the base: fls. in simple, conical racemes; sepals blue, somewhat pubescent outside, nearly equaling the spurs in length; upper petals yellowish: follicles 3, pubescent, or sometimes glabrous; seeds black, winged on the outer angles. Apr.–June. On hills, Calif. and northward to Alaska. B.R. 1192.

13. **pauciflòrum**, Nutt. Roots oblong or fusiform, fasciculate-tuberous: sts. slender, nearly glabrous, ½–1 ft. high: lvs. small, parted into narrow, linear lobes; petioles not dilating at base: fls. and fr. similar to those of *D. Menziesii*, but on shorter pedicels. May, June. Colo. to Wash. and Calif. Intro. 1892.

CC. *Height usually more than 1½ ft.*

D. *Seeds wrinkled or smooth, not winged nor scaly.*

E. *Follicles always 3.*

14. **altíssimum**, Wall. Plant shaggy-hairy above: st. tall and slender, branched: lvs. palmately 5-parted, the divisions 3-lobed and toothed: bracts long-lanceolate: fls. blue or purple, in long, branching racemes; spur straight or slightly incurved, equaling the sepals; petals 2-lobed: follicles 3, erect; seeds not winged or scaly. Aug., Sept. Himalayas.

15. **exaltàtum**, Ait. St. stout, 2–4 ft. high, smoothish: lvs. flat, nearly glabrous, deeply cleft into 3–7 wedge-shaped lobes, which are often trifid; petioles usually not dilated at the base: fls. blue, with yellow on the upper petals, medium in size, on long, crowded, erect, pyramidal racemes; sepals nearly equaling the spur in length: follicles 3, pubescent or smooth; seed-coats irregularly wrinkled. June–Aug. Borders of woods, Ala. to Minn.

16. **elàtum**, Linn. (*D. alpìnum*, Waldst. & Kit. *D. pyramidàle*, Royle). Bee Larkspur. Glabrous, 2–6 ft. high: lvs. somewhat pubescent, 5–7-parted, part rather narrow, cut-lobed; upper lvs. 3–5-parted, petioles not dilated at the base: raceme much like *D. exaltatum* or more spike-like; fls. blue, with dark violet petals; sepals ovate, glabrous, nearly equaling the spurs: follicles 3; seeds transversely wrinkled, not scaly. June–Aug. B.R. 1963 (as *D. intermedium*). F.S. 12:1287. (var. *fl.-pl.*). R.H. 1859, p. 529; 1893, p. 258. —A polymorphous and complex species of Eu. It is probable that all or nearly all the plants sold here under this name should be called *D. exaltatum*, which is a closely allied species.

17. **grandiflòrum**, Linn. (*D. sinénse*, Fisch.). Figs. 1232, 1233. St. rather slender, 2–3 ft. high: lvs. rather small, many times parted into nearly distinct, narrow, linear lobes: fls. large, blue, varying to white, the spur and lower petals often violet, upper petals often yellow; spurs long and taper pointed: follicles 3, pubescent; seeds triangular, coats wrinkled, not scaly. Blooms in midsummer. Siberia. Intro. 1880. B.M. 1686. Gn. 46: 484. Var. **álbum**, Hort. Fls. pure white. Var. **álboplèno**, Hort. Fls. double and pure white. Var. **flòre-plèno**, Hort. (var. *hýbridum fl.-pl.*, Hort.). Fls. double, blue, very pretty. R.H. 1893, p. 259; 1895, p. 379 (same).—This group includes the most common and the most beautiful of the perennial delphiniums. Grandiflorum is also one of the most stately. Its striking foliage remains beautiful throughout the growing season. It is usually planted well back in the hardy border because of its height, smaller plants being in front. They may be massed as close as 2 ft. or less but produce a fine effect when 4 ft. apart.

Var. **chinénse**, Fisch. St. very slender, not much branched: lvs. and fls. like the type, but fls. more numerous. China. L.B.C. 1:71.—A favorite garden form. The double blue form has been known as *D. Bréckii*, Hort.

EE. *Follicles varying from 3–5.*

18. **caroliniànum**, Walt. (*D. azùreum*, Michx. *D. virèscens*, Nutt.). Plant somewhat pubescent: st. 1½–2½ ft. high, not much branched: lvs. 3–5-parted, the divisions 3–5-cleft into usually linear lobes: racemes spicate, usually many-fld.; fls. azure-blue, but varying to whitish or white; sepals often with a brownish spot: follicles 3–5, oblong, erect; seeds transversely wrinkled. July. N. C. to Ill., west and south. P.M. 16:258. Var. **álbum**, Hort. (var. *álbidum*, Hort.). Sts. 2–3 ft. high: lvs. larger than the type and with border divisions: fls. creamy white.—The double form of this is not much used.

Var. **vimíneum**, Gray. St. 2–4 ft. high, sometimes branched, broader-lvd., looser-fld.: fls. violet or white. Texas. B.M. 3593. B.R. 1999 (as *D. azureum*).

19. **mesoleùcum**, Link. St. 3 ft. high, pubescent above: lvs. 3–5-parted, the segms. wedge-shaped and deeply serrated; petioles somewhat dilated at the base: fls. blue, with pale yellow or whitish petals: seeds not seen. June. Nativity not known.

DD. *Seeds winged.*

E. *Upper petals never yellow.*

20. **trolliifòlium**, Gray. St. 2–5 ft., leafy, often reclining: lvs. thinnish, large, often reniform at base, 3–7-parted; lobes wedge-shaped, incised: racemes in larger plants 1–2 ft. long and very loose; fls. blue, with upper petals white; spur and sepals each ¾in. long: follicles glabrous; seeds with thin wing or crown at the end. April. Moist grounds, Columbia River. Intro. 1881.

EE. *Upper petals often yellow.*

21. **símplex**, Douglas. St. nearly simple, 2–3 ft. high, soft-pubescent throughout: lvs. many-parted, into linear divisions and lobes: racemes dense, little branched; fls. pale blue, with upper petals yellow, lower petals white-bearded; sepals equaling the spur: follicles 3, pubescent; seeds dark, with margins white-winged. June. Mts. of Idaho and Ore. Intro. 1881.

22. **Núttallii**, Gray (*D. columbiànum*, Greene). St. erect, simple, nearly glabrous, leafy, 1½–2½ ft.: lvs. thinnish, 3–5-parted, parts divided into many linear-oblong lobes: racemes long, many-fld.; sepals deep blue, ovate, sparingly pubescent, shorter than the spur; petals blue or upper ones yellow, lower ones white-bearded: follicles 3, pubescent, rather erect; seeds thin, dark, with yellow wings. Summer. Low, open woods, Columbia River. Intro. 1892.

23. **scopulòrum**, Gray. St. 2–5 ft., glabrous, at least below: lvs. 5–7-parted, the upper ones the more narrowly cleft; petioles dilating at the base: racemes simple, densely many-fld.; fls. blue or purple, rarely white, upper petals often yellow; spur ½in. long, equaling the sepals: follicles 3, pubescent; seeds large-winged. Aug., Sept. Moist ground, west of Rockies.—A polymorphous species.

Var. **subalpìnum**, Gray (*D. occidentàle*, Wats.). A smaller plant, pubescent above: broader divisions of lvs., shorter racemes, larger and deeper-colored fls.: follicles glabrous. Wasatch Mts.

24. **cheilánthum**, Fisch. St. erect, simple or branched, 2–3 ft.: lvs. glabrous or slightly pubescent, 5-parted, the lobes pointed, sub-trifid, and somewhat toothed: fls. dark blue, the upper petals sometimes pale yellow, the lower ones inflexed, ovate, entire; spur

rather long, straight or somewhat curved: follicles 3, either glabrous or pubescent; seeds 3-cornered, 3-winged, not scaly. June, July. Siberia. B.R. 473. J.F. 1, pl. 49. Gt. 13:253. P.M. 16:258 (as *D. magnificum*).

DDD. *Seeds scaly.*

25. **formòsum,** Boiss. & Huet. Fig. 1234. St. strong, 2–3 ft., hairy below, rather glabrous above: lower lvs. 5–7-parted, long-petioled; upper ones 3–5-parted, short-petioled or sessile, all alternate: racemes many-fld.; fls. blue, with indigo margins; spur long, violet, bifid at the tip: follicles 3, pubescent; seeds scaly. June, July. Asia Minor perhaps, but the origin of it is disputed. F.S. 12:1185. R.H. 1859, p. 528. G.Z. 1:144. H.F. 8:99.—The most permanent form for naturalizing, because it is so hardy. If given rich soil and good cult., it is one of the most effective for use in the permanent fl.-border. Var. **cœlestînum,** Hort. Fls. light blue.



1234. Delphinium formosum. (×⅛)

26. **Maackiànum,** Regel. Erect, 3 ft. high, pubescent or glabrous, branched above: lvs. pubescent on both sides, base often truncate or reniform, 3–5-parted, the parts serrate; petioles dilated at the base: peduncles yellow-hairy, with the bracts often inserted above the base; fls. in loose panicles; sepals blue, half as long as the spurs; petals dark violet: follicles often glabrous, ¾in. long; seeds small, distinctly scaly. July. Siberia.

27. **hýbridum,** Steph. St. 3–4 ft., pubescent above: root somewhat bulbous: lvs. 5-many-parted; lobes linear; petioles dilated and sheathing at the base: racemes dense; fls. blue, lower limbs white-bearded; spur straight, longer than the sepals: follicles 3, hairy; seeds ovate, with transverse scales. June–Aug. Mts. of Asia. R.H. 1893, p. 258; same cut in S.H. 2:282.—There are many double and semi-double varieties of this type. This is the tallest and most robust of the popular species of Delphinium. It will respond well to fertilizer and cult. When the clumps become large and strong they are usually set about 4 ft. apart. Young plants may be set 2 ft. apart and thinned a year or two later.

Var. **Bârlowii,** Paxt. Very large, semi-double fls., deep blue, with brownish center. A supposed hybrid with *D. grandiflorum.* B.R. 1944. Intro. 1892.

AAA. *Perennial, garden hybrids.*

28. **cultòrum,** Voss (*D. hýbridum,* Hort., not Steph.). The general mixed and more or less undefinable hybrid delphiniums, constituting some of the choicest garden and border plants of many colors, single, semi-double and double.

D. cæruléscens, Freyn. A fine Asiatic species, with single and double forms. P.M. 16:258.—*D. cándidum,* Hemsl. A dwarf perennial: fls. pure white. Uganda. B.M. 8170.—*D. cardiopétalum,* DC., is a pretty annual, branching very low, the outer branches very short, giving a pyramidal form when covered with blue fls. R.H. 1893, p. 228.—*D. caucásicum,* C. A. Mey. (D. speciosum var. caucasicum, Huth.). Similar to D. cashmerianum.—*D. Dávidii,* Franch. Hairy: lvs. 3-parted almost to the base: fls. light blue. China.—*D. divaricàtum,* Ledeb. Allied to D. Consolida, but taller, more branched, with smaller more abundant fls. Caucasus and Caspian region. R.H. 1912, p. 513.—*D. macrocéntron,* Oliv. Perennial, hairy in nearly all parts: fls. blue and green or yellow and green. E. Trop. Afr. B. M. 8151.—*D. Moerheìmei,* Hort. A garden hybrid.—*D. Párdonii,* Craib. Fls. blue in somewhat lax raceme. China.—*D. Párryi,* Gray, is also listed in the trade, and is closely allied to D. Consolida.—*D. Wheèlerii* is listed in the trade and is doubtless a variety of D. speciosum, Bieb., from E. Asia. Many other species may be expected in the lists of collectors and fanciers.

K. C. Davis.

DEMAZÈRIA: *Desmazeria.*

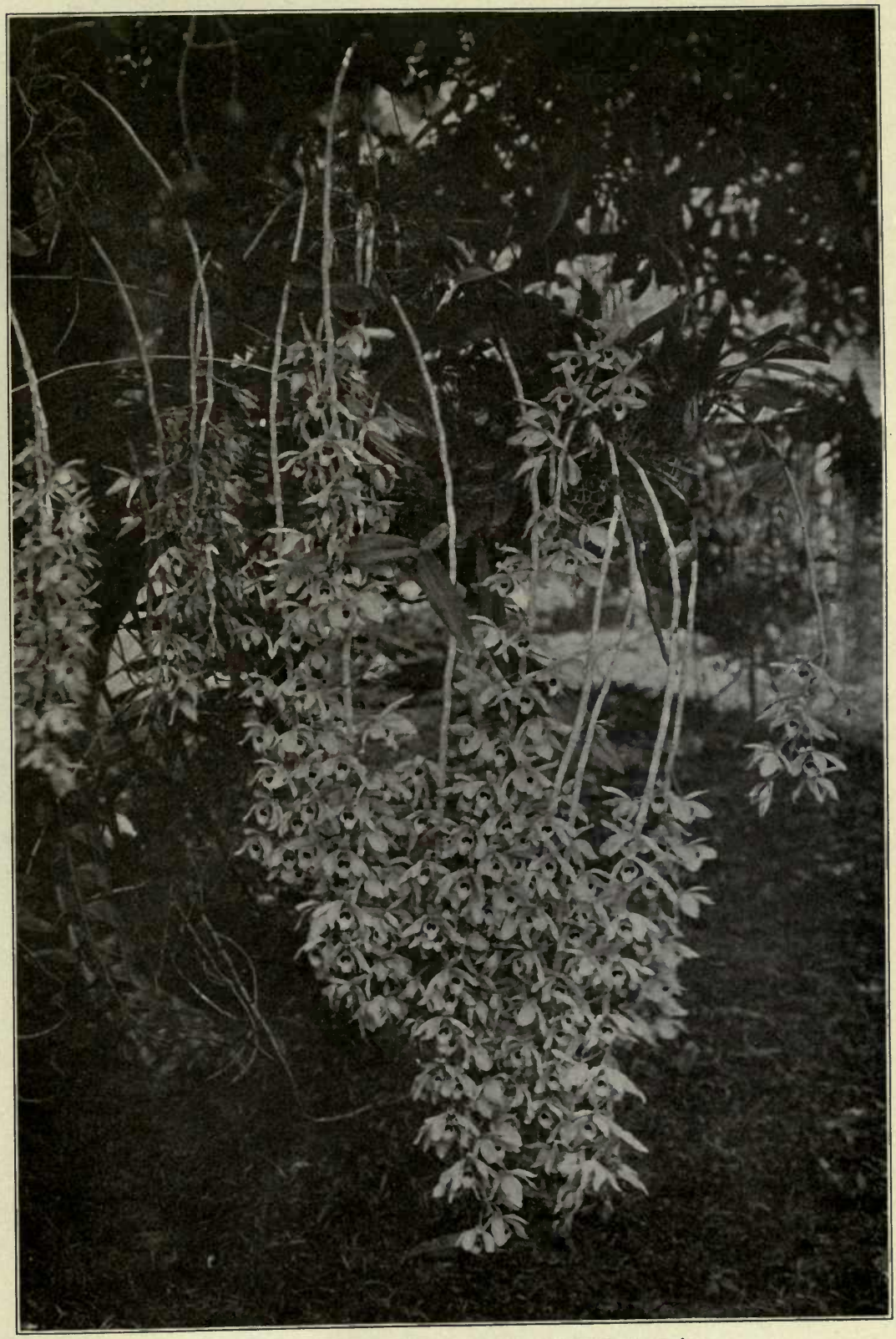
DEMERARA ALMOND: *Terminalia.*

DÉNDRIUM: *Leiophyllum.*

DENDRÒBIUM (*tree* and *life;* they are epiphytic). *Orchidàceæ.* Epiphytic orchids of great horticultural merit, grown in hothouses and greenhouses.

Pseudobulbs (sts.), tufted or arising at intervals from a creeping st. sometimes very short and thick, more commonly elongated and often thickened at or near the base, naked or leafy at time of flowering: fls. usually showy, rarely small, in terminal or lateral racemes which are long and lax or short and dense, sometimes of a few fls., or sometimes reduced to 1 or 2; sepals about equal, the dorsal free, the lateral adnate obliquely to the foot of the column, forming either a short sac-like or long spur-like foot or mentum; petals usually resembling the dorsal sepal, either broader or narrower; lip jointed or adnate to foot of column, 3-lobed or entire; pollinia 4.—A large genus of about 600 species, ranging from India and Ceylon to Austral., New Zeal., Japan, and the Pacific Isls., being especially numerous in the Malay Archipelago. There are numerous hybrids, artifically produced.

There are two well-marked sections in this genus for the guide of the cultivator, the evergreen and the deciduous. The first named should not be allowed to become dry at the roots at any period, or loss of vigor will result. Among these, also, are some that need warm-house treatment all the time, such as *D. Phalænopsis, D. bigibbum, D. Bensoniæ, D. Brymerianum, D. Dearei,* and others. There are, in fact, but few among the evergreen species that need a coolhouse, and of these *D. formosum, D. infundibulum* and its variety *Jamesianum* are conspicuous. Apart from these, the evergreen dendrobes should be kept in a warmhouse during winter where 60° F. may be maintained.—All the deciduous species (typified by *D. Nobile, D. Wardianum* and *D. Pierardii*) need a marked resting period, easily determined by the finishing up of the growth in autumn, and the swelling of the nodes for flowering in spring. When at rest, it does not hurt the plants to be subjected to a low temperature of 45°, and it may be done to retard plants for later blooming, allowing the day heat to be regulated by the sun, with plenty of ventilation on favorable days. After the pseudobulbs have flowered, they cease to be of value to the plants, and should be cut out; if there are portions that have not produced flower-buds, these may be used for propagation, cutting the pieces into lengths of several joints or nodes, and laying them on moss in a warm propagating-house or -case, when they will soon produce growths. The above also applies to the hybrids, now so numerous, that have been raised from the deciduous Indian species.—Another section that requires warmth in winter, and now very much grown for cut bloom, is represented by *D. Phalænopsis* and *D. bigibbum.* These are Australian, quite distinct in growth, and usually short-lived in cultivation. The flowers are produced freely for a



XXXV. Dendrobium superbum as grown in the American tropics.

few years, are very decorative, and the plants may be increased by taking off the young plants that often appear on the stems. These often can be grown on to strong flowering specimens, and thus the stock maintained. When wintered in a temperature less than 60°, the plants suffer, and great care is necessary at the time the young growths appear in spring to prevent damping off. Small pots or pans are best, and always keep the plants suspended near the sun and air. The evergreen tropical species, as *D. densiflorum, D. thyrsiflorum, D. aggregatum, D. Farmeri, D. moschatum, D. fimbriatum* and *D. Dalhousieanum,* also need warmth in winter and must not be dried severely during the resting-period or loss of vigor will ensue at the price of blooming. This section of the genus produces flowers from the old stems for many years. It frequently happens that growths made in India will bloom long after the plants have become established in gardens. It is thus unwise to cut old growths unless they become withered or dead. Enough water may be given to keep the plants plump, and the flowers will be produced freely in their season. In some species, growth begins before or at the time of bloom. This is usually a sign of extra vigor and should not be discouraged. The proper time to repot with all plants of flowering age, is when they begin to recuperate in early summer after the bloom is past; young roots will be seen pushing out at the base of the stems, and if this is anticipated by a week or two, the new material is soon taken to by the roots and no check is experienced. Good sound osmundine is the best material, always using small receptacles rather than large, and if larger than a 6-inch pot or pan, use perforated ones. The roots do not like exposure, but the material will be kept in a sweet healthy condition. Moss is best avoided in most cases; it often fails to grow, and is inimical to the welfare of the plants; when it does grow, it holds too much moisture about the roots. (E. O. Orpet.)

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A. *Lvs. equitant.*
SECTION I. Species 1 and 2.

AA. *Lvs. not equitant.*
B. *Lf.-sheaths black-hairy.*
SECTION II. Species 3–10.

BB. *Lf.-sheaths not black-hairy.*
C. *Pseudobulbs not thickened at base.*
D. *Mentum or chin of fls. elongated.*
SECTION III. Species 11–14.

DD. *Mentum or chin of fls. short (rather long in D. ramosum).*
E. *Fls. usually in pairs, rarely 1 or 3 or more.*
F. *The pseudobulbs leafless at flowering time.*
SECTION IV. Species 15–44.

FF. *The pseudobulbs leafy at flowering time.*
SECTION V. Species 45–55.

EE. *Fls. in 3- to many-fld. racemes (single in D. Jenkinsii).*
F. *The pseudobulbs 1-lvd., short, fusiform.*
SECTION VI. Species 56 and 57.

FF. *The pseudobulbs several-lvd.*
G. *Racemes very short, glomerate.*
SECTION VII. Species 58.

GG. *Racemes usually long, not glomerate.*
H. *Sepals and petals hairy externally; lateral lobes larger than middle lobe of lip.*
SECTION VIII. Species 59.

HH. *Sepals and petals glabrous externally.*
I. *Pseudobulbs gradually attenuated from a thick bulbous base.*
SECTION IX. Species 60.

II. *Pseudobulbs not bulbous at base.*
J. *Fls., at least the lip, purple or red.*
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JJ. *Fls. white or yellow.*
SECTION XI. Species 64–75.

CC. *Pseudobulbs fusiform-thickened above base, attenuated beyond.*
SECTION XII. Species 76.

SECTION I.

A. *Pseudobulbs leafy at base, naked above.* 1. **Macfarlanei**
AA. *Pseudobulbs leafy throughout*.....2. **anceps**

1. **Macfárlanei,** Reichb. Pseudobulbs erect, nearly cylindric, up to 9 in. tall, 2–3-lvd.: lvs. 3–4 in. long: racemes 8–15-fld.; fls. 4–5 in. across, white, except the purple markings on lateral and middle lobes of lip. New Guinea.

2. **ánceps,** Lindl. Pseudobulbs tufted, compressed, 5–8 in. long: lvs. up to 3 in. long, fleshy, laterally compressed: fls. axillary, solitary or in very short racemes, lemon-yellow at maturity. Trop. Himalayas. B.R. 1239. B.M. 3608 and L.B.C. 19:1895 (as *Aporum anceps*).

SECTION II.

A. *Raceme 1–2-, rarely 3-fld.*
B. *Mentum of fls. very short; sepals and petals green, yellow-margined*..... 3. **cruentum**
BB. *Mentum of fls. long, extinguisher-shaped.*
C. *Sepals and petals white, not keeled.*
D. *Fls. 1½–2 in. across; lateral lobes of lip manifest.*
E. *Middle lobe yellow, reflexed; lateral lobes yellowish green.* 4. **scabrilingue**
EE. *Middle lobe white, yellow-marked, fimbriate*..... 5. **longicornu**
DD. *Fls. 3 in. across; lateral lobes of lip indistinct*..... 6. **infundibulum**
CC. *Sepals yellowish white, keeled*..... 7. **cariniferum**
AA. *Raceme 3–8-fld.*
B. *Fls. yellow*..... 8. **Lowii**
BB. *Fls. white.*
C. *Petals broad, oval or obovate*..... 9. **formosum**
CC. *Petals oblong-lanceolate, narrow*...10. **draconis**

3. **cruéntum,** Reichb. Pseudobulbs erect, 10–12 in. tall: fls. 1½–2 in. across; sepals triangular-ovate, keeled; petals linear; lip 3-lobed, the lateral lobes scarlet, the middle lobe pale green, red-margined. Malay Penins. G.C. III. 18:91.

4. **scabrilíngue,** Lindl. Pseudobulbs erect, 8–14 in. tall: fls. about 1½ in. across; sepals and petals similar, ovate-lanceolate, white; lip 3-lobed, the lateral lobes yellow-green, the middle lobe reflexed, yellow with orange-yellow lines. Burma. B.M. 5515 (as *D. hedyosmum*).



1235. Dendrobium Dearei.
(×½)

5. **longicórnu,** Lindl. Pseudobulbs 8–14 in. tall, slender: fls. 2–3 in. across, white except a central orange or yellow band on lip; sepals and petals similar, elliptic-oblong; lip fimbriate; spur slender. Burma. B.R. 1315.

6. **infundíbulum,** Lindl. Pseudobulbs up to 2 ft. long, cylindric, slender: fls. about 3 in. across, white except the yellow blotch on the lip; sepals oblong-elliptic, less than half as broad as the nearly rhomboid petals; lip resembling a wide-mouthed funnel. Burma. B.M. 5446. I.H. 21:172. C.O. 6. Var. **Jamesiànum,** Hort. (*D. Jamesiànum,* Reichb.). Pseudobulbs stouter and stiffer: lateral lobes of lip roughened on the inner surface; disk cinnabar. Gn. W. 9:485.

7. **carinífera,** Reichb. Pseudobulbs 6–10 in. tall, nearly cylindric: fls. about 1½ in. across; sepals yellowish white, fading white, narrower than the ovate white petals; lip 3-lobed, the triangular lateral lobes red-orange, the middle lobe hairy, red-orange at the base, the front part white or pale orange; spur long, obtuse. Burma.

8. **Lòwii,** Lindl. Pseudobulbs 8–15 in. tall, slender: fls. 1½–2 in. across, buff-yellow; sepals narrower than the undulate petals; lip distinctly 3-lobed, the lateral lobes tipped with red, the oblong middle lobe reflexed, marked with 6 lines of red hairs. Borneo. B.M. 5303. F.S. 23:2395. C.O. 30.

9. **formòsum,** Roxbg. Pseudobulbs up to 1½ ft. tall, cylindric: fls. 3–4 in. across, white except the yellow mark on lip; sepals oblong-elliptic, about half as broad as the obovate petals; lip retuse, erose. Khasia Hills. B.R. 25:64. F.S. 3:226. P.M. 6:49. C.O. 8. O.R. 15: frontispiece. Var. **gigantèum,** Hort. Fls. 4–5 in. across. G.C. III. 24:471. Gng. 1:118–9. F.E. 10:1240. F.S. 16:1633–4. G. 25:385.

10. **dracònis,** Reichb. Pseudobulbs up to 1½ ft. tall: fls. about 1½ in. across, white except for some orange-red stripes at base of lip; sepals narrower than the petals; lip 3-lobed, the lateral lobes small, the oblong-oval middle lobe crisped and minutely toothed. Burma. B.M. 5459 (as *D. eburneum*).

SECTION III.

A. *Raceme secund*.....11. **secundum**
AA. *Raceme not secund.*
B. *Bracts small: racemes not capitate.*
C. *Fls. rosy purple, about 1 in. across*..12. **cumulatum**
CC. *Fls. white, about 2½ in. across*.....13. **Dearei**
BB. *Bracts large, colored: racemes capitate* 14. **Bullenianum**

11. **secúndum,** Wall. Pseudobulbs up to 2 ft. tall, cylindric: fls. narrow, less than 1 in. long, rosy purple, on one side of the raceme; lip with an apical orange blotch. Sumatra. B.R. 1291. B.M. 4352. C.O. 35. Var. **níveum,** Hort. Fls. white.

12. **cumulàtum,** Lindl. Pseudobulbs up to 2 ft. long, pendulous: fls. rosy purple, in short racemes with a purple axis; sepals and petals similar, oblong; lip oblong-obovate; spur obtuse, slightly curved. Burma. B.M. 5703.

13. **Dèarei,** Reichb. Fig. 1235. Pseudobulbs up to 3 ft. long: fls. white, 2–2½ in. across, in 5–7-fld. racemes; sepals lanceolate, acuminate, about one-third as broad as the oval petals; lip oblong, obscurely 3-lobed, a pale yellowish green band across the middle; spur funnel-shaped, elongated. Philippines. V.O. 3:37. G.W. 1:225. O. 1912:18. C.O. 36.

14. **Bullenià̀num,** Reichb. f. (*D. salaccénse,* Hort., not Lindl. *D. erythroxánthum,* Reichb. f.). Pseudobulbs 10–18 in. tall: racemes densely fld.; fls. yellow, striped with purple; dorsal sepal and petals oblong; lateral sepals oblong, acute, about as long as the obtuse spur; lip oblong, from a long linear base, acute. Philippines.

SECTION IV.

A. *Sepals and petals not yellow.*
B. *Lip deeply fimbriate*.....15. **Devonianum**
BB. *Lip entire or minutely fimbriate.*
C. *Nodes of pseudobulb much thickened.*
D. *Pseudobulbs thick.*
E. *Internodes abruptly depressed-globose, thickened at apex*...16. **pendulum**
EE. *Internodes gradually thickened toward apex.*
F. *Front lobe of lip ovate, reflexed, purple*.....17. **Linawianum**
FF. *Front lobe of lip orbicular-ovate, yellow*.....18. **Findlayanum**
DD. *Pseudobulbs wand-like, slender*...19. **Falconeri.**
CC. *Nodes not thickened, or but slightly so.*
D. *Internodes usually more than 5 times longer than broad.*

EE. *Lip curved like a trumpet; sepals and petals purple*....20. **lituiflorum**
EE. *Lip not curved.*
F. *Fls. white*.....21. **monile.**
FF. *Fls. with sepals and petals white, tips colored.*
G. *Throat of lip yellow.*
H. *Middle lobe violet, white-margined*.....22. **amœnum**
HH. *Middle lobe yellow, tip rose*.....23. **crystallinum**
GG. *Throat of lip purple*.....24. **transparens**
FFF. *Fls. with sepals and petals mauve, lip primrose*.....25. **Pierardii**
DD. *Internodes usually less than 5 times longer than broad.*
E. *Fls. 2½ in. across or less.*
F. *Color violet-purple*.....26. **Parishii**
FF. *Color white or lilac.*
G. *Lip primrose-yellow; sepals and petals lilac*...27. **primulinum**
GG. *Lip with ground color white, a large light or dark yellow blotch in center.*
H. *Blotch not marked; base plaited*.....28. **crepidatum**
HH. *Blotch marked.*
I. *With 2 basal purple spots*.....29. **Bensoniæ**
II. *With reddish orange lines.*
J. *Shape of lip obtuse; blotch light yellow*.....30. **cretaceum**
JJ. *Shape of lip acute; blotch deep yellow*.....31. **gratiosissi-**
EE. *Fls. exceeding 2½ in. across.* **[mum**
F. *Ground-color of sepals and petals white.*
G. *Throat deep purple*.....32. **nobile**
GG. *Throat yellow, with 2 purple spots*.....33. **Wardianum**
FF. *Ground-color of sepals and petals rose.*
G. *Front lobe of lip rose, the throat yellow*.....34. **regium**
GG. *Front lobe of lip white-margined, the throat with 2 dark spots*.....35. **rhodoptery-**
AA. *Sepals and petals yellow.* **[gium**
B. *Lip deeply pectinate-fringed*.....36. **Brymeri-**
BB. *Lip not fringed.* **[anum**
C. *Disk pilose; 2 large purple fringed spots at base of lip*.....37. **Dalhousie-**
CC. *Disk not pilose, nor with fringed spots* **[anum**
D. *The lip slipper-shaped*.....38. **moschatum**
DD. *The lip not slipper-shaped.*
E. *Unicolored, yellow.*
F. *Shape of sepals and petals acute; lip minutely serrate* 39. **dixanthum**
FF. *Shape of sepals and petals obtuse; lip fimbriate*.....40. **fimbriatum**
EE. *Bi-colored, yellow with purple markings.*
F. *Apex of lip acute; sepals and petals pale yellow.*
G. *Front lobe nearly rhomboid, cream-margined*...41. **Aphrodite**
GG. *Front lobe ovate, red-lined, the apex recurved*.....42. **aureum**
FF. *Apex of lip rounded; sepals and petals rich yellow.*
G. *Fls. 2½ in. or more across; lip with a single large spot.*
H. *Lip serrate or shortly fimbriate; floral bracts large*.....43. **clavatum**
HH. *Lip fimbriate, the divisions branched; floral bracts small*.....40. var. **oculatum**
GG. *Fls. about 2 in. across; lip with 2 spots*.....44. **Gibsonii**

15. **Devonianum,** Paxt. Pseudobulbs up to 3 ft. long, round, pendulous: fls. single or in pairs, about 2 in. across; sepals and petals white tinted amethyst at the apex, the sepals about half as broad as petals, lanceolate, the petals ovate, acute, ciliate; lip white, fringed, the apex purple, and 2 orange blotches in the throat. N. India to S. China. B.M. 4429. J.H. III. 34:197; 52:317. G.C. III. 7:680. C.O. 23. O.R. 4:177; 12:152.

16. **pêndulum,** Roxbg. Pseudobulbs abruptly swollen at the nodes, up to 2 ft. long, somewhat pendulous: fls. solitary or 2 or 3 together, 2–2½ in. long; sepals and petals white, purple-tipped, acute, the petals broader than sepals; lip white, ciliate, pubescent on upper surface, the center yellow, the front margin purple. Moulmein. B.M. 5766 (as *D. crassinode*). C.O. 19. O.R. 2:177; 8:177. Var. **Barberiànum,** Hort. Fls. brighter, the apical spots larger and deeper.

17. **Linawiànum,** Reichb. (*D. monilifórme*, Lindl., not Swartz). Pseudobulbs with internodes gradually thickened toward apex, up to 1½ ft. long, clavate: fls. in pairs or 3's, about 2 in. across; sepals and petals rosy purple above, white below, the sepals half as broad as petals; lip obscurely 3-lobed, small, the front lobe purple, the lower part white with 2 purple spots on disk. China and Japan. B. M. 4153. P.M. 3:77.

18. **Findlayànum,** Par. & Reichb. Pseudobulbs with internodes gradually thickened toward apex, up to 1½ ft. long: fls. in pairs, 2–3 in. across; sepals and petals pale lilac, the sepals much narrower than the petals; lip yellow, white-margined. Burma. B.M. 6438. Gn. 49:446. G.M. 44:373 (var *roseum*). O.R. 8:169.

19. **Fálconeri,** Hook. Pseudobulbs slender, up to 1½ ft. long: fls. solitary, 2–3 in. across; sepals and petals white, purple-tipped, the former tinged with pale rose, the petals broader than sepals; lip obscurely 3-lobed, the throat deep purple, with an orange spot on each side and a white band in front, the acute apex purple. N. India. B.M. 4944. I.H. 23:243. F.M. 1876:226. G.Z. 31:145. Var. **gigantèum,** Hort. Pseudobulbs larger: fls. larger and lasting longer.

20. **lituiflòrum,** Lindl. Pseudobulbs up to 2 ft. long, pendulous: fls. in pairs, rarely more, 2–2½ in. across; sepals and petals amethyst, the former paler at base, the latter the more richly colored, the sepals much narrower than the petals; lip curved like a trumpet, the opening turned up, the throat purple, surrounded by a white zone, the margin purple. Burma. B.M. 6050. Var. **cándidum,** Reichb. Fls. larger, the sepals and petals white, the lip sulfur-yellow. Var. **Freèmanii,** Hort. Sepals and petals deeper in color, the lip with a sulfur-yellow zone.

21. **monîle,** Kränzl (*D. japónicum*, Lindl.). Pseudobulbs up to 1 ft. long, slender-clavate: fls. solitary or in pairs, fragrant, white except for a few purple spots on the lip; sepals narrower than petals, both acute; lip acuminate, reflexed at apex. S. Japan. B.M. 5482.

22. **amœnum,** Lindl. Pseudobulbs up to 1½ ft. long, slender: fls. solitary, or sometimes in 2's or 3's, about 2 in. across; sepals and petals white, amethyst-tipped; lip with the front lobe ovate, amethyst margined with white. Nepal. B.M. 6199. G.C. II. 16:625.

23. **crystâllinum,** Reichb. f. Pseudobulbs up to 2 ft. long, somewhat pendulous: fls. solitary, or sometimes in 2's or 3's, about 2 in. across; sepals and petals white, tipped with amethyst, or this sometimes lacking in the sepals which are much narrower than the petals; lip with a yellow middle lobe margined white. Burma. B.M. 6319. Var. **álbens,** Hort. Sepals and petals pure white; lip rich yellow tipped with white.

24. **transpàrens,** Wall. Pseudobulbs up to 20 in. long, slender: fls. in pairs or 3's, about 1½ in. across, white, the sepals, petals and lip tipped pale mauve; sepals lanceolate; petals oblong-elliptic; lip recurved

at the obtuse apex, the disk with a large purple spot. India. B.M. 4663. J.F. 1:68. C.O. 27.

25. **Pierârdii,** Roxbg. (*D. cucullàtum,* R. Br.). Pseudobulbs up to 3 ft. long, slender, pendulous: fls. commonly in pairs, up to 2 in. across; sepals and petals pale rosy mauve, acute, the sepals lanceolate, much narrower than the elliptic-oblong petals; lip obscurely 3-lobed, pale primrose-yellow, pubescent on the upper surface, purple-streaked at base. India. B.R. 548 (as *D. cucullatum*); 1756. Gn. 55, p. 405. F.S. 9:955. L.B.C. 8:750. C.O. pl. 26. B.M. 2242 (as *D. cucullatum*); 2584. Var. **latifòlium,** Hort. Lvs. broader.

26. **Pârishii,** Reichb. f. Pseudobulbs up to 15 in. long, curved, rather stout: fls. solitary, or in 2's or 3's, amethyst-purple with 2 maroon spots on each side of the throat of lip; sepals oblong-lanceolate, narrower than the oval-oblong petals; lip downy, apiculate. Moulmein. B.M. 5488.

27. **primûlinum,** Lindl. Pseudobulbs up to 20 in. long, erect or nearly so, rather stout: fls. solitary or in pairs, 2–3 in. across; sepals and petals pale mauve-lilac, oblong, obtuse; lip pale primrose-yellow, purple-streaked at base, the middle lobe very broad. Nepal and Sikkim. Gt. 1861:326. J.H. III. 50:377. B.M. 5003 (as *D. nobile,* var.). Var. **gigantèum,** Hort. Pseudobulbs pendulous, more slender: fls. larger, the lip sometimes veined with pale rose.

28. **crepidàtum,** Lindl. Pseudobulbs up to 1½ ft. long, nearly erect, rather stout, longitudinally marked with white lines: fls. in 2's or 3's, about 1½ in. across; sepals and petals white, tinted lilac, obtuse, the sepals oblong, narrower than the petals; lip white tinted lilac, sometimes downy, the front lobe obtuse or retuse, the middle orange-yellow. Assam. B.M. 4993, 5011. C.O. 40. Var. **rôseum,** Hort. Fls. darker. Var. **álbum,** Hort. Fls. white.

29. **Bênsoniæ,** Reichb. f. (*D. Dartoisiànum,* De Wild. *D. signàtum,* Reichb. f.). Pseudobulbs up to 32 in. long, erect, rather slender: fls. solitary, or in 2's or 3's, 2–2½ in. across, white, the disk of the lip yellow with 2 maroon spots; sepals oblong, obtuse, much narrower than the petals; lip with the front lobe orbicular, denticulate, downy on the upper surface. British Burma. B.M. 5679, 8352. O.R. 11:241; 16:68. F.M. 355. Var. **màjus,** Hort. Fls. larger.

30. **cretàceum,** Lindl. Pseudobulbs up to 15 in long, rather stout, curved, pendulous: fls. solitary, about 1½ in. across, cream-white, with a large light yellow spot on lip streaked with orange-red; sepals and petals lanceolate, obtuse; lip with the front lobe orbicular-ovate, obtuse, downy. Khasia Hills. B.R. 33:62. B.M. 4686. F.S. 8:818. J.F. 4:344.

31. **gratiosíssimum,** Reichb. f. (*D. Bóxallii,* Reichb. f. *D. Bulleriànum,* Batem.). Pseudobulbs up to 1½ ft. long, somewhat thickened from a slender base: fls. in 2's and 3's, 2–2½in. across, white, the sepals, petals and lip tipped with rose-purple; sepals oblong-lanceolate, narrower than the ovate-lanceolate petals; lip with the front lobe broadly ovate, acute, a large yellow orange-streaked blotch in the center. Burma and Moulmein. B.M. 5652. F.M. 315. G.W. 1, p. 227.

32. **nôbile,** Lindl. Fig. 1236. Pseudobulbs up to 2 ft. long, erect or nearly so, tufted, nearly round: fls. in 2's or 3's, 2½–3 in. across; sepals and petals white, the upper portion, varying in extent, amethyst-purple, the sepals ligulate, the petals broader, oblong-oval, wavy-margined; lip with a broad nearly orbicular blade, downy, a large rich maroon spot in the center, inclosed by a cream-white zone, the apex amethyst-purple. Himalayas to China. P.M. 7:7. C.O. 1. O.R. 5:209; 9:73. G.M. 47:425. J.H. III. 48:511; 56:511. Var. **albiflòrum,** Hort. Fls. white, with a black-purple spot on the lip. O.R. 2:113; 9:73. Var. **álbum,** Hort. Fls. pure white. Var. **Amèsiæ,** Hort. Similar to the preceding, but fls. larger. Var. **Ármstrongiæ,** Hort. Sepals and petals pure white, of great size; lip very dark maroon-purple. Var. **Ashworthiànum,** Hort. Fls. pure white, except the green mouth of the lip. Var. **Balliànum,** O'Brien. Sepals and petals white; lip yellowish white or white with 2 crimson spots. C.O. 1 b. Var. **cœruléscens,** Reichb. (*D. cœruléscens,* Lindl.). Shorter and more slender pseudobulbs: fls. smaller and of a deeper color, and the lip-blade more oval. Var. **Colmaniànum,** Hort. A large, pure white variety with a sulfur-yellow disk to the lip. Var. **Cooksoniànum,** Reichb. f. Petals concave, approaching the lip in form, erect, with a large basal maroon blotch. C.O. 1*a*. O.R. 2:113; 9:73. Var. **élegans,** Hort. Fls. larger and more symmetrical; petals broader, the base white; a pale sulfur-yellow zone inclosing the maroon spot on lip, which has a rose-purple apex. Var. **formosànum,** Reichb. f. Pseudobulbs somewhat longer, pendulous: fls. with longer pedicels, the tips of the petals and lip only purple, the mouth and mentum green. Var. **jaspídium,** Hort. Fls. very showy; apex of segms. red variegated with purple. Var. **murrhinìacum,** Hort. Like var. *Ballianum,* but finer: sepals and petals slightly tinged violet; disk rich violet, finely veined with rose-violet. Var. **nobílius,** Reichb. f. Fls. larger, the sepals and petals, except at the base, deep purple; lip large, rose-tipped, deep purple in the mouth. C.O. 1*c*. G.M. 46:193. O.R. 2:113; 9:73. Var. **Oweniànum,** Hort. Var. **Ràjah,** Hort. Like var. *albiflorum,* but sepals and petals broader and flushed with delicate pink. Var. **Rothwelliànum,** Hort. Var. **Sanderiànum,** Reichb. f. Resembles var. *nobílius* but fls. smaller, the color more intense, the sepals and petals broader, the lip with a large black purple spot, the surrounding white zone larger. R. 58. O.R. 2:113; 9:73. Var. **Schneideriànum,** Reichb. f. Lip suffused with yellow, and with a deep purple spot. Var. **Schrœderiànum,** Hort. Larger fls. with broader segms., the sepals and petals white, sometimes tipped with amethyst; lip with an almost black spot, bordered with pale yellow, passing into white. Var. **summitênse,** Hort. Var. **Tolliànum,** Reichb. f. Pedicels twisted, the



1236. Dendrobium nobile. (×⅙)

fls. therefore appearing inverted; fls. not fully opening. Var. **virginàle**, Hort. Fls. pure white, except a pale primrose tinge on the lip. G.C. III. 35:357. G.M. 52: 394. O.R. 5:145; 8:121.

33. **Wardiànum**, Warner. Pseudobulbs up to 3 ft. long, round, pendulous: fls. in 2's or 3's, 3–4 in. across; sepals and petals white, oblong, usually tipped with amethyst, about half as wide as the white oval petals which are amethyst-tipped; lip white with an amethyst apical blotch, the throat yellow, with a maroon spot on each side. B.M. 5058. I.H. 24:277. F.R. 1:231. Gn. 47, p. 84. R.B. 23:25. J.H. III. 30:454; 32:237; 42:211. G.M. 45:744. C.O. 5. O.R. 2:177; 8:177; 9:frontispiece. R. 9. Var. **álbum**, Williams. Fls. white, except the yellow throat with 2 purple-crimson spots. C.O. 5a. Var. **aùreum**, Hort. Sepals and petals light yellow. Var. **Fòwleri**, Hort. Lateral sepals with yellow markings and purple blotch as in the lip. G.C. III. 31:125. Var. **xantholeùcum**, Hort. Fls. pure white, with a large orange-yellow disk to the lip.

34. **règium**, Prain. Pseudobulbs up to 1 ft. long, cylindric: fls. in 2's or 3's, nearly 3 in. across; sepals and petals purple-rose, darker veined, obtuse, the sepals oblong, narrower than the ovate or oval petals; lip with the limb nearly orbicular, purple-rose, the throat yellow, surrounded by a cream-white zone. India. B.M. 8003. G.C. III. 42:122.

35. **rhodopterỳgium**, Reichb. f. Pseudobulbs up to 2 ft. long, erect, cylindric: fls. about 2½ in. across; sepals and petals rosy purple, mottled with white; sepals oblong-lanceolate; petals oblong-ovate; lip crimson-purple, striated, white-margined, denticulate, with a central pale longitudinal band. Burma and Moulmein.

36. **Brymeriànum**, Reichb. f. Pseudobulbs up to 2 ft. long, rather stout, a little enlarged at the middle: fls. solitary or in few-fld. racemes, about 3 in. across, golden yellow; sepals broadly lanceolate, acutish, a little broader than the linear-oblong obtuse petals; lip with lateral lobes erect, fimbriated with short ciliate flexuous divisions, the middle lobe ovate, fimbriate with very long branched ciliate divisions; disk papillose. Burma. B.M. 6383. A.F. 6:609. G.C. II. 11:475; 16:689. F.M. n. s. 459. R. 92. Lind. 4:183. G.Z. 30:121. O.R. 12:249; 16:24.

37. **Dalhousieànum**, Wall. Pseudobulbs 2–4 ft. long, round, rather slender: racemes pendulous, 6–10-fld; fls. 4–5 in. across; sepals and petals pale yellow, tinted and veined with rose, the sepals ovate-lanceolate, much narrower than the ovate petals; lip concave, hairy in front, with 2 large fringed purple spots near the base. Burma. B.R. 32:10. I.H. 28:423. Gn. 48:222. G.C. III. 21:157. P.M.11:145. F.S. 7:698. C.O. 7. Var. **lùteum**, Hort. Fls. tinted sulfur-yellow, with crimson disks at base of lip.

38. **moschàtum**, Wall. Pseudobulbs up to 6 ft. tall, cylindric: racemes 5–15-fld.; fls. 3–4 in. across, faintly fragrant of musk; sepals and petals pale yellow, tinted pale rose at apex, veined and reticulated, the sepals much narrower than petals; lip slipper-shaped, pale yellow, with 2 large maroon spots encircled with orange, the front part hairy. India. B.M. 3837. B.R. 1779 (as *D. cupreum*). P.M. 2:241: Var. **Calceolària**, Veitch Man. Fls. smaller, orange-yellow, with deeper veins and reticulation, and deeper spots on lip. C.O. 13.

39. **dixánthum**, Reichb. f. Pseudobulbs up to 3 ft. tall, erect, somewhat clavate: racemes 2–6-fld.; fls. yellow, with an orange mark on lip; sepals and petals acute, the former lanceolate, narrower than the oblong, serrulate petals; lip serrulate, the blade nearly orbicular. Moulmein and Tenasserim. B.M. 5564.

40. **fimbriàtum**, Hook. Pseudobulbs 3–5 ft. tall, cylindric: racemes 6–12-fld., pendulous; fls. 2–3 in. across; sepals and petals bright orange-yellow, the former oblong-elliptic, narrower than the oblong-oval, ciliolate petals; lip bright yellow, with an orange spot on the orbicular fimbriate blade, Nepal. P.M. 2:172. J.F. 3:314. G.C. III. 25:305. C.O. 9. Var. **oculàtum**, Hook. Pseudobulbs shorter, more slender, the smaller fls. with a maroon spot on the lip. B.M. 4160. I.H. 1:15. C.O. 9*a*. P.M. 6:169 (as *D. Paxtoni*). F.S. 7:725 (as *D. Paxtoni*).

41. **Aphrodite**, Reichb. f. (*D. nodàtum*, Lindl.). Pseudobulbs up to 1 ft. long, slender, branched: fls. solitary or in pairs, 2–3 in. across; sepals and petals cream-colored, the former lanceolate, narrower than the ovate petals; lip cream-colored, with a large saffron-yellow spot in the middle, and 2 maroon spots at base, the front lobe nearly rhomboid, acute. Moulmein and Tenasserim. B.M. 5470. F.S. 15:1582.

42. **aùreum**, Wall. (*D. heterocárpum*, Wall. *D. rhomboídeum*, Lindl.). Pseudobulbs up to 1½ ft. tall, erect, somewhat clavate: fls. in 2's and 3's, fragrant, 2–2½ in. across; sepals and petals cream-colored, acute, the former oblong-lanceolate, a little narrower than the oblong-ovate petals; lip yellow, streaked with reddish purple, the front lobe ovate, acuminate, recurved, the disk velvety. Trop. Himalayas to Philippines. B.M. 4708. F.S. 8:842. P.M. 14, p. 68, desc. J.F. 4:386. C.O. 10. R. 63. B.R. 29:17. J.H. III. 52:405; 57:3. O.R. 8:41, 169. Var. **sulphùreum**, Hort. Fls. sulfur-yellow, with the usual orange-colored markings.

43. **clavàtum**, Wall. Pseudobulbs up to 3 ft. long, cylindric, pendulous: racemes 4–6-fld.; fls. 2–3 in. across; sepals and petals orange-yellow, the former oval-oblong, about half as wide as the nearly orbicular petals; lip bright yellow, with a maroon blotch in center, the front lobe orbicular, denticulate, the upper surface pubescent. Trop. Himalayas to S. China. B.M. 6993.

44. **Gíbsonii**, Lindl. (*D. fuscàtum*, Lindl.). Pseudobulbs up to 3 ft. tall, a little enlarged in the middle, slender: racemes 5–10-fld., pendulous; fls. about 2 in. across, golden yellow, with 2 maroon spots on the lip; sepals and petals oval-oblong, obtuse, about the same width; lip with the limb a little broader than long, rounded at apex, fimbriate, villous on the upper surface. Trop. Himalayas to S. China and Java. P.M. 5:169. B.M. 6226.

SECTION V.

A. *Sepals and petals white.*
- B. *Without markings.*
  - C. *Middle lobe of lip quadrate, emarginate, undulate; spur short, saccate* ..... 45. **lasioglossum**
  - CC. *Middle lobe of lip triangular, acute, ciliate; spur long, conic* ..... 46. **aqueum**
- BB. *With purple or mauve at apex* ..... 32. **nobile**

AA. *Sepals and petals purple, mauve or lilac.*
- B. *Base of lip inclosing column; sepals and petals widely spreading.*
  - C. *Lip fringed; disk yellow* ..... 47. **Loddigesii**
  - CC. *Lip denticulate; throat deep purple* 48. **superbum**
- BB. *Base of lip not inclosing column; sepals and petals ascending* ..... 49. **MacCarthiæ**

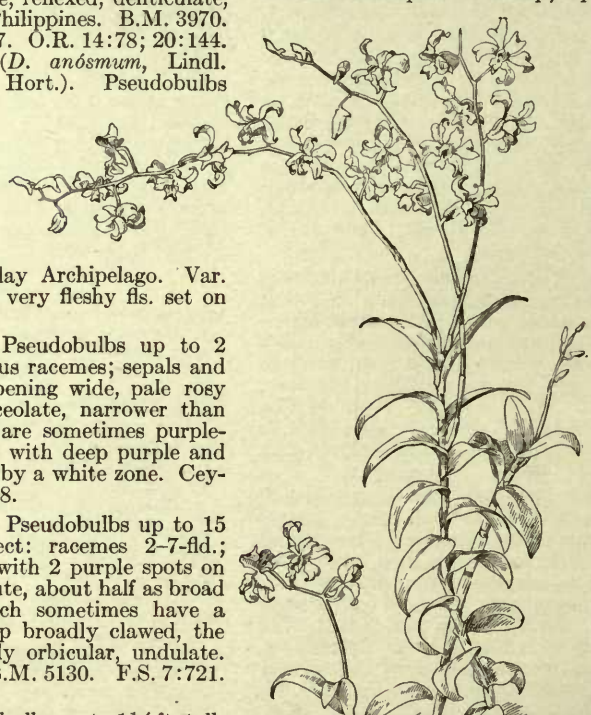
AAA. *Sepals and petals yellow.*
- B. *Color pale.*
  - C. *Fls. buff-yellow; lip clawed, with 2 purple spots* ..... 50. **albo-sanguineum**
  - CC. *Fls. primrose-yellow; lip at base convolute around column.*
    - D. *Middle lobe of lip oblong, emarginate; petals larger than sepals* 51. **luteolum**
    - DD. *Middle lobe of lip nearly orbicular, reflexed, much undulated.* 52. **ramosum**
- BB. *Color bright.*
  - C. *Lip with a single large maroon blotch* ..... 53. **ochreatum**
  - CC. *Lip with 2 purple spots.*
    - D. *Margin of lip denticulate* ..... 54. **chrysanthum**
    - DD. *Margin of lip fimbriate, the divisions long and bearded* .... 55. **Hookerianum**

45. **lasioglóssum,** Reichb. f. Pseudobulbs up to 1½ ft. long, slender, pendulous, a little enlarged at the middle: fls. in 2's or 3's, white, except the reddish lines on the side lobes of the lip; sepals ovate, a little narrower than the petals; lip 3-lobed, the lateral lobes rounded, denticulate, the middle lobe nearly quadrate, undulate, reflexed, the disk with a tuft of orange-yellow hairs. Burma. B.M. 5825.

46. **àqueum,** Lindl. (*D. álbum,* Wight.). Pseudobulbs up to 2 ft. long, rather stout, decumbent: fls. about 2 in. across, solitary or in pairs, cream-white, except a yellow spot on the lip; sepals and petals similar, broadly ovate, acute; lip obscurely 3-lobed, the middle lobe triangular, deflexed, ciliate, the upper surface pubescent. Neilgherry Hills. B.R. 29:54. B.M. 4640. J.F. 3:262.

47. **Lóddigesii,** Rolfe (*D. pulchéllum,* Lodd., not Roxbg. *D. Seideliànum,* Reichb. f.). Dwarf.: pseudobulbs 3–4 in. long: fls. solitary, about 1½ in. across; sepals and petals lilac, the sepals oblong, much narrower than the ovate petals; lip orbicular fringed, the center orange-yellow, the margin pale lilac. China. L.B.C. 20:1935. B.M. 5037.

48. **supérbum,** Reichb. f. (*D. macrophýllum,* Lindl. Plate XXXV. *D. Scortéchinii,* Hook. *D. macránthum,* Hook.). Pseudobulbs up to 3 or 4 ft. long, cylindric, pendulous: fls. in pairs, 3–5 in. across, with the odor of rhubarb; sepals and petals purple-lilac, acute, the former oblong-lanceolate, about half as wide as the oblong-ovate petals; lip with the tube a deep red-purple, this color appearing as 2 large spots in the throat, the front lobe acuminate, reflexed, denticulate, the upper surface pubescent. Philippines. B.M. 3970. C.O. 20. P.M. 8:97. F.S. 8:757. O.R. 14:78; 20:144. Var. **anósmum,** Reichb. f. (*D. anósmum,* Lindl. *D. macrophýllum Dayànum,* Hort.). Pseudobulbs shorter: fls. usually solitary, nearly odorless, smaller, the sepals and petals shorter and broader. Lind. 6:264. P.M. 15:97. Var. **gigantèum,** Reichb. f. Fls. larger. Var. **Húttonii,** Reichb. f. Fls. white, except the base of the lip and 2 spots on it which are purple. Malay Archipelago. Var. **Rìchardii,** Hort. Medium-sized very fleshy fls. set on long bristled pedicels.



1237. Dendrobium superbiens. (×⅓)

49. **MacCárthiæ,** Thwaites. Pseudobulbs up to 2 ft. long: fls. in 2–3-fld. pendulous racemes; sepals and petals ascending, the fl. not opening wide, pale rosy mauve, acute, the former lanceolate, narrower than the oblong-ovate petals which are sometimes purple-striped; lip pale purple, striped with deep purple and with a maroon spot surrounded by a white zone. Ceylon. B.M. 4886. G.W. 14, p. 408.

50. **álbo-sanguíneum,** Lindl. Pseudobulbs up to 15 in. long, stout, cylindric, erect: racemes 2–7-fld.; fls. 2–3 in. across, buff-yellow, with 2 purple spots on lip; sepals oblong-lanceolate, acute, about half as broad as the oblong-oval petals which sometimes have a few red streaks at the base; lip broadly clawed, the blade broadly obovate or nearly orbicular, undulate. Moulmein and Tenasserim. B.M. 5130. F.S. 7:721. J.F. 2:203.

51. **lutèolum,** Batem. Pseudobulbs up to 1½ ft. tall, furrowed, cylindric: fls. 2–4, in lateral racemes, 2–2½ in. across, primrose-yellow; sepals oblong-elliptic, narrower than the oval petals; lip with a few reddish streaks, slightly 3-lobed, the middle lobe oblong, emarginate, a tuft of yellow hairs below the tomentose disk. Moulmein. B.M. 5441. F.S. 23:2395 (as *D. Lowii*). J.H. III. 32:143; 51:519; 54:137. V.O. 57. Var. **chlorocéntrum,** Reichb. Fls. a little larger with greenish hairs on the lip. G.C. II. 19:340.

52. **ramòsum,** Lindl. (*D. Rúckeri,* Lindl.). Pseudobulbs up to 1½ ft. tall, slender: fls. solitary or in pairs, about 1½ in. across; sepals and petals pale primrose-yellow, the dorsal sepal oblong, the lateral triangular, the petals narrower than dorsal sepal; lip 3-lobed, the lateral lobes white, rose-streaked, the middle lobe nearly orbicular, reflexed, deeper yellow than petals, much undulated. Trop. Himalayas. B.R. 29:60.

53. **ochreàtum,** Lindl. (*D. cambridgeànum,* Paxt.). Pseudobulbs up to 10 in. long, stout, curved, cylindric, decumbent: fls. in pairs, 2–3 in. across, rich golden yellow, except the maroon blotch on lip; sepals and petals oblong, acute, similar; lip with the concave blade orbicular, recurved on the margin, the upper surface downy. Trop. Himalayas. B.M. 4450. C.O. 16. Var. **lùteum,** Hort. Fls. lemon-yellow, with blotch on lip of much lighter purple than in type.

54. **chrysánthum,** Wall. (*D. Páxtonii,* Lindl.). Pseudobulbs up to 6 ft. long, slender, furrowed, pendulous: fls. about 2 in. across, in racemes of 4–6, golden, except the 2 maroon spots on the lip; sepals oblong-oval; petals broadly obovate; lip denticulate, the middle lobe orbicular. Tropical Himalayas to Burma and southern China. B.R. 1299. Lind. 5:194. C.O. 2. G.C. III. 15:565; 40:374. Var. **anophtálmum,** Reichb. f. Lip. not spotted. Var. **microphtálmum,** Reichb. f. Petals serrate, and the spots on the lip smaller.

55. **Hookeriànum,** Lindl. (*D. chrysòtis,* Reichb. f.). Pseudobulbs up to 8 ft. long, pendulous: fls. 3–4 in. across, in pendulous racemes of 10–15, golden, except the 2 maroon spots on the lip; sepals and petals oblong, acute, similar; lip with the blade broadly oval, velvety on upper surface, fimbriate, the divisions long and bearded. Trop. Himalayas and Bengal. B.M. 6013. Lind. 16:730. I.H. 20:155. J.H. III. 33:221. Var. **brachystàchyum,** Kränzl. Fls. a little larger, fewer, in shorter racemes. Khasia Hills.

SECTION VI.

A. *Fls. usually single.*
56. **Jenkinsii**

AA. *Fls. in racemes.*
57. **aggregatum**

56. **Jénkinsii,** Wall. Dwarf: pseudobulbs up to 1½ in. long, crowded, oblong, compressed, 1-lvd.: lvs. oblong, oval, 1–2 in. long: fls. solitary, about 1½ in. across, orange-yellow, with the disk on the lip darker; sepals oval, much narrower than the rhomboid petals, the lip downy above. Assam and Burma. B.R. 25:37.

57. **aggregàtum,** Roxbg. Pseudobulbs ovate-fusiform, up to 2 in. long, crowded, 1-lvd.: lvs. 2–3 in.

long, oblong-oval: racemes pendulous, 6–12-fld.; fls. becoming orange-yellow with age, the disk deeper; sepals ovate, about half as broad as the nearly orbicular petals; lip with a pubescent disk. Burma and China. B.R. 1695. B.M. 3643. G.C. III. 50:82. C.O. 33.

SECTION VII.

58. **bicameràtum,** Lindl. (*D. breviflòrum,* Lindl. *D. callibótrys,* Ridley). Pseudobulbs tufted, fusiform, up to 16 in. long: racemes short, fascicled, on the old pseudobulbs; fls. yellow, the sepals and petals marked with red spots in lines; lip cuneate, 3-lobed, the lateral lobes small acute, the middle lobe retuse, the callus fleshy, papillate. Trop. Himalayas.

SECTION VIII.

59. **macrophýllum,** A. Rich. (*D. Veitchiànum,* Lindl. *D. macrophýllum Veitchiànum,* Hook. f. *D. fèrox,* Hassk.). Pseudobulbs stout, clavate, up to 2 ft. long, furrowed, narrowed below: lvs. up to 1 ft. long: racemes many-fld., erect; fls. about 2 in. across; sepals oblong-ovate, hairy externally, pale yellowish green, larger than the whitish spathulate petals; lip 3-lobed, the lateral lobes round, purple-streaked, the middle lobe broader than long, with radiating purple lines. New Guinea, Java, Trinos, Philippines. B.M. 5649. H.F. 2:132. Var. **stenópterum,** Reichb. f. Fls. smaller, the mentum much reduced, the sepals and petals ochre, copiously dotted inside, marked outside with large brown spots.

SECTION IX.

60. **Kingiànum,** Lindl. Dwarf: pseudobulbs 2–3 in. long, attenuated upwards from a bulbous base, 2–5-lvd.: racemes few-fld.; fls. nearly 1 in. across; sepals and petals purple, the acute ovate sepals broader than the petals; lip white, marked with purple, 3-lobed, the lateral lobes obtuse, the middle lobe reniform, apiculate; spur yellow-tipped. Queensland. B.R. 31:61. B.M. 4527. J.F. 2:143. C.O. 38.

SECTION X.

A. *Sepals and petals undulate; ovary same color as fl.* ..... 61. **superbiens**
AA. *Sepals and petals not undulate; ovary green*
B. *Fls. about 2 in. across; middle lobe of lip retuse; disk papillose* ..... 62. **bigibbum**
BB. *Fls. 2½–4 in. across; middle lobe of lip acute; disk smooth* ..... 63. **Phalænopsis**

61. **supérbiens,** Reichb. f. (*D. Gòldiei,* Reichb. f. *D. Fitzgéraldii,* F. Muell.). Fig. 1237. Pseudobulbs up to 2½ ft., cylindric, somewhat narrowed at both ends, leafy above: peduncle nearly terminal, bearing a nodding terminal raceme; fls. about 2 in. across, crimson-purple, the sepals and petals often white-bordered; sepals oblong, reflexed, undulate, narrower than the obovate petals; lip 3-lobed, the lateral lobes round, the middle lobe oblong, wavy, reflexed. Austral. F.M. 1878:294. R. 1:39. G. 34:117. G.W. 14, p. 29. G.C. III. 49:36. C.O. 15.

62. **bigíbbum,** Lindl. Pseudobulbs cylindric, somewhat fusiform, slender, up to 1½ ft. long, leafy: peduncle nearly terminal, slender, with a terminal many-fld. raceme; fls. 1½–2 in. across, purple-magenta, the lip darker; sepal oblong, acute, much narrower than the nearly orbicular petals; lip 3-lobed, the lateral lobes oblong, incurved, the intermediate one oblong, reflexed; crest white, papillose. Austral. B.M. 4898. F.S. 11:1143. Gt. 49:1473. Var. **cándidum,** Reichb. f. Fls. white.

63. **Phalænópsis,** Fitzgerald. Fig. 1238. Pseudobulbs slender, up to 2 ft. long, leafy above: peduncle terminal or nearly so, slender, bearing a terminal raceme of 8–15 fls. which are 2½–3½ in. across; sepals lanceolate, acute, white, flushed pale rose, narrower than the rhomboid orbicular mauve petals with deeper veins; lip 3-lobed, the lateral lobes round, curved over the column, maroon-purple, the middle lobe pale purple, deeper veined. Austral. G.F. 5:440 (adapted in Fig. 1238). A.F. 16: 1442. B.M. 6817. C.O. 4. Var. **hololeûceum,** Hort. Fls. white. G.C. III. 28:23. Var. **Líndeniæ,** Hort. Fls large, creamy white. Var. **Rothschildiànum,** Kränzl. Fls. 4 in. across, the sepals and petals white, suffused rose, the lip rose, intensely veined. Var. **rubéscens,** Hort. An exceptionally dark form. Var. **Schrœderiànum,** Hort. Sepals white, the petals and lip deep violet. G.C. III. 28: 238. Var. **spléndens,** Hort. Fls. bright magenta-rose, white at base of segms. Var. **Statteriànum,** Sander. Fls. deep violet. Var. **thundersleyénse,** Hort. A dark-colored form.



1238. Dendrobium Phalænopsis. (×¼)

SECTION XI.

A. *Sepals and petals not yellow.*
B. *Pseudobulbs clavate, few-jointed.*
C. *Fls. single or in racemes of 2 or 3; sepals and petals contorted* ..... 64. **tortile**
CC. *Fls. in 6- to many-fld. racemes; sepals and petals not contorted.*
D. *Lip white with a yellow spot; racemes loosely fld.* ..... 65. **Palpebræ**
DD. *Lip entirely yellow; racemes densely fld.* ..... 66. **thyrsiflorum**
BB. *Pseudobulbs cylindric, many-jointed.*
C. *Lip white, colored at base; sepals and petals white.*
D. *Middle lobe of lip broadly obcordate, resembling the petals* ..... 67. **Fytchianum**
DD. *Middle lobe, of lip narrowly oblong, much different from petals.* 68. **leucolophotum**
CC. *Lip rose with a large orange blotch; sepals and petals rose* ..... 69. **Bronckartii**
AA. *Sepals and pctals yellow.*
B. *Color pale straw-color, tinted with rose.* 70. **Farmeri**
BB. *Color clear yellow, not tinted.*
C. *Raceme of 2–4 fls.* ..... 71. **capillipes**
CC. *Raceme 10- to many-fld.*
D. *Lip deeply fimbriate, the divisions ciliate* ..... 72. **chrysotoxum**
DD. *Lip minutely fimbriate.*
E. *Throat of lip marked with purple radiating lines* ..... 73. **sulcatum**
EE. *Throat not lined.*
F. *Petals about as wide as sepals* ..... 74. **densiflorum**
FF. *Petals nearly twice as wide as sepals* ..... 75. **Griffithianum**

64. **tórtile,** Lindl. Pseudobulbs up to 1 ft. long, clavate, furrowed: fls. in 2's or 3's, sometimes solitary; sepals and petals narrowly oblong, twisted, pale lilac;

lip convolute at base, nearly orbicular, primrose-yellow, with a purple basal spot. Malay Penins. B.M. 4477. O.R. 8:201. Var. **Dartoisiànum,** O'Brien (*D. Dartoisiànum,* De Wild). Sepals and petals yellowish. French India.

65. **Pálpebræ,** Lindl. Pseudobulbs up to 10 in. long, clavate, 4-angled: racemes loosely 5–10-fld.; fls. white, except the orange-yellow disk on lip; sepals oblong, narrower than the oval petals; lip oblong, downy above, fringed near the base. Burma, Siam, China.

66. **thyrsiflòrum,** Reichb. f. (*D. densiflòrum álbolùteum,* Hook.). Pseudobulbs up to 2 ft. long, terete, leafy: racemes pendulous, many-fld., lateral; fls. 1½–2 in. across; sepals and petals white, nearly transparent, the sepals oblong-ovate, acute, narrower than the nearly orbicular denticulate petals; lip orange-yellow, downy, the blade nearly orbicular, fimbriate. Moulmein and Burma. O.R. 6:209. C.O. 18. Gn. 60, p. 282. Gt. 55, p. 98. J.H. III. 48:313. I.H. 22:207. G. 19:204. F.M. n. s. 449. Var. **Walkeriànum,** Warner. Pseudobulbs longer: fls. larger in longer racemes.

67. **Fytchiànum,** Batem. (*D. barbátulum,* Batem., not Lindl.). Pseudobulbs up to 1½ ft. tall, slender, erect: racemes 10–15-fld.; fls. 1½–2 in. across, white, except the rosy tint on sides of lip; sepals lanceolate, about one-third as wide as the obovate petals; lip 3-lobed, the lateral lobes incurved, the middle lobe broadly obcordate, with basal tufts of yellowish hair. Burma. B.M. 5444. Var. **ròseum,** Berkeley. Fls. rose.

68. **leucolóphotum,** Reichb. f. Pseudobulbs up to 1½ ft. tall, rather stout: raceme nodding, many-fld., 1-sided, on a long peduncle; fls. about 1 in. across, white, except the pale green on the side lobes and base of lip; sepals oblong-linear, keeled, much narrower than the obovate petals; lip 3-lobed, the lateral lobes incurved, the midlobe narrowly oblong. Malay Archipelago.

69. **Brónckartii,** De Wild. Pseudobulbs up to 3 ft. long, furrowed, terete, leafy: racemes pendulous, laxly many-fld.; fls. about 2 in. across, pale rose, except an orange blotch on lip; sepals elliptic-oblong; petals elliptic-ovate; lip nearly orbicular, denticulate, the disk velvety. Annam. B.M. 8252. R.B. 33:369.

70. **Fármeri,** Paxt. (*D. Pálpebræ,* Hook. not Lindl.). Pseudobulbs up to 1½ ft. tall, 4-angled, clavate, leafy: racemes pendulous, laxly many-fld.; fls. about 2 in. across; sepals and petals pale straw-color, tinted rose, the sepals oblong, acute, narrower than the broadly oval petals; lip nearly orbicular, deep yellow, downy above. Sikkim to Nepal and Burma. B.M. 4659. F.S. 7:741. J.F. 307. C.O. 30. Var. **albiflòrum,** Hort. Sepals and petals white. Var. **aùreo-flàvum,** Hook. Sepals and petals golden.

71. **capíllipes,** Reichb. f. Dwarf: pseudobulbs 2–3 in. long, fusiform: racemes few-fld.; fls. about 1¼ in. across, golden yellow, with a deeper blotch on lip; sepals lanceolate, acute, much narrower than the broadly oval petals; lip with the blade about orbicular, emarginate. Burma. B.M. 7639. Var. **élegans,** Reichb. f. Pseudobulbs taller, and base of lip deeper yellow.

72. **chrysotóxum,** Lindl. Pseudobulbs up to 1½ ft. tall, clavate or fusiform: racemes drooping, many-fld.; fls. about 2 in. across, golden yellow, except the reddish streaked orange-yellow disk on lip; sepals oblong-elliptic, about half as broad as the obovate-oblong petals; lip orbicular, fimbriate, pubescent on upper surface. Burma. G. 18:465; 30:275. B.M. 5053. I.H. 5:164. C.O. 11. Var. **suavíssimum,** Hook. f. (*D. suavíssimum,* Hook. f.). Differs in its shorter, thicker pseudobulbs, and the large chestnut spot on the lip. Burma. Gn. 13:166. C.O. 11*a*.

73. **sulcàtum,** Lindl. Pseudobulbs up to 10 in. long, clavate, furrowed: racemes 10–15-fld., short, nodding; fls. yellow, the lip deeper and purple-streaked; sepals oval-oblong, narrower than the ovate petals, lip broadly ovate. Khasia Hills. B.R. 24:65. B.M. 6962.

74. **densiflòrum,** Wall. Pseudobulbs up to 1½ ft. tall, 4-angled, clavate, leafy: racemes pendulous, many-fld.; fls. about 2 in. across; sepals and petals orange-yellow, nearly transparent, the acute sepals oblong-ovate, narrower than the denticulate nearly orbicular petals; lip nearly orbicular, orange-yellow, downy above. Nepal. B.R. 1828. B.M. 3418. F.S. 14:1397. G.W. 1, p. 223. J.H. III. 51:123; 64:94. C.O. 14. Var. **Schrèderi,** Hort. (*D. densiflòrum Schrèderi,* Hort. *D. densiflòrum álbum,* Hort.). Fls. larger in looser, longer racemes, the sepals and petals white, the lip deep orange, shading at margin to pale yellow. F.M. 502. A.G. 20:5.

75. **Griffithiànum,** Lindl. Pseudobulbs up to 1½ ft. tall, furrowed, attenuated below: racemes pendulous, many-fld.; fls. about 2 in. across; sepals and petals bright yellow, the sepals oblong-oval, narrower than the nearly orbicular petals; lip orbicular, fringed, papillose above. Burma. Var. **Guibértii,** Veitch (*D. Guibértii,* Carr.). Fls. larger and more intensely colored: pseudobulbs more abruptly narrowed below.

Section XII.

76. **crumenàtum,** Swartz. Pseudobulbs fusiform, thickened above base, then attenuated: fls. appearing successively in upper part of st., white, or suffused with pale rose; sepals acute, the petals oblong-lanceolate, acute; lip cuneate, the lateral lobes rounded, the middle lobe nearly orbicular, the disk with 5 keels. Malay Archipelago. B.R. 25:22. B.M. 4013.

D. acuminàtum, Rolfe=Sarcopodium acuminatum.—*D. ámplum,* Lindl.=Sarcopodium amplum.—*D. annaménse,* Rolfe. Fls. buff-yellow, rather membranous. Annam.—*D. arcuàtum,* J. J. Smith. Fls. white, with stout spurs curved forward at the tip. Java.—*D. Áshworthiæ,* O'Brien. Fls. cream-white, except a few purple streaks at base of lip, the sepals lanceolate or triangular, the petals clawed. New Guinea. B.M. 8141. G.C. III. 29:86. C.O. 39.—*D. atrovioláceum,* Rolfe. Racemes many-fld., the fls. about 3 in. across, the sepals and petals primrose-yellow, claret-spotted, the lip 3-lobed, the disks violet, white-striped, the middle lobe recurved, dark violet streaked white at base, the upper part yellow, claret-spotted. New Guinea. B.M. 7371. C.O. 12. O.R. 3:305; 9:152; 16:69. G.W. 14, p. 407. J.H.III. 50:355.—*D. bellátulum,* Rolfe. Dwarf, tufted: fls. 1 or 2, axillary, white with a vermilion lip. China. B.M. 7985. G.C. III. 36:114.—*D. bicaudàtum,* Reinw. Sepals and petals whitish, changing to greenish yellow, with faint purple lines; lip elongated; white. Java.—*C. Brándtii,* Kränzl. Resembles D. Phalænopsis. Fls. more fleshy, mauve-purple with silvery crests to the lip; sepals and petals twisted or curled.—*D. capituliflòrum,* Rolfe. Fls. in dense axillary heads, greenish white, with column and disk of lip bright green. New Guinea.—*D. ciliàtum,* Parish. Sepals and petals yellowish green, the lip yellow, purple-lined. Moulmein. B.M. 5430. G.W. 11, p. 340. Var. *annaménse,* Hort. A white-fld. form with fringed lip, purple at the base. Annam.—*D. Cœlógyne,* Reichb. f.= Sarcopodium Cœlogyne. C.O. 32.—*D. compáctum,* Rolfe. A small-growing species: sepals and petals pure white, linear, acuminate; lip nearly as long as sepals, light green. China.—*D. convolùtum,* Rolfe. Sepals and petals light green, with a few small dark brown markings at the base; lip green and dark brown. New Guinea.—*D. criníferum,* Lindl. "Fls. lasting only a single day, whitish, with a 3-lobed lip which breaks up in front into a fringe of long spreading yellow filaments." Malaya. G.C. III. 43:194.—*D. cucumérinum,* M'Leay. Dwarf: lvs. oblong, terete, with tubercles arranged in lines: fls. 3–5, white or yellowish, purple-streaked. New S. Wales. J.F. 4:358. B.M. 4619.—*D. delicátulum,* Kränzl=D. subacaule. —*D. delicàtum,* Bailey. Sepals and petals milky white the lip white, violet-lined, the callus golden, minutely violet-dotted New Guinea. G. 34:245.—*D. epidendrópsis,* Kränzl. Resembling an epidendrum: fls. greenish or yellow outside, yellow inside, about 1½ in. long. Philippines.—*D. Faulhaberiànum,* Schltr. Fls. violet-rose; lateral sepals forming a mentum scarcely ½in. long. Hainan.—*D. fusifórme,* Bailey=D. speciosum fusiforme.—*D. glomerátum,* Rolfe. Fls. rose-purple, in few-fld. fascicles, the lip golden carmine. Molucca. Gn. 65, p. 123.—*D. Goldschmidtiànum,* Kränzl. Over a foot high: racemes short, about 12-fld.; fls. deep rose-purple. Formosa.—*D. Hildebrandii,* Rolfe. Racemes axillary, 3–4-fld.; sepals and petals white, the lip primrose-yellow, the tube pubescent externally. Burma. B.M. 7453. O.R. 3:49; 12:153; 16:26.—*D. Hódgkinsonii,* Rolfe. Raceme 5–7-fld., terminal; fls. pale green, the lip purple-nerved. New Guinea. B.M. 7724.—*D. Imthurnii,* Rolfe. Probably the most robust of all dendrobiums in cult.: racemes axillary, many-fld.; fls. of medium size, white, with lilac streaks on lateral lobes of lip. New Hebrides. B.M. 8452.—*D. inæquále,* Rolfe. Flowering pseudobulbs separate from leafy ones, clavate, the fls. secund, arising alternately from the margin of the internodes; sepals and petals white, the lip tubular, pale yellow, purple-streaked inside.

New Guinea. B.M. 7745.—*D. Jerdoniànum*, Wight=D. nutans.—*D. kardénse*, Schlecht. Fls. solitary in axil of lf. at apex of the st., small, white. A curious species. New Guinea.—*D. Madónnæ*, Rolfe=D. rhodostictum.—*D. monophýllum*, F. Muell. In habit resembling a bulbophyllum: racemes with 9-15 greenish yellow fls. Austral.—*D. Mórtii*, F. Muell. Fls. solitary; sepals and petals light yellow; lip whitish, marked with lilac with 3 undulate green keels on disk. New S. Wales.—*D. muricàtum munìficum*, Finet.= Inobulbon munificum.—*D. nùtans*, Lindl. Fls. short, in few-fld. racemes, golden; sheaths hispidulous. Malabar. B.M. 7741. C.O. 28 (as D. Jerdonianum).—*D. puniceum*, Rolfe. Fls. in racemes, light rose-pink, with light yellow tips to the sepals and petals. New Guinea.—*D. quinàrium*, Rolfe. "Fls. light yellow with several light brown nerves in front of lip." New Guinea.—*D. rhodostictum*, F. Muell. Fls. white, with a few purple spots on margins of lateral lobes of lip. New Guinea. B.M. 7900 (as D. Madonnæ). G.C. III. 43:162.—*D. roséllum*, Ridley. Fls. rose-colored. Borneo.—*D.ròseo-nervàtum*, Schlecht. Fls. pale rose, borne at the summits of the sts. Sumatra.—*D. Sánderæ*, Rolfe. Pseudobulbs up to 3 ft. long, leafy: racemes lateral, 3–4-fld.; fls. large, white, the lip with purple stripes on the disk and lateral lobes, the middle lobe obovate, truncate, crenulate. S. E. Asia. B.M. 8351. G.C. III. 45:374. G.M. 52:621. O.R. 17:209.—*D. Schínzii*, Rolfe. Fls. pale green, very fugacious. Sumatra.—*D. Schuétzei*, Rolfe. Fls. very large, white. A new species of the D. Dearii group.—*D. senile*, Pav. & Reichb. f. Pseudobulbs fusiform, hairy, as are the lvs.: fls. in pairs or solitary, fleshy, rich yellow, with a few orange streaks on lip. Burma, Tenasserim. Moulmein. B.M. 5520. G.W. 9, p. 422.—*D. spathàceum*, Lindl. A small species with slender pseudobulbs: fls. white. Sikkim.—*D. speciòsum fusifórme*, Bailey. Pseudobulbs fusiform: fls. pale sulfur or straw-color to nearly white, the lip white, marked with violet. Austral. G. 33:361. G.C. III. 41:337.—*D. spectábile*, Miq. Pseudobulbs up to 2 ft., clavate, grooved: fls. 3 in. across, white, streaked and spotted with dark purple, the sepals and petals undulate, recurved, the former triangular-lanceolate, the petals much narrower; lip undulate, narrowly panduriform, the narrow lanceolate tip recurved. New Guinea and Solomon Isls. B.M. 7747. C.O. 22. A.G. 21:239. G.M. 43:53. Var. *Símmondsii*, Hort. Lip much longer than in the type, white, veined with dark purple.—*D. spùrium*, J. J. Smith. Fls. solitary; sepals and petals white. A distinct and singular species. Java, Borneo.—*D. striàtum*, Hort. "Sepals and petals narrow and nearly equal; labellum as long as petals, narrow, with sides folded back, whitish tinged with rose." Philippines.—*D. subacaùle*, Reinw. Fls. fragrant, white speckled with purple on lip; lip with very short apiculate middle lobe. Queensland. —*D. taurìnum*, Lindl. Pseudobulbs cylindric: racemes many-fld.; fls. large, the sepals white, the petals and lip pale rose, intensely striated. Philippines. G.C. III. 31:90. B.R. 29:28.—*D. tonkinénse*, De Wild. Lip entire, furnished with crests, the median one very prominent. Tonquin.—*D. Treacherìanum*, Reichb. f. = Sarcopodium Treacherianum.—*D. triflòrum*, Lindl.=Sarcopodium cymbidioides.—*D. undulàtum* var. *Broòmfieldii*, Fitzgerald. Fls. pale greenish yellow. N. Austral.—*D. Victòriæ-reginæ*, Loher. Racemes few-fld.; sepals and petals white at the base, violet-purple above, the lip golden at the base, violet-purple above, marked with black-purple lines of papillæ. Philippines. G.M. 51:610; 54:556. Gn. 75, p. 370. C.O. 21. O.R. 20:17.—*D. Williamsii*, Day & Reichb. f. Pseudobulbs up to 1 ft. tall, hairy, as well as the lvs.: fls. usually in pairs, 2½–3 in. across, ivory-white or yellowish, the throat of lip bright orange-red. N. E. India. B.M. 7974. G.C. III. 35:341.—*D. Wilsonii*, Rolfe. Racemes 2- or 3-fld.; fls. delicate pink or nearly white, with small yellow blotch on disk of lip. W. China.—*D. Wolteriànum*, Schltr. Racemes many-fld.; fls. rose-colored. New Guinea.

The following are some of the hybrid forms: *D. Áinsworthii*, Moore (D. aureum × D. nobile). Fls. white, more or less suffused with rose, the lip with a feathered purple spot. C.O. 1. Gn. 51, p. 338. G.C. II. 16:624. J.H. III. 62:281.—*D. Apóllo grandiflòrum* =D. rubens.—*D. Artemis*=D. aureum × D. Ainsworthii. O.R. 14:72.—*D. Aspàsia*=D. aureum × D. Wardianum. O.R. 1:137.—*D. burfordiénse*=D. aureum × D. Linawianum. G 29:35.—*D. Cassiope*=D. moniliforme × D. nobile. C.O. 2.—*D. chrysodiscus*= D. Ainsworthii × D. Findlayanum.—*D. Cúrtisii*=D. aureum × D. Cassiope. Gn. 69, p. 145. O.R. 14:73.—*D. Dálhousii-nóbile* = *D.* nobile × D. pulchellum. G.C. III. 27:379.—*D. dominyànum*=D. nobile × D. Linawianum.—*D. dúlce*=D. aureum × D. Linawianum. —*D. Edithæ*=D. nobile nobilus × D. aureum.—*D. endócharis*= D. aureum × D. monileforme. G. 32:293. G.Z. 36, p. 195.—*D. euòsmum*=D. endocharis × D. nobile.—*D. Leechiànum*=D. aureum × D. nobile. R.H. 1904:280. C.O. 1*a*.—*D. melanodiscus gloriòsa*=D. Ainsworthii × D. Findlayanum. G.C. III. 35:219.—*D. melanodíscus pállens*=D. Ainsworthii × D. Findlayanum. J.H. III. 50:25.—*D. Rœblingiànum*,=D. nobile × D. ramosum. Gn. 59, p. 198, desc.—*D. Rólfeæ*=D. nobile × D. primulinum.—*D. Rólfeæ ròseum*=D. nobile × D. primulinum. Gn. W. 18:541.—*D. rùbens grandiflòrum*=D. Ainsworthii × D. nobile. G.M. 53:206.—*D. Schneideriànum*=D. aureum × D. Findlayanum.—*D. splendidissimum grandiflòrum*=D. nobile × D. aureum. G.M. 43:179. Gn. 65, p. 140.—*D. Thwàitesæ*=D. Ainsworthii × D. Wiganiæ. G.M. 47:273.—*D. Vènus*=D. nobile × D. Falconeri. G.M. 51:459. C.O. 3.—*D. Wigánіæ*=D. nobile × D. signatum.—*D. Wigániæ xanthochílum*=D. nobile × D. signatum. Gn. W.20:161.—*D. Wiganiànum*=D. Hildebrandii × D. nobile. G.M. 44:167.—*D. xanthocéntron*=D. Wardianum × D. Linawianum.

GEORGE V. NASH.

DENDROCÁLAMUS: A few large bamboos of the East Indies and China; see *Bamboo*.

DENDROCHÌLUM: *Platyclinis*.

DENDROMÈCON (Greek *dendron*, tree; *mecon*, poppy). *Papaveràceæ*. An outdoor shrub in California, with bright yellow flowers; sparingly grown elsewhere.

Smooth low branching plant with rigid alternate mostly entire lvs.: fls. golden yellow, 1–3 in. across, single on short pedicels; petals 4, large; sepals 2; stamens many, short: fr. a linear curved grooved caps. 2–4 in. long.—Long considered to comprise a single species, but lately redefined by Fedde into 20 species, but only one species-name appears to be in the trade. The division into species is largely on foliage characters. It is not unlikely that some of the cult. material represents one or more of these segregates.

rígida, Benth. Rigid, very leafy, 2–10 ft. high: sts. up to 2 in. thick: bark whitish: branches stiff, erect: lvs. lanceolate or ovate-lanceolate, coriaceous, reticulately veined, very acute and mucronate: fls. on pedicels, 1–4 in. long: seeds black, almost globular. Dry parts of Coast ranges and in the Sierras. B.M. 5134. F.S. 14:1411. Gn. 50:292. J.H. III. 29:92.—Spring-flowering. In England it is somewhat tender, requiring some protection in winter. Prop. from seeds, that take very long to germinate. Considerable variation in size of fls. appears to depend on the conditions in which plants are growing. Evergreen, but in hard winters in Calif., loses most of its lvs. by Feb., when, becoming scraggly, it may be cut back to ground for renewal. L. H. B.†



1239. Tip of leaf of Dennstædtia punctilobula. (×¼)



1240. Fruiting lobe of Dennstædtia punctilobula.

DENDRÓPANAX (Greek, *tree Panax*). *Araliàceæ*. Unarmed trees and shrubs from Trop. Amer. and Asia, also China and Japan. Fls. hermaphrodite, rarely polygamous. Species about 20. *D. japónicum*, Seem. (*Hédera japónica*, Jungh.), may be secured from dealers in Japanese plants. The lvs. have been compared to *Fatsia japonica*, but are smaller and mostly 3-lobed but simple. The floral parts are in 5's: infl. umbellate, terminal nearly simple and not showy: berry globose. Cult in temperate house. N. TAYLOR.†

DENDROPHÝLAX: *Polyrrhiza*.

DENNSTÆDTIA (August Wilhelm Dennstedt, early German botanist). *Polypodiàceæ*. Hardy or greenhouse ferns of wide distribution, often referred to Dicksonia but belonging to a different family from the tree ferns of the latter genus from the antarctic or southern hemisphere. Indusium inferior cup-shaped, open at top and adherent on outer side to a reflexed toothlet: lvs. 2–3-pinnatifid, from erect or creeping rootstocks. Species about 30; of simple cultural requirements.

punctilóbula, Moore (*Dicksònia pilosiúscula*, Willd.). Figs. 1239, 1240. Rootstock slender, creeping, underground: lvs. light green, 1–2½ ft. long, 5–9 in. wide, usually tri-pinnatifid, under surface minutely

glandular, giving the dried lvs. a somewhat pleasant fragrance; sori minute, on small, recurved teeth. Canada to Tenn.—Sometimes called hay-scented fern, and boulder fern. Likes light porous soil and semi-shaded places. Variable.

Smíthii, Moore. Lvs. thick, the under surface almost woolly, glandular, tripinnate; lower pinnæ 9–12 in. long, 3–4 in. wide; sori 2–8 to each segm. Philippines.

dissécta, Moore. From the W. Indies, often 6–7 ft. high, with broad (2–4 ft.) lvs.—Sometimes seen in cult. and is well worth a place in the trade.

L. M. UNDERWOOD.

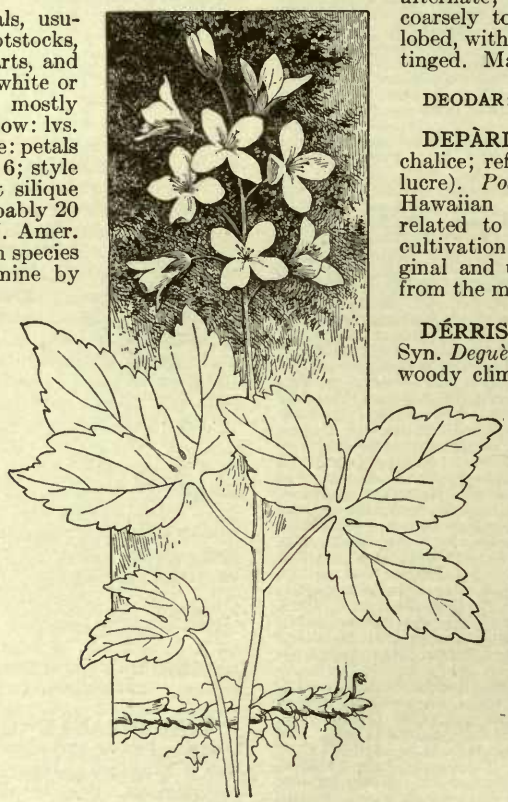
DENTÀRIA (Latin, *dens*, tooth; referring to the toothed rootstocks). *Cruciferæ*. TOOTHWORT. Small early-flowering herbs, sometimes offered by dealers in native plants.

Hardy herbaceous perennials, usually with pleasant-tasting rootstocks, 2 or 3 lvs., mostly with 3 parts, and corymbs or racemes of large white or purplish fls. in spring: sts. mostly unbranched and not leafy below: lvs. palmately 3-divided or laciniate: petals surpassing the sepals; stamens 6; style slender: fr. a very narrow flat silique dehiscent from the base.—Probably 20 species in Eu., Asia and in N. Amer. The European and E. American species are readily told from Cardamine by habit and many obvious differences, but the W. American representatives of the 2 genera converge so that some botanists have merged Dentaria into Cardamine. (See E. L. Greene, Pittonia, 3:117–124.)

Several species are cultivated in Old World rockeries. They are of easy culture in light rich soil, and moist shady positions. Usually propagated by division, as seeds are not abundant.

A. *Rootstock continuous, not tuberous.*

diphýlla, Michx. PEPPER-ROOT. Fig. 1241. Eight to 16 in.: rootstock several inches long, often branched, strongly toothed at the many nodes: st.-lvs. 2, similar to the root-lvs., close together; segms. 3, ovate or oblong-ovate, coarsely crenate, the teeth abruptly acute: petals white inside, pale purple or pinkish outside. Nova Scotia to S. C., west to Minn. and Ky. B.M. 1465.—Rootstocks 5–10 in. long, crisp, tasting like water-cress. Pretty spring fl.



1241. Dentaria diphylla. (×½)

AA. *Rootstock tuberous or jointed.*

B. *Lvs. deeply 3-parted, but not into distinct lfts.*

laciniàta, Muhl. Eight to 16 in.: the st. pubescent above: tubers deep: st.-lvs. 3, with lateral segms. often 2-lobed, all oblong to linear, more or less sharply toothed: petals purplish to white. Que. to Minn., south to Fla. and La. Var. **íntegra,** Fern., has the lateral segms. entire or nearly so. *D. anómala,* Eames, is perhaps a hybrid with *D. diphylla;* Conn.

macrocárpa, Nutt. (*C. gemmàta,* Greene). St. simple, 4–15 in.: lvs. 1–3, palmately or pinnately 3–5-parted, or divided; segms. linear to oblong, entire: fls. purple or rose: tubers with joints about 1 in. long. N. Calif. to Brit. Col.

BB. *Lvs. of st. cut into 3 distinct lfts. (except sometimes in D. californica).*

tenélla, Pursh. Six to 12 in.: tubers small, irregular: basal lvs. simple and round-cordate, crenate or sinuate; st.-lvs. 1 or 2, nearly sessile, sometimes bulbiferous; lfts. linear-oblong or linear, obtuse, entire: petals rose. Ore., Wash.

califórnica, Nutt. Tubers mostly small: st. ½–2 ft. high: lvs. very variable; st.-lvs. 2–4, mostly short-petiolate, and above the middle of the st. with 3–5 lfts., rarely simple or lobed; lfts. mostly short-petiolulate, ovate to lanceolate or linear, entire or toothed: petals white or rose. Mountains and streams of Calif. and Ore.

máxima, Nutt. Ten to 16 in.: tubers near the surface, jointed, strongly tubercled: st.-lvs. 2 or 3, usually alternate; lfts. ovate or oblong-ovate, coarsely toothed and somewhat cleft or lobed, with petiolules: fls. white or purple-tinged. Maine to Mich. and Pa.

L. H. B.†

DEODAR: *Cedrus Deodara.*

DEPÀRIA (Greek, *depas,* a beaker or chalice; referring to the form of the involucre). *Polypodiàceæ*. A small genus of Hawaiian and South American ferns related to Dennstædtia, rarely seen in cultivation in America. The sori are marginal and usually on stalked projections from the margin of the leaf.

DÉRRIS (Greek, *a leather covering*). Syn. *Deguèlia. Leguminòsæ.* Tropical, tall woody climbers (sometimes trees), one of which has been offered in S. Calif., but is now apparently out of cult. there. Lvs. alternate; lfts. opposite, the odd one distant; stipules none: fls. violet, purple or white, never yellow, in racemes or panicles or fascicles, papilionaceous, standard broad and rounded; wings oblique: pod indehiscent; 1- to several-seeded.—About 40 species, of little horticultural significance.

scándens, Benth. Climbing: lfts. 9–18, 1–2 in. long, oblong, obtuse, or acute, glabrous or minutely pilose beneath: fls. pale rose, in very long racemes: pod long, lanceolate, acute at both ends, narrowly winged at the base; ovules 6–8. S. Asia and Indian Archipelago to Austral.—It has been offered in this country, but has not been successfully cult.

D. alboràbra, Hemsl., from China, has been flowered at Kew in the palm house "where it covered some square yards of the roof:" fls. white, fragrant, with red calyx, in long panicles: lfts. coriaceous, glabrous, ovate-oblong: a climbing evergreen shrub: once confused with D. Fordii, Oliver. B.M. 8008.

L. H. B.

DESCHÁMPSIA (for Deslongchamps, a French botanist, 1774–1849). *Gramíneæ*. Tufted perennials with shining spikelets in narrow or loose panicles, sometimes grown for dry bouquets.

Spikelets mostly 2-fld., with a hairy prolongation of the rachilla; glumes about as long as the florets; lemmas toothed, bearing a dorsal awn.—Species about 20, in the cooler regions of the northern hemisphere.

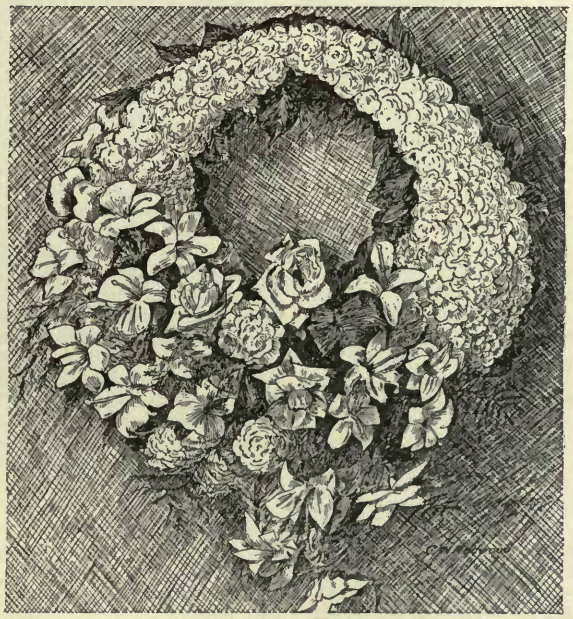
cæspitòsa, Beauv. (*Àira cæspitòsa,* Linn.). TUFTED HAIR-GRASS. HASSOCK-GRASS. Growing in tufts 1–3 ft.: blades firm, narrow: panicle open, the branches slender. G.M. 54:916. Common in N. U. S., extending

south in the mountains.—In England, it is sometimes used by the farmers to make door-mats.

flexuòsa, Trin. (*Aìra flexuòsa,* Linn.). Wood Hair-Grass. Culms slender, 1–2 ft.: blades numerous, capillary: panicle open, the flexuous branches spikelet-bearing near the ends. Dept. Agric., Div. Agrost. 7:173. Open woods N. E. U. S.—Of some value for woodland pastures, as it will grow well in the shade. Also used for ornament. A form with yellow-striped foliage is sold under the name *Aira foliis variegatis.*

A. S. Hitchcock.

DESIGN, FLORAL. An important feature of the work of a retail florist is the making of floral designs or "set pieces." Fig. 1242. This work is directly opposed to the informal arrangement of flowers which is so much admired at the present time. See *Bouquets,* Vol. I. By artistic arrangement, however, these designs are now made less formal than in the earlier history of the retailer's work. These designs lend themselves well to the working out of various inscriptions and legends in flowers; therefore, these are most frequently used as tokens of affection sent to friends or relatives at the time of a death. These designs are also much in demand by various fraternal orders and other societies, when the emblems of the order or society are worked out in flowers and sent as a tribute to the house of sorrow. They therefore have their place in the work of every flower-shop.



1242. A floral design.

As has been stated, the present-day tendency in the arrangement of flowers in designs is to get as far away as possible from a stiff, set formality. A design must, of necessity, be distinct in outline, but by a careful and free use of ferns and other florists' "green," the effect may be made somewhat informal and pleasing. Various forms of the "shower" wreath illustrate this, as well as a loose arrangement of flowers, and even foliage and flowering plants about the base of a standing emblem.

The most common forms of floral designs in use at the present time are flat and standing wreaths, pillows, casket-covers, crosses, anchors, and the emblems of various fraternal orders, such as the Masonic square and compass, and the Odd Fellows' three links.

The flowers, of which these designs are made, vary in different stores. The price which is to be paid for the design usually governs the species and varieties used. Orchids, lilies, lilies-of-the-valley, roses and Farleyense ferns compose the most expensive designs; while carnations, stevia, Roman white hyacinths and other more common flowers, with asparagus fern, comprise the cheaper designs. Usually the florist determines the price the customer wishes to pay and selects the flowers in accordance with this. Within recent years there has come to be a demand for unusual material in designs, and boxwood, galax, leucothoë and magnolia leaves, ericas and other woody plants have been much used.

In making these designs, the arrangement must necessarily be quite formal; therefore, wire frames are used. These are made in large quantities by various wire-working firms and are sold at wholesale at a comparatively low figure. In order to emphasize the particular formal outline and to hold the flowers permanently in place, the flower-stems are usually removed and the flowers then wired with 9- or 12-inch, No. 22 or No. 24 wire. The wire forms are first filled with sphagnum moss, which is moistened so that the flowers will retain their freshness, and the wired stems of the flowers are inserted in this moss. The wiring is an art, and the design-worker becomes so proficient in this that many flowers may be wired in a short period of time. This is necessary when many designs must be made quickly, as is so frequently the case in a flower-shop at the time of the funeral of a distinguished person.

Design work usually brings the retailer a substantial remuneration. In many instances, flowers of a lower quality may be used in designs than are demanded by persons buying cut-flowers. They must always be fresh, however; but, when roses are used, those having short stems are just as desirable as long-stemmed flowers. In carnations, many having a split calyx may be used when they would be salable in no other way. If Roman hyacinths are used, the main truss may be sold as cut-flowers, and the secondary trusses used in designs.

The green elements in the design, which are used to emphasize the beauty of the flowers, vary much in different stores. Each designer has his own ideas regarding the uses of this material, but often he is compelled to use what is available at the precise moment when it is needed. Because of its excellent keeping qualities, the "dagger," or Christmas fern, is frequently used; but, when this is plainly visible in the finished design, it has a coarse appearance which cheapens the effectiveness of the piece. It may, however, be used as a cover for the frame and moss, with excellent effects. The "fancy dagger," or spinulose wood fern, is more attractive than the common dagger fern. One of the earlier greens used was smilax, but this has inferior keeping qualities to other kinds and is not so popular at the present time. It does not lend itself readily to a loose, formal arrangement. Both *Asparagus plumosus* and *A. Sprengeri* make excellent backgrounds for all design work. For softening effects to be worked among the flowers, nothing adds value to the design so much as a few sprays of *Adiantum Croweanum* or *A. Farleyense.* Often the foliage of the plants from which the flowers come adds a more pleasing effect than does the green of any other species. This is especially true when roses or lilies-of-the-valley are used.

Of the many designs made by the retailer of flowers, wreaths are probably the most in demand. They exhibit good taste, and many have excellent keeping qualities. One of the earlier forms was made of English ivy, and the effect was pleasing. This was especially so when the wreath was enriched with a large bunch of violets, arranged in a loose, artistic manner. Because of the difficulty of getting a sufficient quantity of these leaves, the ivy wreath has been largely replaced by that made of galax leaves. These have excellent

keeping qualities and are obtained in large quantities by wholesale dealers from the mountains of North and South Carolina. Both bronze and green galax may be secured, but the green is most satisfactory as it makes a more pleasing contrast with a larger number of colors of flowers. It is customary to make these in rather large sizes, a 16-inch frame, or even larger, being used. Usually the right-hand side of the wreath is decorated with roses, lilies-of-the-valley, or other flowers. A standing galax wreath, with a base of galax leaves, cocos palms, white roses and "valley," and the wreath itself decorated with white roses, lilies-of-the-valley, with shower sprays of "valley" and maidenhair ferns on dainty narrow ribbon, makes an effective design. If a single spray of cattleyas is placed among the roses and "valley," the effect is enriched wonderfully. Magnolia and leucothoë leaves are also used extensively for wreaths, but this foliage is heavier and less pleasing than galax. However, the buying public is tiring of the galax, and the retailer is searching the continents for something to replace it. Boxwood also makes a rich and attractive wreath. Wreaths made principally of flowers are often in demand, and when varieties are carefully selected, the results are pleasing. Fig. 1242 (redrawn from American Florist).

In selecting the flowers for any design, certain rules must be observed. In the first place, a designer must realize that, as in all other flower-arrangement, a lavish use of material is not essential to good effects. A flower has an individuality of its own, and this should be just as pronounced in a design as in a loose vase arrangement. At no time should the material be crowded. When an inscription is to be placed over the flowers, as, for example, in a pillow when carnations are to be the background, even then each carnation should show its form and the background should not be a mass of petals without definite shape. As a general thing, it is best to place the flowers in position first, after having covered the mossed frame with green, and then to work the foliage among the flowers where it is needed for the best effects. This method requires fewer flowers, and the effect is more artistic. In making a design, it must be remembered that there may be contrast of forms as well as colors. As a rule, there should not be over three contrasts of forms and two contrasts of colors, although there may be variations to this rule in special cases. As regards shapes and forms, it is quite essential that larger, heavier blooms, such as lilies and roses, should be contrasted with sprays of a light and graceful character, like lilies-of-the-valley and Roman hyacinths. The larger flowers are to be placed low in the arrangement, and the finer sprays higher. Often the center of a design is made of one particular species, as, for example, pink roses with their foliage; and the borders of the design are filled with sprays of lighter flowers, like lilies-of-the-valley with their foliage or that of the maidenhair fern. If in the arrangement of the larger flowers a few buds of the species used are added, the effectiveness of form is increased.

In selecting colors for designs, the lighter shades are the most desired, although in recent years there has come to be a freer use of darker colors. For example, a large wreath of Richmond or other red roses contrasted with lilies-of-the-valley or white Roman hyacinths, is very effective and is not considered out of place for a funeral design. The amateur should, however, avoid striking contrasts or to endeavor to harmonize unusual forms in flowers. The experienced designer may bring these together with pleasing effects, but this ability comes only after years of study and experience. Large designs are more easily arranged than small ones, and in them may be used a wider range of colors. The most striking colors are, however, widely separated, and between these the flowers should be of such tints that they assist in blending.

Flowers with a strong fragrance should not be used in designs if they can be avoided. They are especially objectionable if they are to be used in a dwelling-house where the rooms are often crowded. In a church or other large room, the fragrance is less noticeable. Polyanthus narcissi, tuberoses and freesias are especially objectionable. The more delicate odors of violets, lilies-of-the-valley and Roman hyacinths are less so.

The funeral designs most frequently ordered by the immediate family are pillows and casket-covers. Both of these demand careful treatment in making, the pillow being especially difficult. The smaller the pillow, the harder it is to produce a pleasing result. The flowers should be of a rich character, and it shows better judgment to select a less expensive wreath as a floral tribute than to purchase a pillow made of cheap flowers. Casket-covers should also be made of expensive flowers. These covers are not lasting, for they must of necessity be light in character; and moss, which is so necessary to retain moisture and freshness in the flowers, cannot well be used. Light wire of a fine mesh, such as mosquito netting, is cut of the desired size and the flowers which are usually of one species, like Easter lilies or roses, are wired to this with sufficient foliage or other green to cover the wire. A flower of some contrasting color may be used for a border; or a rich outline of smilax is effective.

The construction of many fraternal emblems in a pleasing, artistic way, demands all the fine points of the professional designer's skill. Often all rules of flower-arrangement have to be disregarded. Special emblems have to be made of special colors; and when an emblem must be made which calls for definite parts to be blue, others to be yellow, red, white and green, the problem to harmonize these is a serious one. The designer has no choice in such a case, and can meet this demand only with an attempt to reduce to the minimum these clashing contrasts in color.

As has been stated, formal designs in the arrangement of cut-flowers are a necessity, and for these there will probably always be a demand. The designer should have in mind, however, that it is possible to arrange flowers in a pleasing way and still emphasize the formal lines. Artists in this line of work are just as truly "born, not made," as in any other branch of art; and unless one has a genuine love for flowers and the artist's skill in their arrangement, the making of formal designs should not be attempted.

E. A. WHITE.



1243. Desmazeria sicula. (×½)

DESMÁNTHUS (name refers to flowers being in bundles). Syn. *Ácuan. Leguminòsæ.* About 10 herbs or shrubs in subtropical N. Amer., and 1 in the tropics of the Old World, a few of the American species reaching well north in the U. S.; probably not regularly cult., but now and then transferred to the garden for the effect of their bipinnate lvs. and small greenish white fls., in axillary peduncled heads or spikes. The genus is one of the Mimosa tribe, and the fls. are not papilionaceous: petals 5, distinct or very nearly so; calyx bell-shaped, 5-toothed; stamens 5 or 10, distinct, usually exserted: pod flat, narrow, straight or curved, several-seeded. *D. illinoénsis,* MacM. (*Mimòsa illinoénsis,* Michx. *Ácuan illinoénsis,* Kuntze), occurs in prairies and river borders from Ind. west and south: 1–5 ft., nearly glabrous, perennial erect

herb: lfts. 20–30 pairs, obtusish. *D. leptólobus*, Torr. & Gray, occurs on prairies from Kans. to Texas: lfts. mostly fewer and acute, and peduncles much shorter (1 in. or less long).

DESMAZÈRIA (in honor of Desmazieres, a French botanist). *Gramíneæ*. Plants resembling Eragrostis, sometimes grown as ornamental grasses.

Spikelets many-fld., strongly compressed, the lemmas keeled and coriaceous but faintly 3- or rarely 5-nerved, awnless: infl. several closely imbricated spikelets, arranged in a linear, dense, nearly simple spike-like panicle.—Species 4, 1 in Medit. region, and 3 in S. Afr.

sícula, Dum. (*Brizopỳrum sículum*, Link). SPIKE-GRASS. Fig. 1243. Annual, 8–12 in.: spikelets ½in., in a nearly simple spike. Eu.—Cult. for ornament and frequently used for edging. A. S. HITCHCOCK.

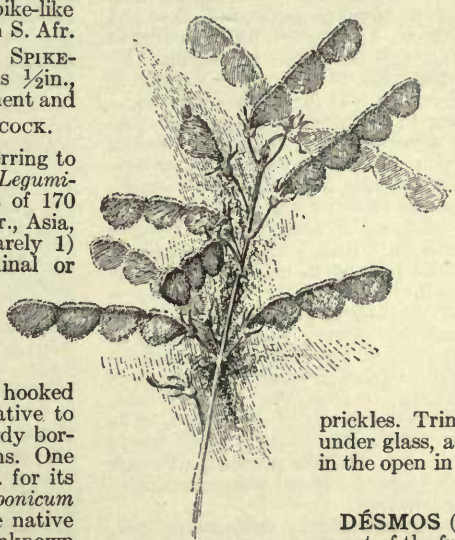
DESMÒDIUM (Greek, a *band* or *chain;* referring to the jointed pods). By some called *Meibòmia*. *Legumenòsæ*. TICK TREFOIL. Mostly herbs, upwards of 170 species, in temperate and warm regions of Amer., Asia, Afr. and Austral. Lvs. pinnate, with 3–5 (rarely 1) lfts.: fls. small and papilionaceous, in terminal or axillary racemes in summer, mostly purple; calyx with a short tube, more or less 2-lipped; standard broad; wings joined to the keel: pod flat, deeply lobed or jointed, the joints often breaking apart and adhering to clothing and to animals by means of small hooked hairs. Fig. 1244. A number of species are native to N. Amer., and are sometimes grown in the hardy border, where they thrive under ordinary conditions. One hothouse species, *D. gyrans*, is sometimes cult. for its odd moving lfts. *D. penduliflorum* and *D. japonicum* will be found under Lespedeza. Several of the native species are worthy of cult., but are practically unknown in the trade. The following have been offered by collectors: *D. canadense*, DC. (Fig. 1244); *D. cuspidatum*, Hook.; *D. Dillenii*, Darl.; *D. marilandicum*, Boott; *D. nudiflorum*, DC.; *D. paniculatum*, DC.; *D. pauciflorum*, DC.; *D. sessilifolium*, Torr. & Gray. The Florida beggarweed is *Desmodium tortuosum*, DC., of the W. Indies. It is coming into prominence in the S. as a forage plant (see Cyclo. Amer. Agric., Vol. II, p. 214).

Two Chinese shrubby species have recently been intro. to Eu.: *D. amethýstinum*, Dunn, growing 3–5 ft.: lvs. 3-foliolate, the lfts. elliptic, 4–7 in. long: fls. amethystine, ½in. long, in a terminal panicle. *D. cinerascens*, Franch., not Gray: broad bush, 3 ft. high, densely leafy: lvs. large, the lfts. lozenge-shaped: fls. rosy lilac to violet, in many racemes, produced in June and again in Sept.

The greenhouse species, *D. gyrans*, is of tolerably easy culture. It requires stove temperature, and, although a perennial, it is best treated as an annual. The best method of propagation is by seeds. These should be sown in February in a light, sandy soil, in 4-inch pots, and placed in a warm, close atmosphere, where they will soon germinate. The seedlings should be potted singly into small pots as soon as large enough to handle and grown on as rapidly as possible, using a mixture of good, fibrous loam and leaf soil in about equal proportions. By midsummer they will be good bushy plants, and, though not showy, they are very interesting. (Edward J. Canning.)

gỳrans, DC. TELEGRAPH PLANT. Undershrub, 2–4 ft. high, with 3 oblong or elliptic lfts., the small lateral ones (which are almost linear) moving in various directions when the temperature is congenial, and especially in the sunshine: fls. purple or violet, in racemes and terminal racemose panicles. Ceylon to the Himalayas and the Philippines.—Grown occasionally as a curiosity, particularly in botanical collections. See Darwin's "Power of Movement in Plants," and various botanical treatises, for fuller accounts. L. H. B.

DESMÓNCUS (*band* and *hook*, referring to hook-like points on the lvs.). *Palmàceæ*. About 25 palms of U. S., S. Mex. to Bolivia and Brazil, differing from Bactris in the long slender climbing caudex and technical characters. They are gregarious plants, with spines or hooks by means of which they climb or are elevated on growing trees, the sts. usually thin and flexuose and annular: lvs. scattered along the st., pinnate or pinnatisect, the parts or segms. opposite or alternate, the rachis produced into a long hook-bearing climbing organ: fls. greenish, in solitary spadices with 2 spathe-lvs.: fr. small, pea-shaped, red. **D. màjor**, Crueg., st. becoming very long and clinging to supports by the modified retrorse opposite segms. on the prolonged rachis: lvs. pinnate; lfts. 20 pairs, linear-acuminate and usually clustered; rachis spiny, dark-tomentose: spathe covered with brown prickles. Trinidad. Little known under glass, and reported as cult. in the open in S. Fla. and S. Calif. L. H. B.



1244. Desmodium canadense pods. (Nearly natural size.)

DÉSMOS (Greek, *chain*, on account of the fruit resembling nodes chained together). *Annonàceæ*. A genus established in 1790 by Loureiro and based upon *Desmos cochinchinensis* (*Unona Desmos*, Dunal, 1817; *Unona cochinchinensis*, DC., 1824). The flowers are composed of 3 sepals and 6 petals in 2 series, the latter valvate, nearly equal, and flat; stamens numerous, tetragonal-oblong or cuneate, the connective expanded above the dorsal oblong or linear-oblong pollen-sacs into a truncate hood-like process; receptacle, or torus, slightly raised, usually truncate or somewhat concave at the apex; carpels indefinite; ovules several, usually forming a single column, but sometimes sub-biseriate; style ovoid or oblong, recurved; ripe carpels indefinite, either elongate and chain-like from constrictions between the seeds, or baccate and spheroid. *D. cochin-chinénsis*, Lour., is a shrub with an erect or climbing st. and weak reclinate branches, lanceolate lvs., fragrant yellowish green pendulous fls., and reddish green moniliform frs. *D. chinénsis*, Lour. (*Unòna discolor*, Vahl), is a small tree of the E. Indies, with ovate-oblong lvs. glaucous beneath and extra-axillary sweet-scented aromatic fls., for the sake of which it is often cult. The greenish yellow corolla resembles that of *Canangium odoratum*, but the moniliform fr. consists of several joints, each containing a pea-like seed. It is used when green by the Chinese at Hongkong, who make from it a fine purple dye. *D. élegans*, Safford (*Unòna élegans*, Thwaites), remarkable for its fr., which resembles strings of beads, and the very closely allied *D. zeylánicus*, Safford (*U. zeylánica*, Hook. f. & Thoms.), are endemic in the moist forests of Ceylon. Many species of Desmos have been erroneously referred to the genus Unona, based upon a S. American plant (*Unona discreta*, Linn. f.) not congeneric with the Asiatic genus above described, but more closely allied, if not to be identified with the genus Xylopia. See Safford, W. E., Bull. Torrey Bot. Club. 39:501–8 (1912). W. E. SAFFORD.

DEÙTZIA (named by Thunberg in honor of his friend and patron, Johann van der Deutz). *Saxifragàceæ.* Very ornamental shrubs grown for their showy white or blush flowers appearing in spring or early summer.

Upright: lvs. deciduous, rarely persistent, opposite, petioled, serrate, usually with rough stellate pubescence: fls. in panicles, rarely in racemes or in corymbs, white, sometimes purplish, epigynous; calyx-teeth 5; petals 5; stamens 10, rarely more, shorter than the petals; filaments usually winged and toothed at the apex; styles 3–5, distinct: caps. 3–5-celled, with numerous minute seeds.—About 50 species in E. Asia and Himalayas and 1 in Mex. Monograph by Schneider in M.D. 1904:172–188, and a hort. monograph by Lemoine in J.H.F. 1902:298–314; see also Rehder in Sargent, Plant. Wilson. 1:14–24 for Chinese species.

The deutzias belong to our most beautiful and most popular ornamental shrubs; they are very floriferous and of easy cultivation. *D. parviflora* and *D. grandiflora* are the hardiest, and also *D. gracilis, D. Sieboldiana* and *D. scabra* are hardy as far north as Massachusetts; the recently introduced *D. longifolia, D. Schneideriana, D. discolor,* and *D. Wilsonii* have proved fairly hardy with slight protection or in sheltered positions at the Arnold Arboretum. One of the most tender is *D. purpurascens.* Of the hybrids, *D. Lemoinei* is the hardiest, while *D. rosea* has proved about as hardy as *D. gracilis; D. kalmiæflora, D. myriantha* and others are tenderer. Most of the deutzias have white flowers, but *D. rosea, D. purpurascens, D. longifolia, D. myriantha, D. kalmiæflora* and some varieties of *D. scabra,* have the flowers carmine outside or pinkish. They flower most profusely if pruned as little as possible, although an occasional thinning out of the old wood soon after flowering will be of advantage.

The deutzias thrive in almost any well-drained soil, and are well adapted for borders of shrubberies. Potted plants forced with a temperature not exceeding 50° develop into beautiful specimens for the decoration of greenhouses and conservatories, especially *D. Lemoinei, D. gracilis* and *D. discolor.* The same plants cannot be forced again. Propagate readily by greenwood and hardwood cuttings, also by seeds sown in pans or boxes in spring.

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major, 12.
marmorata, 3.
mitis, 3.
multiflora, 2.
Musæi, 16.
myriantha, 10.
parviflora, 16.
plena, 3.
punctata, 3.
punicea, 3.
purpurascens, 8.
rosea, 2.
scabra, 3, 6,
Schneideriana, 4.
setchuenensis, 7.
Sieboldiana, 6.
superba, 5.
Veitchii, 9.
venusta, 2.
Vilmorinæ, 13.
Watereri, 3.
Wellsii, 3.
Wilsonii, 14.

A. *Petals valvate in the bud.*

B. *Fls. in panicles or racemes; calyx-teeth short (except in the hybrids).*

C. *Lvs. glabrous below or nearly so.*

1. **grâcilis,** Sieb. & Zucc. Fig. 1245. Shrub, to 3 ft., with slender, often arching branches: lvs. oblong-lanceolate, acuminate, sharply serrate, with sparse stellate hairs above, nearly glabrous beneath, bright green, 1–2 in. long: fls. pure white, in racemes; petals erect or somewhat spreading, oblong; stamens much shorter than the petals; calyx-teeth persistent. May, June. Japan. S.Z. 8. P.F.G. 2, p. 7. F.S. 6:611. R.H. 1891, p. 203. G.M. 50:563. Gn. 39, p. 200. G.W. 12, p. 534. Gt. 1897:384. H.F. 1:48. J.F. 1:44. V. 7:217. Var. **aûrea,** Schelle. Lvs. yellow. Var. **álbo-marmoràta,** Lemoine. Lvs. sprinkled with white.

2. **rôsea,** Rehd. (*D. grácilis* × *D. purpuráscens. D. grácilis rôsea* and *D. discolor rôsea,* Lemoine). Lvs. ovate-oblong, acuminate, bright green, slightly paler below, very sparingly stellate-pubescent on both sides: fls. pink, campanulate, in panicles; calyx-lobes longer than the tube; filaments slightly toothed or subulate, but strongly toothed in all varieties except in var. *venusta* and var. *multiflora.* F.E. 30:423. G. 27:274. Var. **campanulàta,** Rehd. With large white campanulate fls. G. 28:485. Var. **venústa,** Rehd. With white fls. G. 27:275. Var. **multiflôra,** Rehd. With white fls. Var. **exímia,** Rehd. With white fls. tinted pink outside, in upright panicles. Var. **carmínea,** Rehd. With light pink fls. tinted carmine outside. Var. **floribúnda,** Rehd. With white fls. tinted pink outside. J.H.F. 1902:312. Var. **grandiflôra,** Rehd. With fls. of the same color, but larger. All these varieties were originally described by Lemoine as varieties of *D. gracilis* except the two last ones, which he has under *D. discolor.*



1245. Deutzia gracilis. (×½)

CC. *Lvs. stellate-pubescent beneath.*

D. *Filaments all toothed at the apex.*

E. *Calyx-lobes shorter than the tube; petals upright.*

3. **scàbra,** Thunb. Shrub, to 6 ft.: lvs. all petioled, ovate to ovate-lanceolate, rounded at the base, crenate-dentate, with rough pubescence on both sides, dull green, 1–3 in. long: panicles erect, 2–4 in. long; fls. white or blushed, with erect petals;

calyx-lobes deciduous. June, July. Japan, China. S.Z. 6. B.M. 3838. B.R. 1718. S.B.F.G. II. 4:393. Gn. 37, p. 315. F.E. 31:1163. H.U. 1, p. 106. Var. **angustifólia,** Voss. Branches reddish brown: lvs. ovate-lanceolate, rougher. Var. **crenàta,** Voss (*D. crenàta,* Sieb. & Zucc. *D. dentàta,* Hort. *D. mìtis,* Hort.). Branches brown: lvs. ovate or oblong-ovate, less rough. This variety is less common in cult. than the former. Var. **marmoràta,** Rehd. (var. *aùreo-variegàta,* Schneid.). Lvs. spotted with yellowish white. Var. **punctàta,** Arb. Kew (var. *álbo-punctàta,* Schneid.). Lvs. sprinkled with white dots. Var. **Fórtunei,** Schneid. Fls. larger. F.E. 31:1071. Var. **Wátereri,** Rehd. (var. *punícea,* Schneid. *D. crenàta Wátereri,* Lemoine). Fls. white, tinted carmine outside. G.C. III. 39:340. Var. **plèna,** Rehd. (*D. crenàta* var. *plèna,* Maxim.). Fls. double, white, tinged with rose outside. R.H. 1867: 70. F.S. 17:1790; 18:1850. G. 21:263. F. 1863:153. G.F. 8:112; here belongs also *Pride of Rochester,* with very large fls., faintly tinged with rose outside. Gn. 33, p. 514. Var. **candidíssima,** Rehd. (*D. scàbra* var. *álbo-plèna,* Schneid. *D. crenàta candidíssima plèna,* Carr. *D. Wéllsii,* Hort.). Fls. double, pure white.

4. **Schneideriàna,** Rehd. Shrub, to 6 ft.: lvs. elliptic-ovate to elliptic-oblong, short-acuminate, sharply serrulate, stellate-tomentose and whitish below, 1½–3 in. long: panicles broadly pyramidal; fls. nearly ½in. long, white; stamens nearly as long as the petals; calyx-lobes deciduous. Cent. China. Var. **laxiflòra,** Rehd. Lvs. oblong-lanceolate, acuminate, remotely denticulate, rough-pubescent above, thinly stellate-pubescent beneath and light green: panicles broad and rather loose, 2½–3½ in. long; fls. about ½in. long. June. W. China.—Only the var. is in cult.; similar to *D. scabra,* but the panicles looser and more graceful.

EE. *Calyx-lobes longer than the tube.*

5. **magnífica,** Rehd. (*D. scàbra* × *D. Vilmòrinæ. D. crenàta magnífica,* Lemoine). Lvs. ovate-oblong, acuminate, appressed-serrulate, rough above, stellate-tomentose and grayish green below, 1½–2½ in. long: fls. in erect panicles, white, double; sepals ovate or ovate-oblong, about as long as calyx, acute. June. G.M. 53:108. F.E. 31:322. Var. **latiflòra,** Rehd., with very large single fls. 1½ in. across. Var. **supérba,** Rehd., with large single campanulate fls. Var. **ebúrnea,** with white single campanulate fls. in loose panicles; stamens slightly shorter than petals. Var. **erécta,** Rehd., with white fls. in dense panicles. Var. **formòsa,** Rehd., with double white fls. in large panicles. These varieties were originally described as vars. of *D. crenata.*

DD. *Filaments, at least the longer ones, subulate, without teeth.*

6. **Sieboldiàna,** Maxim. (*D. scàbra,* Sieb. & Zucc., not Thunb.). Low shrub, to 2 ft.: lvs. short-petioled, the pair below the panicle nearly sessile, ovate or ovate-elliptic to oblong-ovate, rounded or cordate at the base, rough and rugose above, stellate-pubescent and light green beneath, 1–2 in long: panicles erect, loose, 2–3 in. long with appressed stellate pubescence mixed with spreading simple hairs; fls. white, rather small, with spreading petals; the shorter filaments usually abruptly contracted or with very short teeth; calyx-lobes persistent. June. Japan. S.Z. 7. G.C. III. 36:244. Var. **Dippeliàna,** Schneid. (*D. scàbra vèra,* Hort.). Lvs. broader and smaller: panicle only with appressed pubescence; stamens all subulate.—Graceful low shrub, but less showy than most other species.

BB. *Fls. in corymbs or cymes.*

C. *Infl. many- or several-fld.*

D. *Calyx-teeth shorter than tube; anthers attached to the inside of the broad filament.*

7. **setchuenénsis,** Franch. (*D. corymbiflòra erécta,* Hort.). Shrub, to 6 ft.: lvs. ovate-lanceolate to lanceolate, denticulate, rough-pubescent above, grayish green below and densely covered with stellate and simple hairs, 2–4 in. long: corymbs few-fld.; fls. less than ½in. across; filaments with large broad teeth about as long as the nearly sessile anther. Cent. China. Var. **corymbiflòra,** Rehd. (*D. corymbiflòra,* Lemoine). Lvs. elliptic-ovate to ovate-lanceolate, acuminate, sometimes slightly cordate at the base, 2–4 in. long: corymbs many-fld.; fls. with spreading petals, ½in. across;



1246. Deutzia purpurascens.

stamens about one-third as long as the petals, upright and connivent; styles shorter than stamens. June, July. Cent. China. B.M. 8255. G.C. III. 24:267. R.H. 1897, pp. 466, 467 (as *D. corymbosa*); 1898, p. 402. M.D.G. 1913:9 (lower picture). A.F. 14:166. Gng. 7:2.—The variety is much handsomer than the type; the fls. are comparatively small, but very numerous. Tender.

DD. *Calyx-teeth lanceolate, as long or longer than the tube.*

E. *Anthers of the inner stamens borne on the inner side of the petaloid filaments; fls. pink or purplish outside.*

8. **purpuráscens,** Rehd. (*D. díscolor* var. *purpuráscens,* Franch.). Fig. 1246. Shrub, to 3 ft., with slender arching branches: lvs. ovate to ovate-lanceolate, crenately and unequally serrate, usually rounded at the base, green and only sparingly stellate-pubescent on both sides, 1½–2½ in. long: corymbs 5–10-fld.; fls. with spreading petals, about ¾in. across, white, outside purple; the inner filaments with the anther below the apex. May, June. S. W. China. B.M. 7708. G.C. III. 2:45; 26:45. G.F. 7:287 (adapted in Fig. 1246). G. 27:201. R.H. 1895:64.—Very handsome, but tender.

9. **longifólia,** Franch. Shrub, to 6 ft., with upright branches: lvs. oblong-lanceolate to narrow-lanceolate, long-acuminate, narrowed at the base, thickish, rough and somewhat rugose above, grayish white and densely tomentose below, 2–4½ in. long: corymbs many-fld., loose or dense; fls. with spreading petals, more than ¾in. across; the shorter filaments lanceolate with the anther inside near the middle. June. W. China. G.C. III. 51:409. Gn. 76, p. 243. G.M. 55:353. Var.

Veìtchii, Rehd. (*D. Veìtchii,* Veitch) with somewhat larger fls. in dense many-fld. corymbs. G.C. III. 51: suppl. 19. M.D.G. 1913:17.—One of the handsomest deutzias, but has proved hardy only under protection at the Arnold Arboretum.

EE. *Anthers borne at the end of the filaments.*

F. *Fls. usually pinkish outside (hybrids of D. purpurascens).*

10. **myriántha,** Lemoine (*D. Lemoìnei* × *D. purpurascens*). Lvs. oblong-ovate, acuminate, rounded or broadly cuneate at the base, serrulate with spreading teeth, rough above, slightly stellate-pubescent beneath, 1½–3 in. long: fls. in broad corymbs, white, with spreading petals, partly imbricate in bud; filaments strongly toothed; anthers short-stalked; styles shorter than stamens; sepals triangular-ovate, about as long as calyx-tube. G.C. III. 52:45. F.S.R. 3, p. 193. A.F. 31:100, 101. M.D.G. 1907:376, fig. 5; 377, fig. 8. G.W. 13, p. 614. Var. *Boule Rose* and var. *Fleur de Pommier* have the fls. pink outside.

11. **kalmiæflòra,** Lemoine (*D. parviflòra* × *D. purpurascens*). Lvs. oblong to ovate-oblong, short-acuminate, broadly cuneate at the base, serrulate, rough above, slightly stellate pubescent below, 1–2½ in. long: fls. in rather small corymbs, pinkish, white in the center, light carmine outside, cup-shaped, ¾in. across; petals mostly imbricate in bud; stamens half as long as petals; filaments with large teeth, nearly as long as the anthers; styles shorter than stamens. M.D.G. 1913:25. G. 27:199. Gn. W. 17:627.—One of the handsomest hybrids.

FF. *Fls. white.*

G. *Filaments toothed below the apex.*

12. **díscolor,** Hemsl. Upright shrub, to 6 ft.: lvs. oblong-lanceolate, acuminate, cuneate at the base, denticulate, sparingly stellate-hairy above, stellate-tomentose and whitish below, 2–4 in. long.: corymbs dense, hemispherical; pedicels usually not exceeding ¼in.; fls. white, with spreading elliptic petals, about ¾in. across; stamens about half as long as petals; filaments with large teeth usually as long as the stalk of the anther, the anthers of the inner stamens sometimes inserted inside a little below the apex. June. Cent. China. Var. **màjor,** Veitch. Fls. about 1 in. across. G. 30:307. R.B. 32, p. 174. M.D.G. 1913:9 (upper picture).

13. **Vilmorínæ,** Lemoine. Shrub, to 5 ft.: lvs. oblong-lanceolate, acuminate, narrowed at the base, serrulate, thinly stellate-pubescent above, densely so below and grayish white, 2–3 in. long: corymbs loose and large; pedicels ⅓–½in. long; fls. more than ½in. across; larger stamens only slightly shorter than petals; the teeth of the filaments shorter than the stalks of the anthers; styles as long as stamens. May, June. Cent. China. R.H. 1895, pp. 266, 267. F.V. 126. A very graceful shrub with its large and loose corymbs of white fls.

GG. *Filaments, at least the longer ones, gradually narrowed toward the apex, without teeth.*

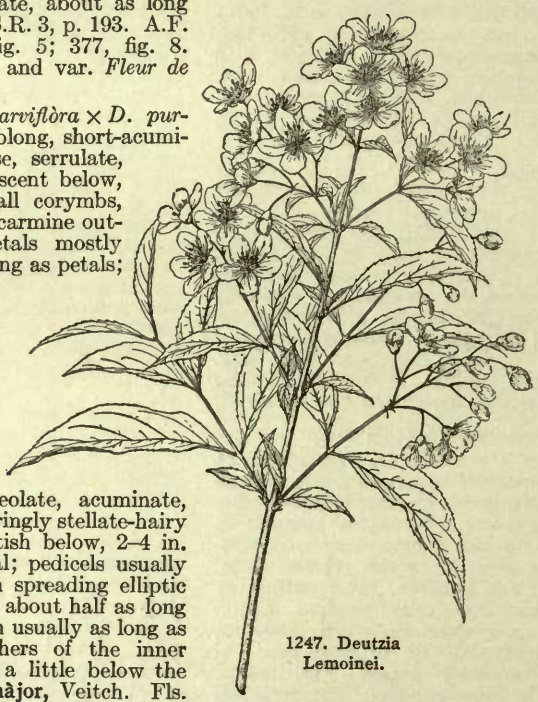
14. **Wílsonii,** Duthie. Shrub, to 6 ft.: lvs. elliptic-lanceolate to oblong-lanceolate, short-acuminate, rounded or narrowed at the base, rough-pubescent above, grayish white and tomentose below, 2–4 in. long: corymbs compact, many-fld.; fls. white, more than ¾in. across; stamens a third shorter than the petals; the shorter filaments usually abruptly contracted or sometimes with short obtuse teeth; calyx-lobes oblong-ovate, about as long as tube. May, June. Cent. China. B.M. 8083. G. 30:373. G.M. 51:473. M.D.G. 1912:27; 1913:16.

CC. *Infl. 1–3-fld.; filaments with long and slender recurved teeth.*

15. **grandiflòra,** Bunge. Shrub, to 6 ft.: lvs. ovate, acuminate, rounded at the base, unequally and closely denticulate, rough pubescent above, whitish stellate-tomentose below and reticulate, 1–2½ in. long: fls. white, nodding, with slightly spreading petals about ¾in. long; stamens about half as long as petals; calyx-lobes lanceolate, twice as long as tube. April, May. N. China.—A very distinct species, the earliest of all to bloom, the fls. appearing with the lvs.; has proved perfectly hardy at the Arnold Arboretum.

AA. *Petals imbricate in the bud (or partly imbricate in the hybrid); fls. white.*

16. **parviflòra,** Bunge. Shrub, to 6 ft., with erect branches: lvs. ovate or oblong-ovate, usually narrowed at the base, finely serrate, with stellate hairs on both sides, often grayish green beneath, 2–3 in. long: fls. in many-fld. corymbs; petals roundish obovate, spreading, imbricate in the bud; longer filaments without teeth. June. N. China, Mongolia. G. F. 1:365. Gt. 11:370; 43, p. 65; 46, p. 382. R.H. 1892, p. 223. G.C. III. 14:153. Gn. 44, p. 181. F.S.R. 3, p. 197. A.F. 15:1297. Gng. 8:305, 307. Var. **Musàei,** Lemoine. Of stronger growth: lvs. larger and more acuminate: fls. creamy white in denser corymbs.



1247. Deutzia Lemoinei.

17. **Lemòinei,** Hort. (*D. grácilis* × *D. parviflòra. D. angustifòlia,* Dipp.). Fig. 1247. Spreading shrub, to 3 ft.: lvs. elliptic-lanceolate, finely serrate with appressed teeth, with sparse stellate hairs above, nearly glabrous beneath, 1½–3 in. long: fls. in large corymbs or broad panicles, pure white; petals broadly ovate, spreading, partially valvate and partially imbricate in the bud; filaments with large teeth. G.F. 9:285 (adapted in Fig. 1247). A.F. 11:457; 15:1296. Gt. 44, p. 567; 46, p. 383. Gng. 4:135; 8:307. J.H. III. 34:77. G.C. III. 18:389. Gn. 48, p. 317. G.M. 39:251; 51:962, 963. G. 16:223. F.E. 24:747; 31:1119. G.W. 2, p. 173. M.D.G. 1895:438, 439.—A very desirable shrub, more vigorous and with showier fls. than *D. gracilis.* Excellent for forcing.

Var. **compácta,** Lemoine. Dwarfer and of more compact habit. *D. Boule de Neige,* Lemoine, with creamy white fls. (Gng. 8:306) and *D. Avalanche,* Lemoine, with pure white fls., are exceedingly floriferous forms.

D. Brunoniàna, R. Br.=D. staminea var. Brunoniana.—*D. candelábrum,* Rehd. (D. gracilis × D. Sieboldiana. D. gracilis var. candelabrum, Lemoine). Shrub with slender branches and large white fls. in dense elongated panicles. R.B. 33, p. 372. R.H. 1908, p. 174. M.D.G. 1907:378. Var. *erécta,* Rehd. (D. gracilis erecta, Lemoine). Fls. smaller and panicles shorter. Var. *fastuòsa,* Rehd. (D. gracilis fastuosa, Lemoine). Fls. in elongated rather dense panicles.—*D. cándida,* Rehd. (D. Lemoinei × D. Sieboldiana. D. discolor candida, Lemoine). Upright shrub with large white fls. in panicles. M.D.G. 1907:376, fig. 6.—*D. cárnea,* Rehd. (D. Sieboldiana × D. rosea grandiflora. D. discolor carnea, Lemoine). Upright shrub with pink rather small fls. in upright loose panicles.

Var. *láctea*, Rehd., with white fls., var. *stellàta*, Rehd., with narrow spreading petals, pale pink or carmine-pink, and var. *densiflòra*, Rehd., with white fls. in dense upright panicles, petals narrow; all these varieties described by Lemoine as varieties of D. discolor.—*D. compácta*, Craib. Allied to D. parviflora. Lvs. lanceolate, sparingly pubescent on both sides, ¾–2 in. long: fls. white in dense corymbs; filaments strongly dentate. W. China.—*D. corymbòsa*, R. Br. Allied to D. parviflora. Lvs. rounded at the base, crenate-serrate, long-acuminate: fls. larger; all filaments toothed. Himalayas.—*D. discolor* vars.=D. candida, D. carnea, D. elegantissima, D. excellens.—*D. elegantíssima*, Rehd. (D. purpurascens × D. Sieboldiana. D. discolor var. elegantissima, Lemoine). Shrub, with slender branches, with numerous corymbs of large white, open fls. slightly tinted with rose inside and outside. R.B. 36, p. 387. M.D.G. 1907:377, fig. 9. Var. *arcuàta*, Rehd. (D. discolor var. arcuata, Lemoine), with white fls. Var. *fasciculàta*, Rehd. (D. discolor var. fasciculata, Lemoine). Flat white fls. tinted with pink.—*D. excéllens*, Rehd. (D. Vilmoriniana × D. rosea grandiflora. D. discolor var. excellens, Lemoine). Shrub, with slender upright branches, with large loose corymbs of pure white fls.—*D. globòsa*, Duthie. Similar to D. Wilsonii, but smaller in every part: fls. creamy white in dense corymbs; filaments abruptly contracted below the apex. Cent. Chiua.—*D. glomeruliflòra*, Franch. Similar to D. discolor. Shrub, to 6 ft.: lvs. smaller, grayish white and soft-pubescent below: fls. white in dense and small, but very numerous corymbs along the slender branches; stamens like those of D. longifolia. W. China. Handsome and fairly hardy.—*D. grácilis* vars.=D. candelabrum.—*D. móllis*, Duthie. Allied to D. parviflora. Shrub, to 6 ft., with upright branches: lvs. elliptic-ovate to elliptic-lanceolate, soft-pubescent below, 2–4 in. long: fls. small, creamy white or slightly pinkish in dense flat corymbs; filaments subulate. Cent. China.—*D. reflèxa*, Duthie. Allied to D. discolor. Lvs. oblong-lanceolate, 2–3 in. long: fls. smaller in loose corymbs, petals with reflexed margin; filaments with short teeth or abruptly contracted. Cent. China.—*D. staminea*, R. Br. Shrub, to 3 ft.: lvs. ovate or ovate-lanceolate, with whitish stellate pubescence beneath: corymbs many-fld.; fls. white, fragrant; filaments with large teeth. Himalayas. B.R. 33:13. Var. *Brunoniàna*, Hook. f. & Thoms. Lvs. less densely pubescent: fls. larger. B.R. 26:5 (as D. corymbosa).

ALFRED REHDER.

DEVIL-IN-A-BUSH: *Nigella.*

DEWBERRY. A blackberry-like fruit of trailing and climbing habit, now considerably grown in North America.

The botanist makes no distinction between dewberries and blackberries. But to the fruit-grower, trailing blackberries are dewberries, distinguished further, and probably better separated, by the flower- and fruit-clusters. In the true dewberries, the center flowers open first and flowers and fruits are few and scattered; in true blackberries—there are hybrids between the two in which the distinguishing characters are confused—the lower and outer flowers open first and flower- and fruit-clusters are comparatively dense. In the method of propagation there is a further distinction. In nature or under cultivation, dewberries are usually propagated from the tips, while blackberries are naturally propagated from suckers and under cultivation from root-cuttings.

The dewberry is an American fruit but very recently domesticated—if, indeed, it can be said to be domesticated, for it is the most uncertain and the most unmanageable of the small fruits. Its history as a garden plant, according to Card (Card's "Bush-Fruits," page 132) at the most does not go back further than 1863, and dewberries were not generally cultivated until well toward the close of the nineteenth century. Undoubtedly, despite unmanageable habits of growth, uncertainty in fruiting, the necessity of cross-pollination between varieties, capriciousness as to soils and lack of hardiness in northerly climates, the several species and the rapidly increasing number of varieties of dewberries, fill a place not occupied by the better-known and longer domesticated blackberries; for, as a rule, they ripen earlier and, when well grown, give larger, handsomer and better, or at least, differently flavored fruits than the blackberry. Moreover, from the several species of dewberries are being derived greatly improved varieties and hybrids between them and species of blackberries, of which there are now several under cultivation, as Wilson Early and Wilson Junior, which are most promising. These qualities make certain the place of the dewberry in home and commercial plantations and presage for it even greater value in the future.

Of the thirty or more species of Rubus which all could agree in calling blackberries and dewberries, the fruit-grower would probably distinguish five as dewberries. Between these there are hybrid forms under cultivation, as probably there are in the wild, and since



1248. Lucretia dewberry. (×¼)

there are also hybrids between blackberries and dewberries, the group is one of great taxonomic difficulty. The five species of dewberries are: (1) *Rubus procumbens*, Muhl., found in dry open places from Maine westward and southward. The species is characterized by woody, stoutly armed stems, membranaceous leaves, villous beneath, flowers few to several in leafy racemes, and short cyclindrical fruits with few to many large drupelets. Var. *roribaccus*, Bailey, is a well-marked subspecies from West Virginia of more vigor, with larger flowers with elongated pedicels, and larger fruits; much cultivated with the Lucretia as the best representative. (Figs. 1248, 1249). (2) *Rubus invisus*, Bailey, is similar but stouter, with canes less procumbent, leaves more coarsely toothed, pedicels longer, and with the sepals large and leaf-like. The species grows wild from New York to Kansas and southwest and is the parent of several cultivated dewberries of which Bartel (Fig. 1250, adapted from G.F. 4:19) is the type. (3) *Rubus trivialis*, Michx., the southern dewberry, is quite distinct from 1 and 2. This species is found near the coast from Virginia to Florida and westward to Texas. It is characterized by slender trailing stems armed with recurved prickles, evergreen, smooth, leathery leaves, corymbs 1–3-flowered, and cyclindrical fruits with many drupelets. Of the few varieties of this species cultivated, Manatee is probably the oldest and best known. (4) *Rubus rubrisetus*, Rydb., found in sandy soils in Missouri and Louisiana, is similar to *R. trivialis* but with stems, petioles, and pedicels rough with reddish, purplish hairs; the flowers are smaller but the corymbs are 3–9-flowered. The species is locally cultivated and gives some promise for greater improvement. (5) *Rubus vitifolius*, Cham. & Schlecht, is the Pacific Coast dewberry characterized by trailing, slender, pubescent canes with weak, straight or recurved prickles, leaves various, flowers staminate or pistillate on different plants,



1249. Lucretia dewberry. (Nat. size).

fruit of medium size, round-oblong, sweet. Several varieties, of which possibly Aughinbaugh and Skagit Chief are the best known, are cultivated in the far West. The loganberry is said to be a hybrid between this species and *R. Idæus*, and several less well-known hybrids are recorded.

The dewberry should receive under cultivation much the same treatment given the more common blackberry. The culture of the two differs chiefly in the dewberries requiring more care in training and must usually be better protected for the winter. The plants are trained on trellises of two or three wires or tied to stakes, the former method giving better results, but the latter being more common. The object in either case is threefold,—namely, to regulate the amount of bearing wood, to keep the vine out of the way of the cultivator and to keep the fruit off the ground. The plants should be set 4 by 7 feet apart, these distances varying somewhat in accordance with the variety and



1250. Bartel dewberry. (×½)

the soil. Pruning is a simple matter, consisting of shortening back young plants to 4 or 5 feet the first season to keep them from sprawling too much, cutting out old canes at any time after fruiting, and heading-in long shoots and laterals in early summer. From four to six fruiting canes are allowed to the plant. In northern climates, the vines must be laid on the ground and protected in winter with straw or other material. The plants thrive on a somewhat lighter soil than the blackberry—in fact some sorts require such a soil. Varieties should be intermixed to secure cross-pollination and thereby insure a good set of fruits and avoid the formation of nubbins.

Of about thirty named varieties, Lucretia, Bartel, Austin and Premo are the best. Of these four, Lucretia is far most commonly grown, being adapted to the greatest diversity of soils and is in general best suited to varying environments. For history and botany, see Bailey, "Evolution of our Native Fruits;" for culture, see Card's "Bush-Fruits," and Cornell Bulletins Nos. 34 and 117. Consult *Blackberry, Loganberry* and *Rubus*.

U. P. Hedrick.

DEYEÙXIA: *Calamagrostis.*

DIACÁTTLEYA (compounded of Diacrium and Cattleya). *Orchidàceæ.* A genus established to include hybrids between the two genera, Diacrium and Cattleya. A hybrid between *Diacrium bicornutum* and *Cattleya Mendelii* is known as *Diacattleya Sanderæ*. It was raised by Sander & Sons. The fls. are pure white, the lip with a pale yellow disk and small rose markings. G.C. III. 49:290. *D. Còlmaniæ*, Hort. (*Diacrocáttleya Còlmaniæ* is a hybrid between *Diacrium bicornutum* and *Cattleya intermedia* var. *nivea*. G.C. III. 43:114. J.H. 56:167. It resembles a slender plant of *Diacrium bicornutum*: sepals and petals pure white, lip slightly tinged primrose-yellow.

George V. Nash.

DIÁCRIUM (*through* and *point;* the sts. are surrounded by sheaths). *Orchidàceæ.* Four Trop. Amer. epiphytes, closely allied to Epidendrum, with which they have been included. It differs from that genus in the fact that the column and lip are not united. Fls. showy, in loose racemes: lvs. few, sheathing: pseudobulbs slender. Cult. of Epidendrum and Cattleya.

bicornùtum, Benth. (*Epidéndrum bicornùtum,* Hook.). Pseudobulbs 1–2 ft. long, hollow, bearing dry sheaths: lvs. short and leathery: raceme slender, 3–12-fld.; fls. white, with small crimson spots on the 3-lobed lip, fragrant. B.M. 3332. G.C III. 16:337. J.H. III. 33:29. O.R. 12:113; 16:81; 20:361.—A handsome orchid, requiring high temperature.

D. bidentàtum, Hemsl. (Epidendrum bidentatum, Lindl.), of Mex., has been listed in trade catalogues, but it is practically unknown to cult., and is probably not now in the American trade.

L. H. B.

DIALÆLIA (Compounded of the genera Diacrium and Lælia). *Orchidàceæ. D. Veìtchii,* Hort., is a hybrid between *Diacrium bicornutum* and *Lælia cinnabarina*. Pseudobulbs fleshy: fls. 9 or 10, the segms. white suffused with lilac, also showing a bronze tint derived from the Lælia parent.

DIAMOND FLOWER: *Ionopsidium.*

DIANDROLÝRA (*two-stamened Olyra*). *Gramíneæ.* A single species raised at Kew some 8 years ago from seed supplied by Sander but native country unknown: differs from Olyra in its twin spikelets and other characters, the upper one being male and the lower one female, the male fls. with 2 stamens. The species is *D. bícolor,* Stapf, a perennial densely tufted grass with erect culms bearing 1–3 lanceolate or lance-oblong lvs. that are dark green above and violet-purple beneath.

DIANÉLLA (diminutive of Diana, goddess of the hunt). *Liliàceæ.* Tender perennial rhizomatous plants, related to Phormium.

Leaves hard, linear, sheathing, grass-like, crowded at base of st., often 2–3 ft. long: fls. blue, in large loose panicles, on delicate pendent pedicels; perianth withering but not falling, with 6 distinct spreading segms.; stamens 6, with thickened filaments; ovary 3-celled, each cell several-ovuled, the style filiform and stigma very small: plant bearing great numbers of pretty blue berries, which remain attractive for several weeks, and are the chief charm of the plant.—There are about a dozen species in Trop. Asia, Austral. and Polynesia. They perhaps succeed best in the open border of a cool greenhouse. Prop. by division, or by seeds sown in spring in mild heat. They are little known in this country. They are spring and summer bloomers.

A. *Lvs. radical or nearly so.*

tasmánica, Hook. f. Height 4–5 ft.: lvs. numerous, in a rosette, broadly ensiform, 2–4 ft. long, ¾–1 in. wide, margined with small reddish brown spines that cut the hand if the lvs. are carelessly grasped: panicle very lax, surpassing the lvs. 1–2 ft., with as many as 60 fls.; fls. pale blue, nodding, ½–¾in. across, segms. finally reflexed; anthers 1 line long: berries bright blue, on very slender pedicels. Tasmania and Austral. B.M. 5551. Var. **variegàta,** Bull. Lvs. handsomely striped with light yellow. R.B. 29:61.

lævis, R. Br. Lvs. 1–1½ ft. long, 6–9 lines wide, less leathery and paler than in *D. cærulea* and at first slightly glaucous: panicle deltoid, the branches more compound than in *D. revoluta,* outer segms. of the perianth with 5 distant veins, inner ones densely 3-veined in the middle third; anthers 1½ lines long. Eastern temperate parts of Austral. B.R. 751. L.B.C. 12:1136 (both as *D. strumdsa*).

revolùta, R. Br. Height 2–3 ft.: lvs. in a rosette, 1–1½ ft. long, 3–4 lines wide, dark green, purplish at the base and margin, not spiny at the margin: panicle branches short, ascending; fls. later than *D. cærulea;* veins of the perianth-segms. crowded into a central space. W. and E. Austral. in temperate parts. Tasmania. B.R. 734 (as *D. longifolia*); 1120.

AA. *Lvs. more or less scattered on sts. that often branch at base.*

cærùlea, Sims. Sub-shrubby, with a short st. in age, branching: lvs. about 6, clustered at the ends of branches, 9–12 in. long, 6–9 lines wide, dark green, rough on the back and margin: outer perianth-segms. with 5 distant veins, inner ones with 3 closer veins. E. Temp. Austral. B.M. 505.

nemorôsa, Lam. (*C. ensifòlia*, Red.) Caulescent 3–6 ft. high, the lvs. never in a rosette, numerous, hard, linear, 1–2 ft. long, 9–12 lines wide, lighter-colored on the keel and margin: fls. blue or greenish white. Trop. Asia, China, Austral., Hawaiian Isls. B.M. 1404.

WILHELM MILLER.
L. H. B.†

DIANTHÈRA (*double anther* referring to the separated anther-cells). *Acanthàceæ.* WATER-WILLOW. Herbs, mostly of greenhouses and warmhouses, and sometimes of open planting in mild climates.

Glabrous or pilose perennial herbs or sometimes somewhat woody, mostly of wet places, with opposite, mostly entire lvs.: fls. mostly purplish or whitish, irregular, usually in axillary spikes, heads or fascicles, or the clusters combined in a terminal thyrse; corolla slender-tubed, 2-lipped, the upper lip erect and more or less concave or arched and entire or 2-toothed, the lower lip 3-lobed or 3-crenate and spreading, and with a palate-like structure; anther-cells separated on a broadened connective, not parallel with each other: fr. an oblong or ovoid 2-celled caps., the seeds 4 or less: floral bractlets small or minute.—Probably more than 100 species, mostly in warm and tropical countries. Lindau in Engler & Prantl unites it with Justicia as a subgenus, and the number of species is estimated as more than 70 in Trop. Amer. The diantheras are little known in cult. *D. Pohliana* is to be found in Jacobinia. The treatment given Jacobinia and Justicia applies to these plants.

americàna, Linn. St. angled, 1–3 ft.: lvs. narrow-lanceolate, 3–4 in. long, nearly sessile: fls. several in a close cluster with a peduncle mostly exceeding the lvs., pale violet or whitish, the corolla mostly less than ½in. long, the tube shorter than the lips. In water, Quebec to Wis., Ga. and Texas.—Sometimes transferred to garden bogs and streams.

secúnda, Griseb. (*Justícia secúnda*, Vahl). Nearly glabrous, constricted at the nodes: lvs. ovate or ovate-lanceolate, acuminate: fls. crimson, short-pedicellate, in a usually 1-sided panicle; lower lip 3-crenate. W. Indies. B.M. 2060.

pectoràlis, Gmel. (*Justícia pectoràlis*, Jacq.). GARDEN BALSAM. St. slender, often woody, 1–3 ft.: lvs. lanceolate-acuminate or nearly oblong, to 4 in. long: fls. rosy or pale blue, with a parti-colored throat, rather distant in elongated branched mostly 1-sided spikes. W. Indies, Mex., Brazil.

D. bullàta, N. E. Br. St. terete, purplish: lvs. elliptic, to 4½ in. long, short-stalked, cordate at base, bullate or puckered between the veins, dark green above and purple-veined beneath: fls. whitish, small, clustered. Borneo. I.H. 33:589.—A. handsome foliage subject, with the appearance of a rubiaceous plant.—*D. ciliàta*, Benth. & Hook. (Jacobinia ciliata, Seem.). St. obscurely 4-angled, 2 ft.: lvs. ovate-lanceolate, 2–3 in. long, short-stalked: fls. violet with white palate, sessile, many in a short-peduncled fascicle; calyx ciliate; corolla-tube ¾in. long, cylindrical; upper lip very small, 2-lobed, concave and recurved; lower lip very large and showy (1¼ in. across), flat, with 3 large lobes. Costa Rica. Panama(?). B.M. 5888 (as Beloperone ciliata, Hook. f.).—Described as an annual. Perhaps not of this genus.

L. H. B.

DIANTHUS (Greek for *Jove's flower*). *Caryophyllàceæ.* PINK. Small herbs, many of them prized for their rich and showy flowers in the open garden; and one is the carnation. Some of them are deliciously fragrant.

Mostly perennials forming tufts and with grass-like lvs., and jointed sts. with terminal fls. and opposite lvs. From kindred genera Dianthus is distinguished by the sepal-like bracts at the base of a cylindrical calyx (Figs. 802, 803); petals without a crown; styles 2: caps. opening by 4 valves. Mostly temperate-region plants, of S. Eu. and N. Afr., but occurring elsewhere, one of them (a form of *D. alpinus*) being native in N. Amer.; about 250 species are recognized. The fls. are usually pink or red, but in garden forms white and purple are frequent colors. Most of the cult. species are hardy in the N. and are easy of cult. The perennial species are excellent border plants. The chief care required in their cult. is to see that the grass does not run them out. Best results in flowering are secured usually from 2-year-old seedling plants. The genus abounds in attractive species, and other names than those in this article may be expected to appear in the catalogues. Numbers of species are likely to be grown by rock-garden specialists. Pinks are among the old-fashioned flowers, particularly *D. plumarius*, which was formerly common in edgings and in circle-beds. The sweet williams are always popular. All the species described in this article are perennial, but there are a few annuals in the genus but apparently not in cult. Two weedy annual species, *D. prolifer*, Linn., and *D. Armeria*, Linn., are naturalized in the eastern states, and two or three others have run wild more or less. See E. T. Cook, "Carnations, Picotees, and the Wild and Garden Pinks," London, 1905. See p. 3568.

Dianthuses like a warm soil, and one that will not become too wet at any time, especially in winter, when the perennial kinds are grown, as they are often killed not so much from cold as from too much ice around them. Snow is the best possible protection, but ice is the reverse.—All dianthuses are readily propagated from seeds sown in rich soil (usually beginning to bloom the second year), but the double kinds are reproduced from cuttings alone to be sure to have them true, and in the fall months cuttings are easily rooted if taken with a "heel" or a part of the old stem adhering to the base of the shoot; so that to make cuttings it is best to strip them off rather than to make them with a knife. It will be found, also, that cuttings made from plants growing in the open ground do not root readily but seem to dry up in the cutting-bench; if the plants to be increased are carefully lifted and potted, placed in a temperature of say 50° until young growth shows signs of starting, every cutting taken off at this stage will root easily. The transition from outdoors to the propagating-house should not be too abrupt. Another method of propagation is by layering, and with the garden pinks, or forms of *D. plumarius*, it is the easiest and surest. After hot weather is past, stir the soil round the parent plant, take the branches that have a portion of bare stem, make an incision half way through and along the stem for an inch, and peg this down in the soil without breaking off the shoot (Fig. 809). Roots will be formed and good strong plants be the result before winter. The layering method is specially suitable to such species as *D. plumarius*, *D. Caryophyllus* and double forms of others, such as sweet william.—Among the species are various pretty little alpine tufted sorts as *D. neglectus*, *D. glacialis* and *D. alpinus*, all of which are of dwarf close habit, not exceeding 3 inches high and having very large single flowers of brightest colors. These are suited only for rock-gardening, as on level ground they often become smothered with weeds or swamped with soil after a heavy rainstorm, and to these two causes are attributable the failures to cultivate them. (E. O. Orpet.)

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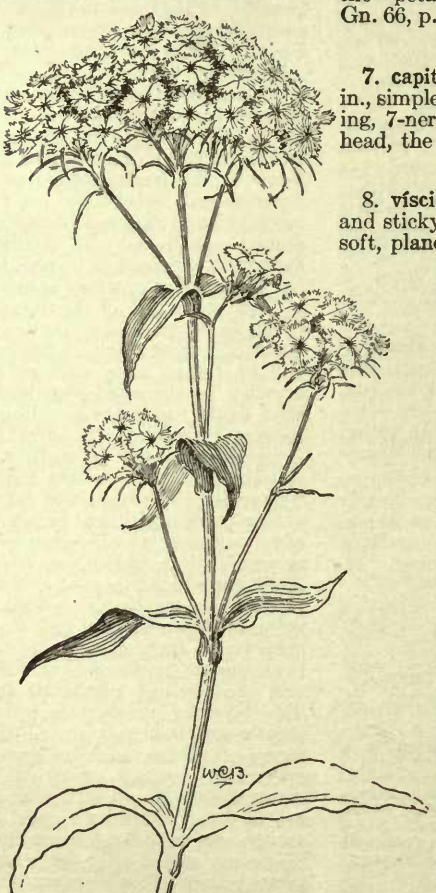
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A. *Fls. mostly in cymes or in heads, often densely aggregated, the cluster often subtended by involucre-like lvs.*

B. *Petals not bearing hairs or barbs: bracts dry.*

1. **cinnabarìnus,** Sprun. A foot high, woody at base, many-stemmed, the sts. simple and 4-angled, blooming in Aug. and Sept.: lvs. linear, sharp-pointed and rigid, 7-nerved: fls. few in heads; petals fiery red above, paler beneath, glandular; stamens included. Greece.—Handsome little species; useful for hardy border or rockery.

2. **Pàncicii,** Velen. (*D. stenopétalus* var. *Páncicii*, Williams). Cespitose, glabrous, 2–3 ft., the sts. slender and 4-angled: lvs. linear-acuminate, soft, 3-nerved, in a dense grass-like basal tuft: fls. 5–15 in a paniculate cyme or head; calyx green; petals rose or crimson. Balkan region. Var. **grandiflòrus,** Hort., has very stout sts., large clusters, and large purple-carmine fls.



1251. Sweet William—Dianthus barbatus. (×½)

BB. *Petals with hairs or barbs on the lower part of the blade.*

C. *Plant glabrous but usually not glaucous.*

3. **barbàtus,** Linn. Sweet William. Fig. 1251. Readily grown from seed and flowering well the second year: glabrous, the sts. 4-angled, 10-20 in. high, simple or branched only above: lvs. broad and flat or conduplicate, 5-nerved: fls. several to many in a round-topped dense cyme, the petals toothed and bearded, red, rose, purple or white and also varicolored in garden forms, the bracts subtending the calyx 4 and long-pointed. Russia to China and south to the Pyrenees. G.1:372. Gn. M. 2:217; 14:55. F. E. 23:219.—The sweet william is one of the oldest garden fls. It is sure to be found in the old-fashioned gardens. The cult. forms run into many colors. Sometimes found along roadsides as an escape. There are double-fld. forms. R.H. 1894, p. 277. Some of the modern improved large-fld. forms are very showy, and produce their bloom over a long season. **D. Laucheànus,** Bolle, is a hybrid of *D. barbatus* and *D. deltoides*. Gt. 53:1528.

4. **carthusianòrum,** Linn. (*D. atrórubens*, Willd.). Hardy, glabrous, scarcely glaucous, 12–20 in. high, the st. angled: lvs. linear and pointed, without prominent nerves when fresh: fls. in a dense, 6–20-fld. head (sometimes the clusters very few-fld.), in shades of red, odorless, the petals sharply but not deeply toothed, the cluster subtended by very narrow or even awl-like lvs.; calyx-bracts 4, coriaceous, yellowish or straw-colored. Denmark to Portugal and Egypt. B.M. 1775, 2039.—Widely variable. Little planted in American gardens.

CC. *Plant glabrous and glaucous.*

5. **cruéntus,** Griseb. (*D. atrococcíneus*, Hort.). Cespitose, glaucous, glabrous: st. 1–2 ft., terete, forking: lvs. linear or lance-linear, sharp acuminate, spreading, 7-nerved, the cauline linear-appressed and 5-nerved: fls. deep blood-red, small, about 20 in a subglobose dense head, odorless; petals red-hairy towards the base. July. Greece and N.

6. **gigantèus,** Urv. Cespitose, glabrous, glaucous, 2–3 ft. or more, simple: lvs. long-linear, 7-nerved, plane, spreading and acuminate: fls. 10–12 in a head, red, the petal-blade obovate-cuneate. Balkan region. Gn. 66, p. 122.

CCC. *Plant woolly, glaucous.*

7. **capitàtus,** Balb. Plant glaucous, woolly, 12–16 in., simple, st. 4-angled: lvs. linear, acute, plane, spreading, 7-nerved, those on the st. 5-nerved: fls. 6–8 in a head, the petals purple-spotted. Siberia to Servia.

CCCC. *Plant viscid-pubescent.*

8. **víscidus,** Bory & Chaub. Cespitose, pubescent and sticky, about 12 in., simple: lvs. linear, acuminate, soft, plane, 1–3-nerved: fls. 3–6 in a fascicle, the petals purple-spotted, the blade obovate-cuneate and few-toothed. Bulgaria, Greece, Turkey.—Runs into several marked forms.

AA. *Fls. solitary, or loosely in 2's or 3's.*

B. *Calyx-bracts short and broad, mostly appressed.*

C. *Petals fimbriate.*

D. *Teeth of calyx mucronate.*

9. **plumàrius,** Linn. (*D. scóticus*, Hort.). Common Grass or Garden Pink. Scotch Pink. Pheasant's-Eye Pink. Low, tufty, 1 ft.: sts. simple or forked: plant blooming in spring and early summer, very fragrant: lvs. elongate-linear, keeled, spreading or recurved, thickish, 1-nerved, blue-glaucous: fls. medium size, rose-colored (varying in cult. to purple, white and variegated), the blade of the petal fringed a fourth or fifth of its depth; calyx cylindrical, with short broad-topped mucronate bracts. Austria to Siberia. Gn. 66, p. 260. F.E. 23:401.—A universal favorite. Hardy. Much used in old-fashioned gardens as edging for beds. There are double-fld. forms. A more continuous-blooming form is catalogued as var. *semperflòrens*.

10. **arenàrius,** Linn. Cespitose, glabrous, 1 ft. or less, the sts. simple or forked, slender, 1–3-fld.: lvs. elongate-linear, keeled, obtuse, fascicled, spreading: fls. white, fragrant; petals much cut beyond the middle; calyx purplish, the teeth ovate-lanceolate.

Dalmatia to Finland. G.26:433.—Var. **glaùcus**, Blocki, connects this species with No. 9.

DD. *Teeth of calyx acuminate or attenuate.*

11. **monspessulànus**, Linn. Sts. terete, glabrous, branching, 12–20 in.: lvs. linear, acuminate, plane, spreading but strict, 5-nerved: fls. solitary or 2 or 3 together, showy, odorless; petals rose, rarely white, cut or fimbriate; calyx attenuated at top, the teeth 7-nerved. Spain to Caucasus.



1252. Dianthus superbus. (×½)

12. **squarròsus**, Bieb. Cespitose: sts. terete, slender and squarrosely few-fld., glabrous, more or less branching, 1½–2 ft.: lvs. linear, acute, canaliculate, recurved: fls. rose; petals oblong, pinnately many-parted. Russia, Siberia.

13. **petræus**, Waldst. & Kit. Cespitose, glabrous, the sts. slender and simple, 1 ft. or less: lvs. linear-lanceolate, acute, keeled, spreading, 3-nerved: fls. white, fragrant; petal-limb obovate, fimbriate but not bearded. Bulgaria, Austria. B.M. 1204.

14. **fimbriàtus**, Bieb. Suffruticose, glabrous, the sts. simple, 1 ft.: lvs. linear, acute, appressed, 3-nerved, plane or keeled: fls. variable, rose-colored, much fimbriate, bearded. Var. **orientàlis**, Williams (*D. orientàlis*, Donn), has fls. with linear-cuneate petals, strongly imbricate obovate straw-colored bracts. B.M. 1069. —A very variable species, ranging from Portugal to Thibet.

15. **supérbus**, Linn. Fig. 1252. Glabrous, light green: sts. 10–20 in., dichotomous and branched at top, terete and slender: lvs. lance-linear, acute, 3–5-nerved, rather soft, plane: fls. very fragrant, in a lax forking panicle; petals lilac, dissected below the middle. Norway to Japan and Spain. Variable. B.M. 297.—A handsome species; garden forms are sometimes offered.

CC. *Petals only dentate (except perhaps in some garden forms).*

16. **cæsius**, Smith. CHEDDAR PINK. Cespitose, glabrous, glaucous: sts. 12 in. or less, simple, or forked above, 4-angled, 1–2-fld.: lvs. lance-linear, plane, 3-nerved, the cauline acute and keeled: fls. showy, fragrant, the petal-limb rose-colored, obovate-cuneate and irregularly toothed. Eu. G.C. III. 44:214. Gn. 64, p. 236.—Runs into several forms.

17. **sylvéstris**, Wulf. (*D. virgìneus*, Hort.). Cespitose, slender, 1 ft. high, the st. simple or somewhat branched, angular-compressed and bearing 1–3 odorless fls.: lvs. tufted, linear and sharp-pointed, scabrous on the margins: fls. rather small, red, the petals obovate-cuneate and shallow-toothed. Spain to Greece and Austria.—Very variable. Pretty perennial border plant. Var. **frígidus**, Williams (*D. frígidus*, Kit.) is a dwarf Hungarian form.

18. **attenuàtus**, Smith. Cespitose, glaucous, woody at base, the sts. diffuse and tortuose, 20 in.: lvs. linear, acute, plane, 3-nerved: fls. small, solitary or twin but disposed in a lax panicle, odorless, rose-colored; petal-limb oblong. Eu.

19. **Caryophýllus**, Linn. CARNATION. CLOVE PINK PICOTEE. GRENADINE. Figs. 801–818. Plate XXII. Cespitose, glabrous, 1–3 ft., the sts. hard or almost woody below, the nodes or joints conspicuous: lvs. thick, long-linear, very glaucous, keeled, 5-nerved, stiffish at the ends: fls. mostly solitary, showy, very fragrant, rose, purple or white; calyx-bracts 4, very broad, abruptly pointed. B.M. 39 (Bizarre Carnation); 1622 (var. imbricatus); 2744 (Picotees).—Generally supposed to be native to the Medit. region, but Williams gives its geographical limits as "north and west Normandy" and "south and east Punjaub" (northwestern Hindoostan). In Eu. it is largely grown as an outdoor pink, but in this country it is chiefly known as the greenhouse carnation. The American forcing type (which may be called var. **longicaùlis**) is distinguished by very long stems and a continuous blooming habit; it is here the carnation of commerce. Garden varieties of *D. Caryophyllus* are numberless, and they often pass under Latinized names (*D. punctatus*, Hort., is one of these names). See *Carnation*. The carnation has been long in cult. The bloom is now very variable in size, form and color; originally probably pale lilac. Fragrant.

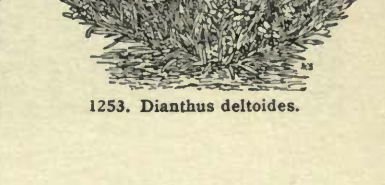
BB. *Calyx-bracts half the length of the calyx, mostly narrow-pointed, more or less spreading at the tips: lvs. short and spreading, the radical ones obtuse or nearly so.*

20. **deltoìdes**, Linn. MAIDEN PINK. Fig. 1253. Densely tufted, 6–10 in., blooming in spring and early summer, creeping: sts. ascending, forking, with solitary fls. on the branchlets: st.-lvs. an inch long, linear-lanceolate, sharp-pointed: fls. small (½–¾in. across), the petals toothed, deep red with a crimson eye, the petals bearing an inverted V-shaped pocket at their base (whence the name *deltoides*), fragrant. Scotland to Norway and Japan. Gn. 66, p. 224. G.M. 55:28. G.W. 14, p. 181.—One of the prettiest border pinks, making neat mats of foliage and bearing profusely of the little bright fls. There is a white-fld. variety.

21. **alpìnus**, Linn. More or less cespitose, very dwarf, the 1-fld. slender sts. rarely reaching more than 3–4 in. high, more or less prostrate: foliage dark shining green, the lvs. linear or lance-linear, those on the st. keeled and strict: fl. 1 in. or more across, odorless, deep rose or purplish and crimson spotted, a darker ring around the eye. Russia to Greece and Swiss Alps. B.M. 1205. Gn. 26:184; 47, p. 292; 45, p. 53. Gt. 4:110. G.W. 8, p. 14.—One of the choicest of alpine and rockwork plants. Var. **rèpens**, Regel (*D. rèpens*, Willd.), of Siberia and Alaska, has a single root and procumbent sts. branched from near base: fls. purple; calyx somewhat inflated, ½in. long. Apparently not cult. This is kept as a distinct species by some.

22. **versícolor**, Fisch. Glabrous, the sts. 10–12 in., terete, paniculately branched: lvs. narrow-linear, plane, those on the st. becoming scale-like: fls. loosely paniculate, the petal-limb obovate-cuneate, red-spotted above and greenish yellow beneath; calyx-teeth lanceolate, acute. Altai Mts., Siberia.

23. **callizònus**, Schott & Kotschy. Smooth and glaucous, the sts. terete, 1-fld., 12–16 in.: lvs. canaliculate, 3–5-nerved, the radical linear-lanceolate and acute, the cauline lance-linear and acuminate: petal-



1253. Dianthus deltoides.

limb obovate-cuneate, purple-spotted above, and with a zone at the center, rose-colored beneath; calyx purple, the teeth lanceolate-acuminate. S. E. Eu. Gn. 64, p. 298; 66, p. 54; 70, p. 275.

BBB. *Calyx-bracts leafy and spreading.*

24. **glaciàlis,** Haenke. Three to 4 in. high, the 4-angled sts. tufted and 1–2-fld.: lvs. green, linear-lanceolate, pointed, those on the st. linear-acute and strict or recurved, 3-nerved: fls. small and odorless, red-purple; the petals toothed, yellowish beneath, contiguous; bracts 2–4. Mts. of S. Eu. G.C. II. 21:809.—A pretty species, but difficult to establish. Grown among alpine plants. Var. **Frèynii,** Williams (*D. Frèynii,* Vandas). Lvs. rather soft, keeled, the lateral nerves obscure: sts. usually 1-fld.: calyx-teeth ciliate. Var. **negléctus,** Williams (*D. negléctus,* Loisel). Lvs. plane: fls. rarely twin; bracts 4: petals separate. G.C. III. 49:415. Gn. 76, p. 339. Gn.W. 20:711.

25. **chinénsis,** Linn. (*D. sinénsis,* Hort.). Fig. 1254. Cespitose, glabrous, more or less creeping at base: st. forking, angled and more or less grooved, pubescent: lvs. broad and nearly flat or slightly trough-shaped, 3–5-nerved: fls. large, solitary or more or less clustered, pink or lilac; the petals (at least in the wild) barbed or hairy toward the base; calyx-bracts 4, in some cult. vars. short. China and Japan; but recent authorities consider a European pink to be but a form of it, and thereby extend its range west to Portugal. B.M. 25. The Amoor pink (*D. dentòsus,* Fisch.) is a form known as var. **macrosépalus,** Franch.: it is a hardy border plant, 1 ft. high, with bright red fls. and a spot at base of each petal. Var. **àsper,** Koch (*D. Séguieri,* Auth.). has fls. in panicles, and the bracts squarrose-spreading: the European form of the species. **D. semperflòrens,** Hort., is a hardy perennial form, 12–18 in., with silvery foliage and deep pink, red-eyed, fragrant fls. *D. chinensis* has given rise to a beautiful and variable race of garden pinks, var. **Héddewigii,** Regel (*D. Héddewigii,* Hort.). These are extensively grown from seeds, and are practically annuals, although plants may survive the winter and give a feeble bloom in the spring in mild climates. The fls. are scarcely odorous. They are single and double, of many vivid colors; and many of the garden forms have bizarre markings. Gt. 7:328. G. 2:537. In some forms, var. **laciniàtus,** Regel (*D. laciniàtus,* Hort.), the petals are slashed and cut. G. 2:538. G.Z. 6:1. **D. imperiàlis,** Hort., is a name applied to a strain with strong habit and rather tall growth, mostly double. **C. diademàtus,** Hort., is another garden strain. G. 2:538. **D. cincinnàtus,** Lem., is a red form with shredded petals. I.H. 11:388. **D. hýbridus,** Hort., is another set. This name (*D. hybridus*) is also applied to a *dentosus*-like form, which some regard as a hybrid of *D. dentosus* and some other species. A recent race of the garden pinks, with narrow petals and a star-like effect, is var. **stellàris,** (*D. stellàris,* Hort.). For portraits of garden pinks, see B.M. 5536. F.S. 11:1150; 12:1288–9; 13:1380–1. Gn. 49:82.—The garden pinks are of easy cult. Seeds may be sown in the open where the plants are to stand, but better results are obtained, at least in the N., if plants are started in the house. Plants bloom after the first fall frosts. They grow 10–16 in. high, and should be planted 6–8 in. apart. They are very valuable for borders and flower-gardens. Species-names now referred to *D. chinensis* are *D. caucasicus,* Sims, *D. ibericus,* Willd., *D. ruthenicus,* Roem., *D. montanus,* Bieb., *D. collinus,* Waldst. & Kit., representing the European extension of the species.



1254. Dianthus chinensis. (×⅓)

26. **latifòlius,** Hort. Plant 6–12 in. high, of doubtful origin, but in habit intermediate between *D. chinensis* and *D. barbatus.* Fls. large, double, in close clusters or even heads, in good colors: lvs. oblong-lanceolate.—A good border plant; perhaps a hybrid.

D. arbòreus, Linn. 3–4 ft., glabrous and glaucous, with a woody trunk, linear-acute canaliculate 3-nerved lvs., and showy rose-colored fragrant fls. in a dense corymb. S. E. Eu. G.C. III. 43:52. This species is one of the sub-shrubby group of Dianthus, comprising also D. fruticosus, Linn. (of the Grecian Archipelago), D. Bisignani, Tenore (of Tunis and Naples), and others. D. suffruticosus, Willd., probably belongs with the last.—*D. call-alpinus,* Hort. Hybrid of D. callizonus and D. alpinus. G.M. 47, p. 408.—*D. diùtinus,* Kit. Allied to D. barbatus: glabrous: sts. simple, 12–18 in., 4-angled: fls. pale red, 6–8 together in a head, the petals barbed. Hungary, Servia. Rockery.—*D. frágrans,* Bieb. Cespitose, glabrous: sts. 10–16 in., simple, or branched above: lvs. elongated-linear, acuminate, 3–5-nerved: fls. fragrant, the limb white suffused with rose, petals beardless. Caucasia, Algeria.—*D. grácilis,* Sibth. More or less woody at base, glabrous and glaucous, the sts. 14–18 in. and simple and slender: lvs. linear-acute, strict, 3-nerved: fls. rose, paler beneath, 2–3 in a cluster. Balkans.—*D. graníticus,* Jord. Sts. simple, scabrous below and glabrous above, slender, 4-angled, 6 in.: lvs. linear-acute, 3-nerved: fls. solitary or in pairs, purple. France. Rockery.—*D. japónicus,* Thunb. Glabrous perennial, with simple sts. 20 in.: lvs. ovate-lanceolate, acute, canaliculate, twisted at base: fls. 6–8 in a head, red. Japan, Manchuria.—*D. micrólepis,* Boiss. Very dwarf, cespitose, glabrous: lvs. scale-like: fls. rose-colored (varying to white). Balkans. A marked little alpine.

L. H. B.

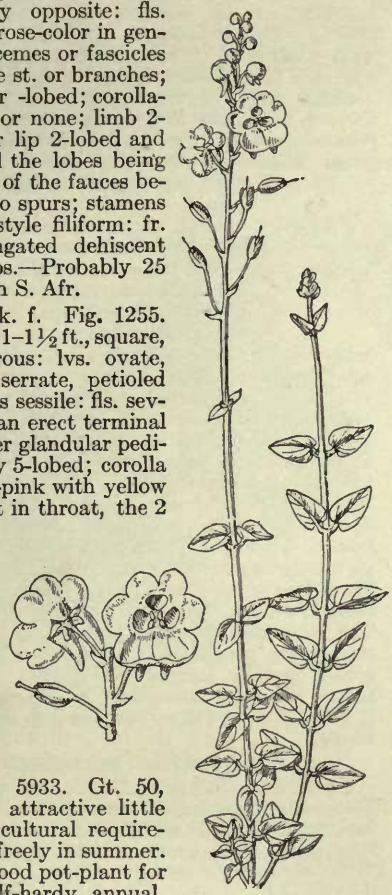
DIAPÉNSIA (ancient name of obscure application). *Diapensiàceæ.* Two alpine-arctic species, one nearly circumpolar and one Himalayan, the former at least sometimes transferred to alpine gardens and rockeries. Diapensias are very small compact tufted evergreen more or less woody perennials, with small entire coriaceous crowded lvs.: corolla 5-lobed, bell-shaped; calyx inclosing the caps.; stamens 5, affixed in the corolla, the filaments broad; ovary 3-celled; fls. solitary on peduncles that project above the dense lf.-rosettes (or the peduncle projected, at least in fr.), white or rose-purple. **D. lappónica,** Linn., on mountain summits in New England and N. Y., and distributed northward to the arctic, forms dense cushion-like tufts, 1 or 2 in. high, with white fls. on peduncles that become 1 or 2 in. long; a very interesting alpine, but seldom grown. B.M. 1108. **D. himalàica,** Hook. f. & Thom Densely tufted: lvs. somewhat acute, very short: fls. white or rose-red, subsessile, the corolla-tube twice the length of the calyx. Sikkim, 10,000–14,000 ft.

L. H. B.

DIÁSCIA (*to adorn*, Greek, having regard to the attractive flowers). *Scrophulariàceæ*. Low and slender herbs, mostly annual, one of which is recently grown in flower-gardens.

Leaves usually opposite: fls. mostly violet or rose-color in general effect, in racemes or fascicles at the end of the st. or branches; calyx 5-parted or -lobed; corolla-tube very short or none; limb 2-lipped, the upper lip 2-lobed and lower 3-lobed, all the lobes being broad and flat, 2 of the fauces being projected into spurs; stamens 4, didynamous; style filiform: fr. a globose or elongated dehiscent many-seeded caps.—Probably 25 or more species in S. Afr.

Bárberæ, Hook. f. Fig. 1255. Annual: st. erect, 1–1½ ft., square, green and glabrous: lvs. ovate, blunt, obtusely serrate, petioled or the upper ones sessile: fls. several to many in an erect terminal raceme, on slender glandular pedicels; calyx deeply 5-lobed; corolla ⅔in. across, rose-pink with yellow green-dotted spot in throat, the 2 upper lobes small and nearly orbicular, the lateral twice larger, and the lower one much larger and obscurely4-angled, the spurs cylindric and about as long as lower lobe; filaments glandular. B.M. 5933. Gt. 50, p. 639.—A very attractive little plant, of simple cultural requirements, blooming freely in summer. It also makes a good pot-plant for indoor use. Half-hardy annual. Pink and orange shades are advertised. L. H. B.



1255. Diascia Barberæ. (Plant ×⅓)

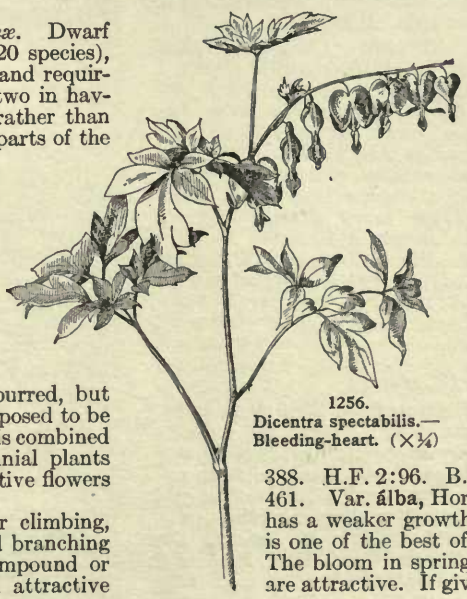
DIASTÈMA (*two stamens*). *Gesneriàceæ*. Dwarf warmhouse plants of Trop. Amer. (about 20 species), allied to Dicyrta, Achimenes and Isoloma, and requiring similar treatment; differs from former two in having 5 distinct glandular parts to the disk rather than annular, and from Isoloma in the narrower parts of the disk, plants weak, fls. pale, white or purplish, and in the short or nearly globular anther-cells, and other features: summer-flowering. **D. ochroleùcum**, Hook., has yellowish white fls.; corolla somewhat swollen at base: lvs. ovate, acute, hairy, coarsely serrate, on hairy purplish erect sts. 1–2 ft. high. Colombia. B.M. 4254. **D. píctum** is offered abroad, but its identity is in doubt; see *Isoloma*. L. H. B.

DICÉNTRA (Greek, *dis*, *kentron*, two-spurred, but originally misprinted *Diclytra*, and then supposed to be *Dielytra*). *Fumariàceæ;* by some this family is combined with *Papaveràceæ*. Charming hardy perennial plants with much-cut foliage, and clustered attractive flowers of interesting structure.

Herbs of various habit, erect, diffuse or climbing, often stemless, with rhizome horizontal and branching or more or less bulbous: lvs. ternately compound or dissected: fls. rose-red, yellow or white in attractive racemes, very irregular, with 4 petals cohering into a heart-shaped or 2-spurred apparently gamopetalous corolla (the 2 outer petals oblong with spreading tips and spurred or saccate at base, the inner 2 narrow and clawed and crested or winged and more or less united over the stigma); sepals 2, very small, scale-like; stamens 6, in sets of 3; pistil 1-celled, with a 2–4-crested and sometimes 2–4-horned stigma, ripening into an oblong or linear 2-valved caps. bearing crested seeds; pedicels 2-bracted.—About 15 species, in N. Amer., W. Asia and the Himalayas. The names Bikukulla (or Bicuculla) and Capnorchis are older than Dicentra, but are rejected by the "nomina conservanda" list of the Vienna code.

The squirrel-corn and dutchman's breeches are two of the daintiest native springtime flowers; and the bleeding-heart is one of the choicest memories of old-fashioned gardens: it is also the most widely cultivated of all the plants of this delightful order. Though long known to herbaria, plants of bleeding-heart were not introduced to western cultivation from Japan until the late forties of last century. Robert Fortune saw it on the Island of Chusan, where he also got *Diervilla rosea* and the "Chusan daisy," the parent of pompon chrysanthemums. The first live plants seen in England flowered in May, 1847. It rapidly spread into every garden in the land, and is now rich in home associations. It is an altogether lovely plant. The species of Dicentra may be classed as caulescent and acaulescent. The stemless kinds send up their short scapes directly from the ground, as *D. Cucullaria, D. canadensis, D. formosa, D. eximia*. The species with leaf-bearing stems are such as *D. chrysantha* and *D. spectabilis*. In the species here described the flowers are nodding except in *D. chrysantha*.

Dicentras are easily cultivated in borders and wild gardens. Two or three kinds can be readily secured from the woods in the East. Effort should be made to reproduce the natural conditions, especially the degree of shade. They like a rich light soil. Propagation is by dividing crowns or roots. The forcing of bleeding-hearts, though pactically unknown in America, is said to be commoner in England than outdoor culture. The forcing must be very gentle and the plants kept as near the glass as possible. It is best to have fresh plants each year, and return the forced ones to the border. None of the species is much cultivated with the exception of the bleeding-heart (*D. spectabilis*).



1256. Dicentra spectabilis.—Bleeding-heart. (×¼)

A. *Fls. rose-purple.*

B. *Racemes simple.*

spectábilis, Lem. (*Dielýtra spectábilis*, Don). Bleeding-Heart. Fig. 1256. Height 1–2 ft.: lvs. and lfts. broadest of the group, the ultimate segms. obovate or cuneate: fls. large, deep rosy red; corolla heart-shaped; inner petals white, protruding. Japan. F.S. 3: 258. Gn. 40:198; 60, p. 375; 70, p. 192. Gn.W. 23: suppl. July 14. G. 2:375; 26:142; 27:112. G.M. 49:718; 51:160. G.W. 5, p. 388. H.F. 2:96. B.M. 4458. R.H. 1847: 461. Var. **álba**, Hort., the white-fld. form, has a weaker growth. The bleeding-heart is one of the best of flowering perennials. The bloom in spring and also the foliage are attractive. If given room and moisture,

the plant will continue to be attractive as a foliage mass till late summer.

BB. *Racemes compound.*

exímia, Torr. Stemless, glabrous and somewhat glaucous, 1–2 ft., from a scaly rootstock: ultimate lf.-segms. broadly oblong or ovate, the lvs. being ternately parted: scape about equaling the lvs.; fls. rose or pink, heart-shaped, tapering to a neck, inner petals protruded. Rocks of W. N. Y. and mountains to Ga. Var. **multipinnàta,** Hort., has lvs. more finely cut, making a very handsome foliage plant.

formòsa, Walp. Fig. 1257. Stemless, with a fleshy and spreading rootstock: lvs. very long-stalked, biternately compound, the segms. cleft or pinnatifid.: scapes about 2 ft., somewhat exceeding the lvs., naked; fls. in a terminal cluster of short and bracted racemes, rose-purple, the corolla ovate-cordate, the petals all united to above the middle, the inner petals scarcely protruding. Cent. Calif. to Brit. Col. A.F. 21:459. Mn. 8:17. B.M. 1335 (as *Fumaria formosa*).



1257. Dicentra formosa. (×⅓)

AA. *Fls. chiefly white.*

canadénsis, Walp. (*Dielýtra canadénsis,* Don). SQUIRREL-CORN, from the scattered little tubers resembling grains of maize. Fig. 1258. Stemless, fragile: lvs. finely cut, glaucous, the segms. linear and abruptly pointed: raceme simple, few-fld.; fls. white, tipped with rose; corolla merely heart-shaped, the spurs being short and rounded; crest of the inner petals conspicuous, projecting. Nova Scotia to Mich., to N. C. and Mo. and Neb., but chiefly northward in the vegetable mold of rich woods. B.M. 3031.

Cucullària, Bernh. (*Dielýtra Cucullària,* Don). DUTCHMAN'S-BREECHES. Fig. 1259. Easily told from *D. canadensis* by its loose, granular cluster of tubers, forming a bulb-like body: lvs. finely cut, little or not at all glaucous: racemes simple, few-fld.; fls. white, tipped creamy yellow; corolla not heart-shaped, the spurs longer and divergent; crest of the inner petals minute. Nova Scotia to Ga. and Mo., and also along the Columbia River (the western form differing in having shorter and rounded spurs). I.H. 6:215. Mn. 6:41. A.G. 13:516. B.M. 1127 (as *Fumaria Cucullaria*).

AAA. *Fls. yellow.*

chrysántha, Walp. GOLDEN EARDROPS. Pale and glaucous, with leafy sts. 2–3 ft. high: lvs. bipinnate, 1 ft. or more long, segms. narrow: infl. thyrsoid paniculate; fls. numerous, as many as 50 in a thryse, erect, golden yellow; corolla linear-oblong; outer petals hardly larger than the inner, the tips soon recurving to below the middle, all distinct. Dry hills of the inner Coast range. Calif. B.M. 7954. F.S. 8:820 (as *Capnorchis chrysantha*).—Rare in cult.

D. torulòsa, Hook. f. & Thoms., of the Himalayan region, has been intro. abroad. It is an annual climber, 10–16 ft.: lvs. attractively cut: fls. 6–8 together, yellow: fr. red. L. H. B.†

DICHORISÁNDRA (compounded of Greek words referring to the division of the stamens into two series). *Commelinàceæ.* Tropical perennial herbs, with handsome foliage, often beautifully variegated, and rich blue flowers borne in thyrse-like panicles.

Stems simple or branched, erect or partially scandent, the lvs. sheathing at the nodes: lvs. entire, sessile or petiolate, mostly long: sepals 3, distinct, ovate or oblong, green or colored, not equal; petals 3, distinct, wider than the sepals; stamens 6 or 5; ovary sessile, 3-celled: fr. an ovate-3-angled 3-valved caps., few-seeded.—About 30 species in the American tropics.

The dichorisandras are usually handled as warmhouse subjects, although some of them may be plunged in the open ground south of Philadelphia. *D. thyrsiflora* is a satisfactory plant of unusual and interesting appearance, which requires little attention when once well established, and may be relied upon to flower regularly year after year. It needs careful repotting every year at first until a good-sized pot (say 8-inch) is well filled with roots. It then throws up a strong shoot each year about 5 or 6 feet high, unbranched, and with perhaps 8 or 9 leaves near the top. The handsome thyrse of blue flowers gives a color that is rare in the greenhouse. This plant may be the only representative of its interesting order in a private collection. It is willing to be crowded into the background, where its bare stem is hidden, and where the light may be poorest. The stem dies down in the winter time, when water should be gradually withdrawn. Water should be given liberally during the growing season. Of the foliage plants of this genus, *D. mosaica* is commonest. It is dwarfer, and does not flower so regularly. (Robert Shore.)

A. *Foliage not variegated.*

thyrsiflòra, Mikan. Simple or nearly so, stout, 3–6 ft.: distinguished by its large lvs., which are lanceolate, narrowed into a distinct petiole, glabrous, 6–10 in. long, 2 in. wide, green on both sides: st. about 3 ft. high, scarcely branched, robust, glabrous: racemes subpanicled, pubescent; petals dark or light blue; sepals glabrous, blue or somewhat herbaceous. Brazil. B.R. 682. L.B.C. 12:1196. P.M. 3:127. G. 27:569. J.H. III. 43:262.

AA. *Foliage variegated.*

mosàica, Lind. (*D. musàica,* Koch & Lind.). St. erect, simple, stout, spotted: distinguished by its large, broadly elliptical lvs., which are roundish at



1258. Leaf of Dicentra canadensis. —Squirrel-corn.

the base, sessile, glabrous, about 6 in. long, 3–4 in. wide, with a short, sharp, rather abrupt point: st. unbranched, robust, spotted: raceme short, densely thyrsoid; sepals white or greenish. Gt. 1868:593. F.S. 16:1711.—Its chief beauty is the mosaic appearance of the foliage, due to numberless short transverse whitish lines, which do not pass by the longitudinal veins of the lf. The under side of the lvs. is a rich purplish color. Var. **gigantèa**, Hort., a large form, has been offered.

Var. **undâta**, Miller (*D. undàta*, C. Koch & Lind.). Foliage without any mosaic appearance, the variegation being entirely longitudinal. Each parallel vein



1259. Dicentra Cucullaria.—Dutchman's Breeches.

lies in the middle of a long, whitish band extending the full length of the lf. F.S. 17:1763. G.W. 3, p. 159.

D. acaùlis, Cogn. Stemless: lvs. in a rosette, almost sessile, narrowly oblong, wavy, acutish, short-cuneate at the base, sparsely pilose on both sides: panicles terminal, sessile, much shorter than the lvs. Brazil. I.H. 41:19. Handsomely variegated with countless short longitudinal lines.—*D. álbo-marginàta*, Lind. St. 3–4 ft.: lvs. lanceolate, acuminate, attenuate to base, glabrous: raceme peduncled, 2 in. long, dense; petals dark blue, white at base; sepals white. Brazil. G.W. 4, p. 307.—*D. angustifòlia*, Lind. & Rod. St. purple, spotted green: lvs. oblong-lanceolate, sessile, glabrous, roundish at the base, acute, about 6 in. long, 2 in. wide at the middle, purple below, marked above with short transverse white lines. Ecuador. I.H. 39:158.—*D. leucophthálmos*, Hook., differs in having radical infl., its fls. lying flat on the ground. Lvs. elliptic, acuminate, green on both sides: fls. blue, with a white eye; stamens 6. Brazil. B.M. 4733. J.F. 4:428.—*D. ovalifòlia*, Presl. Lvs. oval, sessile, acuminate, glabrous, the upper ones oblong-lanceolate: panicle wide-branching. Nicaragua to Colombia.—*D. oxypétala*, Hook., is instantly recognized by its acute petals, which are purple. Lvs. green on both sides. Brazil. B.M. 2721.—*D. pícta*, Lodd., has narrower petals than usual, with a white spot at the base, but is told from all others here described by the irregular blotches of purple on the upper side of the lvs. The purple is the same color as that on the under surface. Brazil (?). B.M 4760. L.B.C. 17:1667. — *D. Regìna*, Hort. = Tradescantia Reginæ, Lind. & Rod., intro. about 20 years ago by a firm of Continental Eu. —*D. Saùndersii*, Hook., differs from all others here described in the extreme density of its head-like infl. Lvs. green on both sides, lanceolate: sepals white, tinged blue. Brazil. B.M. 6165.—*D. Sièbertii*, Hort. A little-known plant with white midrib and margins; probably a form of D. ovalifolia.—*D. thysiàna*=Palisota.

WILHELM MILLER.
L. H. B.†

DÍCHROA (Greek, *dis*, two, and *chros*, color). Syn. *Adàmia*. *Saxifragàceæ*. Rare greenhouse shrub in habit resembling a Hydrangea, with violet-blue fls. in a pyramidal panicle a foot across, and handsome blue berries. Lvs. persistent, opposite, stalked, narrow, tapering both ways, serrate: panicles terminal, many-fld.; fls. blue, lilac, or violet; petals 5 or 6, valvate; styles 3–5, club-shaped: seeds numerous, small. The genus has only 1 species, in the Himalayas, Malaya, and China. It is sometimes considered to be bitypic, but the other species, *D. pubescens*, Miq., is considered by Koorders (Exkursionoflora von Java) to be probably a true Hydrangea.

febrífuga, Lour. (*Adàmia versícolor*, Fortune. *Cyanòtis sylvática*, Reinw.). Later writers also include *Adàmia cyànea*, Wall., which Lindley distinguished by its smaller lvs. and fls., 5 petals, and 10 stamens, while *A. versicolor* had 7, or sometimes 6 petals, and 20 stamens. Plants may still be cult. under the name of *A. cyanea*, but it cannot be stated here how distinct they are for horticultural purposes. A somewhat virgate shrub 5–9 ft. tall, with lanceolate or obovate-lanceolate lvs. to 8 in. long, glabrous except on the nerves; petals less than ¼in. long. Clarke states that the Chinese varieties have larger fls. than the Indian forms. Occurs in the temperate Himalayas from 5,000–8,000 ft. B.M. 3046. P.M. 16:322.

WILHELM MILLER.
L. H. B.†

DICHROPHÝLLUM: *Euphorbia*.

DICHRÓSTACHYS (*two-colored spikes*). *Leguminòsæ*. Stiff shrubs, with bipinnate lvs. and small leathery lfts. and very small polygamous fls. in spikes, sometimes mentioned as useful for cult. in warmhouses. The species are few, in Trop. Asia, Afr., and Austral. Fls. in the upper part of the spike perfect, those of the lower part bearing 10 long filiform staminodia; corolla not papilionaceous, comprising 5 strap-shaped petals that are more or less united at base; stamens 10 in the perfect fls., free, slightly exserted: pod narrow, compressed, mostly or nearly indehiscent. **D. platycârpa**, Welw., is or has been in cult.: a slender spiny tree, 10–15 ft. high: pinnæ 10–18 pairs, the lfts. 1–2 lines long and very narrow: spikes usually shorter than the lvs.: pod twisted, 2–4 in. long, about 1 in. broad. Guinea. **D. nûtans**, Benth. (*Caillièa Dichróstachys*, Guill. & Perr.), has been intro. in S. Calif.: spiny, much contorted shrub or small tree: lvs. glabrous or pubescent, acacia-like; pinnæ 5–10 pairs; lfts. 10–20 or more pairs, sessile, linear or linear-oblong, rarely as long as ½in.: fls. in dense axillary twin or solitary spikes, the upper ones sulfur-yellow and the lower ones rosy lilac: pod twisted, ⅓in. or less broad. Cent. Afr.

L. H. B.

DICKSÒNIA (named for James Dickson, an English botanist, 1738–1822). *Cyatheàceæ*. Tree ferns of greenhouses.

Plants with a distinctly 2-valved inferior indusium, the outer valve formed by the apex of the lf.-segm. —A small genus, mostly of the southern hemisphere. For *D. pilosiuscula*, *D. punctilobula* and *D. Smithii*, see *Dennstædtia*. For *D. Schiedei* and *D. regalis*, see *Cibotium*. These are only two of several confusions of species which have been called Dicksonia, but really belong in other genera. Modern fern students are now reaching the conclusion that Dicksonia is not only very distinct from the genus Cyathea and its relatives, but belongs in a distinct family.

Dicksonias are amongst the most important tree ferns, both for their beauty and because of their relative hardiness. In their native countries some of them are occasionally weighted with snow, and *D. antarctica* has to endure frosts. They can be grown in coolhouses, and should be tried southward outdoors in sheltered places. Their trunks are more fibrous than those of most tree ferns, and hence more retentive of moisture, so that they need less care. A good trunk produces thirty to forty fronds a year, and retains them until the next set is matured, unless the trees suffer for moisture in winter. Although they rest in winter, the fronds soon shrivel up if the trunks are allowed to get too dry. Dicksonias should have their trunks thoroughly watered twice a day during the growing season. These waterings

should be gradually decreased until winter, when the trunks should be kept merely moist all the time. Only in the hottest summer days is slight shade needed. It is a pity to grow tree ferns in pots, but if this must be done several principles should be observed. The lapse of a single day's watering will often cause serious damage. As a rule, the pots should be of the smallest size consistent with the size of the trunk. Three or 4 inches of soil all around the trunks are enough. The above points are taken from Schneider's "Book of Choice Ferns;" see also the discussion of tree ferns, under *Ferns*, Vol. III.

antárctica, Labill. Lf.-stalks short, the scales dense, dark purplish brown; lvs. 5–6 ft. long, the middle pinnæ 12–18 in. long; segms. oblong, the sterile incised. Austral. and Tasmania. G.C. III. 9:81.—Trunk sometimes 30–35 ft. high. A very useful decorative plant.

squarrósa, Swartz. Lf.-stalks short, the scales hair-like, light colored: lvs. 3–4 ft. long, the pinnæ 9–15 in. long; segms. lanceolate, the sterile toothed, the ribs scabrous. New Zeal. and Chatham Isl.

L. M. Underwood and Wilhelm Miller.

DICLÍPTERA (named in allusion to the 2-celled winged caps.). *Acanthàceæ.* Pubescent or hirsute annual or perennial herbs or sub-shrubs, with red, violet or blue bracted flowers in terminal or axillary clusters, in the tropical parts of the world, 1 or 2 of which may sometimes occur in the trade. Lvs. opposite, entire, the plant usually evergreen: corolla-tube, slender, often somewhat expanded above; limb 2-lipped, the lips narrow; stamens 2, on the throat. **D. Niederleiniàna,** Lind., has been recently intro. abroad from Argentina: sub-shrub: lvs. oval, to 3 in. long, petioled, rounded at apex, densely pubescent: fls. about 1¼ in. long, several crowded in a terminal paniculate cyme. *D. Tweediàna,* Nees, of Uruguay, is a showy perennial with orange-red fls. and oblong-obtuse lvs. There are probably 75 species of Dicliptera. Very likely the horticultural names are confused as between this genus and others. L. H. B.

DICLÝTRA: An ancient typographical error for Dielytra. See *Dicentra.*

DICTÂMNUS (old Greek name, supposed to indicate foliage like the ash: hence Fraxinella, diminutive of the Latin Fraxinus, an ash). *Rutàceæ.* Gas-Plant. Burning-Bush. Fraxinella. Dittany. A hardy perennial herb.

Stout plants woody at the base: lvs. alternate, odd-pinnate, the lfts. ovate, serrulate and pellucid-punctate: fls. showy, white or rose, on bracted pedicels; petals 5, the lower one declined; disk thickish, annular; stamens 10, declined; ovary deeply 5-lobed, 5-celled, hispid, becoming a hard 5-divided caps., each division or separate part being 2–3-seeded.—One variable species, native from S. Eu. to N. China.

This genus includes an old garden favorite which has a strong smell of lemon, and which will give a flash of light on sultry still summer evenings when a lighted match is held under the flower-cluster and near the main stem. It is one of the most permanent and beautiful features of the hardy herbaceous border. Instances are known in which it has outlived father, son and grandson in the same spot. It thrives in the sun.

The gas plant makes a sturdy, bold, upright growth, and a clump 3 feet high and as much in thickness makes a brave sight when in flower. A strong, rather heavy soil, moderately rich, is best for these plants They are not fastidious as to situation, succeeding as well in partial shade as when fully exposed to the sun, and drought will not affect them when once fairly established. Old strong clumps are good subjects as isolated specimens on a lawn, and a large patch, planted in the border, is not only effective while in full flower, but the dark, persistent foliage is ornamental throughout the season. It is not advisable to disturb the plants very often, as they improve with age, producing taller flower-stems and more of them as they grow older. They are excellent for cutting, especially the white variety. Propagation is accomplished with difficulty by division, but easily by seeds, which are sown in the open ground in fall as soon as ripe, and covered an inch or so. They will germinate the next spring, and, when two years old, the seedlings may be removed to their permanent positions, where they will flower the following year. (J. B. Keller.)

álbus, Linn. (*D. Fraxinélla,* Pers. *Fraxinélla álba,* Gaertn. *F. Dictámnus,* Moench). A vigorous, symmetrical, hardy herb, with glossy leathery foliage surmounted by long showy terminal racemes of good-sized fragrant fls.: lvs. alternate, odd-pinnate; lfts. ovate, serrulate, dotted with oil-glands: fls. white. G.C. III. 34:409. Gn. 35:458; 68, p. 73; 75, p. 381. G. 13:25. A.F. 5:328. Gng. 5:321. Var. **purpùreus,** Hort., has large dark-colored fls. Var. **rùbra,** Hort., has rosy purple fls., the veins deeper colored. Var. **gigantèus,** Hort. (*D. gigantèus,* Hort.). Plant large. Var. **caucásicus** (*D. caucásicus,* Hort.), is a giant form with racemes twice the length of those of the common kind and standing well above the foliage. R.B. 32, p. 253. Perhaps the same as var. *giganteus.*

Wilhelm Miller.
L. H. B.†

DICTYOGRÁMMA: *Coniogramme.*

DICTYOSPÉRMA (Greek, *netted seed*). *Palmàceæ.* Areca-like palms, comprising several species of desirable pinnate house and table palms that are becoming deservedly well known.

Slender spineless palms, with a ringed trunk: lvs. equally pinnatisect; segms. linear-lanceolate, acuminate or bifid, the apical ones confluent; margins thickened, recurved at the base; midrib and nerves prominent, sparsely clothed with persistent scales beneath, or naked; rachis and petiole slender, scaly, 3-sided, furrowed, sheath elongated, entire: spadix on a short glabrous or tomentose peduncle, the branches erect or spreading and flexuose, the lower ones with membranaceous bracts at the base; spathes 2, complete, dorsally compressed, papery, the lower one 2-crested; fl.-bearing areas much depressed; bracts and bractlets scaly; pistillate fls. rather large, white or yellowish: fr. scaly, small, olive-shaped or subglobose.—There are 6 or 8 species all from Trop. Asia but only the following seem to be known in the trade. For cult., see *Areca* from which Dictyosperma differs only in having a 1-celled and 1-seeded fr.

álba, Wendl. & Drude (*Arèca álba,* Bory. *Ptychospérma álba,* Scheff.). Distinguished by the whitish petioles and the whitish green veins of the lvs.: caudex about 30 ft. high, 8–9 in. diam., dilated at the base: lvs. 8–12 ft. long; petiole 6–18 in. long, grooved down the face; segms. 2½–3 ft. long, 2–3 in. wide, 7-nerved; veins and margins green or reddish: branches of the spadix 6–18 in. long, erect or slightly reflexed, zigzag when young.—By far the best of the genus and rather widely sold as Areca as is also *D. rubra.*

aùrea, Wendl. & Drude (*Arèca aùrea,* Hort.). Distinguished by the yellow or orange petioles and veins of young plants: caudex about 30 ft. high, smaller and more slender than the preceding: lvs. 4–8 ft. long; petiole 8 in. long; segms. 1½–2 ft. long, 1 in. wide; secondary veins scarcely visible: branches of the spadix rigidly erect, 9–11 in. long.

furfuràcea, Wendl. & Drude (*Arèca furfuràcea,* Hort.). Like *D. rubra,* but the petiole and lf.-sheath of the young plant tomentose.

rùbra, Wendl. & Drude (*Arèca rùbra,* Hort.). Resembling *D. alba,* but the lvs. of the young plants

darker green, the primary veins and margins dark red, the redness disappearing very much in adult plants: branches of the spadix longer and more reflexed. —Young plants of this may be used for table decorations as the plant grows quickly and is attractive in juvenile condition. JARED G. SMITH. N. TAYLOR.†

DICÝRTA (*twice curved*, referring to structure of fls.). *Gesneriàceæ*. Very closely related to Achimenes with which some authors unite it, differing in the smaller fls., and diverging anther-cells. Low-growing slender villous herbs with creeping roots: lvs. opposite, membranaceous: fls. axillary, small, white or pale lilac, sometimes spotted; corolla-tube declinate, the limb oblique with 5 nearly equal spreading lobes; stamens affixed in the base of the corolla-tube, included, the anther-cells distinct. Two species occur in Guatemala. **D. cándida,** Hanst. & Klotzsch (*Achímenes cándida*, Lindl. *Diastèma grácile*, Regel). To 1½ ft.: lvs. ovate to ovate-lanceolate, acuminate, serrate, short-petioled: fl. on a bracted pedicel that much exceeds the petiole, white, tubular-campanulate, the lowest lobe projecting. Summer. The other species is *D. Warscewicziàna*, Regel (*A. misèra*, Lindl.), apparently not in cult.: fls. smaller. L. H. B.

DIDÍSCUS: *Trachymene.*

DIDYMOCÁRPUS (*twin fruit*). *Gesneriàceæ*. Attractive warmhouse herbs, with few showy flowers.

A polymorphous genus, distributed in E. India, Malaya, China, and Trop. Afr., differently named and defined by different authors. Roettlera is an older name, and has been used recently, but it is discarded by the "nomina conservanda" list of the Vienna code. The genus includes Chirita and Trachystigma according to Fritsch, and it then numbers more than 100 species. Bentham & Hooker omit Chirita, which differs in its 2-parted stigma, always 2 stamens, and other characters; in this work it is kept distinct. Didymocarpus comprises plants that are caulescent or nearly acaulescent, sometimes woody, of various habit: lvs. radical and cauline, those on the st. opposite or alternate, crenate, more or less wrinkled and hairy: fls. violet, blue, white or even yellow, on few-fld. scapes or axillary peduncles; corolla with an elongated tube which is widened at the throat or ventricose, the limb spreading and somewhat 2-lobed; stamens 2 or rarely 4, the anthers connivent or coherent and cells divergent; style long or short, the stigma little dilated and entire or nearly so.—The species require the treatment given the warmhouse gesneriaceous plants; usually difficult to grow, or are soon lost because seeds may not be produced. Several species are mentioned in horticultural literature; but the following are more recently intro. and are likely to be cult. or perhaps in the trade. They are low herbs with few lvs., resembling Streptocarpus. Many new species have recently been added to this interesting genus, and a number of them may be expected to appear in cult.

cyàneus, Ridley. Stemless: lvs. in a rosette, ovate, elliptic or obovate, ascending, somewhat obtuse, to 6 in. long, crenate-serrate, soft pubescent, petioled: fls. deep blue, trumpet-shaped, about 1½ in. long, with rounded spreading lobes, 4 or 5 on a scape. Malaya. B.M. 8204.—Blooms in autumn; should have warm treatment, such as is given Streptocarpus.

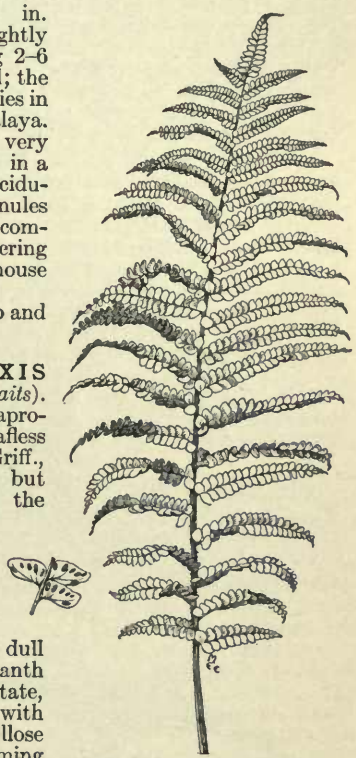
Veitchiàna, W. W. Smith. Eight in. or less: lvs. 2–4 pairs, ovate, somewhat cordate at base, serrate, 4 in. or less long, stalked: fls. lilac with longitudinal lines, tubular, nearly 1¾ in. long, in few-fld. axillary cymes. China. L. H. B.

DIDYMOCHLÆNA (Greek, *twin cloak;* alluding to the indusium). *Polypodiàceæ*. Greenhouse ferns of rather coarse foliage.

Indusium elliptical, emarginate at the base, attached along a central vein, free all around the margin.—One or 2 species. Large coarse ferns somewhat resembling the shield ferns, Dryopteris, in habit and gross appearance.

D. lunulata is a very distinct fern. It looks like a tree maidenhair, but the stems are thick and fleshy and the leaves are fleshier than any Adiantum. In cultivation the trunk is only a few inches high, but the fronds are 4 to 6 feet long and densely covered with long, brown, chaffy scales and has a metallic luster. This is a warmhouse fern, and may be used for subtropical bedding. It has a bad trick of dropping its pinnules if allowed to get too dry at the root, but soon rallies under liberal treatment.

lunulàta, Desv. (*D. trunculàta*, Hort.). Fig. 1260. Lvs. clustered from an erect rigid st., bipinnate, 3–6 ft. long; pinnules almost quadrangular, ¾–1 in. broad, entire or slightly sinuate, each bearing 2–6 sori. Cuba to Brazil; the same or an allied species in Madagascar and Malaya. —*D. lunulata* is a very attractive fern while in a small state, but its deciduous articulated pinnules are a drawback as a commercial species, rendering it of little value for house decoration. L. M. UNDERWOOD and W. H. TAPLIN.



1260. Didymochlæna lunulata. (×¼)

DIDYMOPLÉXIS (*double* or *twin plaits*). *Orchidàceæ*. One saprophytic orchid with leafless sts. *D. pállens*, Griff., has been cult. abroad but is probably not in the trade: root branching and tuberous, bearing a st. 4–6 in. high with loose sheaths: racemes terminal, with 4–8 small brownish or dull yellow-white fls.; perianth ⅓in. diam.; lip stipitate, transversely oblong, with 3 nerves and a papillose disk; pedicels becoming greatly elongated after fertilization. E. India.—The genus Didymoplexis comprises 2 or 3 species (Leucorchis is a more recent name), in India, Malaya and the Pacific Isls., characterized by simple flexuous scapes, dorsal sepals and petals connate into a 3-parted upper lip, the lateral connate into an entire or 2-parted lower lip, the regular lip inserted on the foot of the column, very short and broad, entire: caps. becoming very long-pedicelled. Apparently of little horticultural interest.

DIDYMOSPÉRMA (Greek, *double-seeded*). *Palmàceæ*, tribe *Arèceæ*. Low or almost stemless pinnate oriental palms.

Leaves terminal, unequally pinnatisect, silvery-scaly below; segms. opposite, alternate, solitary, or the lower ones in groups, cuneate at the base, obovate-oblong or oblanceolate, sinuate-lobed and erose, the terminal one cuneate; margins recurved at the base; midnerve distinct, nerves flabellate; sheath short, fibrous: spadices with a short, thick peduncle and thick branches; spathes numerous, sheathing the spadix; fls. rather large; calyx 3-lvd., corolla with 3 stiff petals;

ovary 2–3-celled: fr. ovoid or oblong, 2–3-, rarely 1-, seeded.

Didymosperma is a genus of East Indian palms of moderate growth, containing possibly eight species, most of which are stemless or else forming but a short trunk, the pinnate leaves rising from a mass of coarse brownish fibers that surround the base of the plant. The leaflets are of irregular shape, bearing some resemblance to those of Caryota, and the plants frequently throw up suckers from the base. The members of this genus are not very common in cultivation. The species that is most frequently seen is the plant known to the trade as *D. caryotoides*, an attractive warmhouse palm that has also appeared under the synonym *Harina caryotoides*, and has lately been referred to Wallichia, which see. While young, at least, the didymospermas enjoy a warm house and moist atmosphere with shading from full sunshine, though one species, *D. oblongifolia* (or *Wallichia*), is frequently found in Sikkim at an elevation of 3,000 feet above the sea. Propagated usually by seeds; occasionally by suckers, which are kept rather close for a time after their removal from the parent plant. See G.C. II. 24:362 for description of garden forms.

porphyrocárpon, Wendl. & Drude (*Wallichia porphyrocárpa*, Mart.). Sts. reedy, 3–6 ft.: lvs. 5–8 ft. long; lfts. 9–15, about 6 in. long, distant, narrowly oblong, long-cuneate, blunt, or sinuately 2–3-lobed, truncate, denticulate, glaucous beneath. Java.

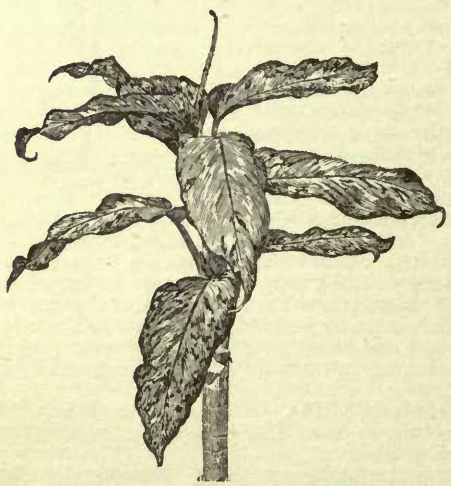
nànum, Hook. A dwarf robust palm, 2–3 ft., covered with rusty pubescence: lvs. 1–2 ft. long, glabrous above, glaucous beneath; lfts. 1–3 pairs with an odd terminal one, 7–10 in. long, 3–5 in. broad, wedge-shaped, sharply toothed. Assam. B.M. 6836.—One of the smallest of all palms.

D. Hookeriàna, Becc. Resembles a Caryota, about 3 ft. high. Malay Penins. Plant scarcely known in cult. in Amer. but perhaps cult. in Eu.

JARED G. SMITH.
N. TAYLOR.†

DIEFFENBÁCHIA (J. F. Dieffenbach, a German botanist, 1794–1847) *Aràceæ*. Popular hothouse plants, grown for their handsome and striking foliage.

Low, shrubby perennials: sts. rather thick, inclined or creeping at the base, then erect, with a leafy top:



1261. Dieffenbachia picta var. Bausei.

petioles half-cylindrical, sheathed to above the middle, long, cylindrical at the apex; blade oblong, with a thick midrib at the base; veins very numerous, the first and second parallel, ascending, curving upward at their ends: peduncle shorter than the lvs. Differs from Aglaonema in floral characters. Cent. and S. Amer.—Perhaps a dozen species. Engler (in Engler & Prantl, 1889) recognizes many species, with many varieties.

For dieffenbachias, similar rooting material to that mentioned for anthuriums, combined with a high and moist atmosphere, will produce a very healthy and luxuriant growth of foliage, especially after the plants have made their first few leaves in ordinary light potting soil. Unless it be the very large-leaved kinds, like *D. triumphans*, *D. nobilis* and *D. Baumannii*, three or four plants may be placed together in large pots, keeping the balls near the surface in potting. *D. Jenmanii*, *D. Shuttleworthiana*, *D. Leopoldii* and *D. eburnea* are all well suited for massing together in large pots. When above a certain height, varying in different species, the plants come to have fewer leaves, and those that remain are small; they should then be topped, retaining a considerable piece of the stem, and placed in the sand-bed, where they will throw out thick roots in a week or two. The remaining part of the stems should then be cut up into pieces 2 or 3 inches long, dried for a day or so, and then put into boxes of sand, when, if kept warm and only slightly moist, every piece will send out a shoot, and from the base of this shoot roots will be produced. These can be potted up as soon as roots have formed. (G. W. Oliver.)

pícta, Schott (*D. brasiliénsis*, Veitch. *D. Shuttleworthiàna*, Regel). Blade oblong, or oblong-elliptical, or oblong-lanceolate, 2½–4 times longer than wide, rounded or acute at the base, gradually narrowing to the long acuminate-cuspidate apex, green, with numerous irregular oblong or linear spots between the veins; veins 15–20 on each side, ascending. L.B.C. 7:608 (as, *Caladium maculatum*). J.H. III. 46:165

Var. **Baûsei,** Engler (*D. Baùsei*, Regel). Fig. 1261. Blade nearly or completely yellowish green, with obscurely green-spotted margins and scattered white spots. I.H. 26:338.

Var. **Shuttleworthiàna,** Engler (*D. Shuttleworthiàna*, Bull). Blade pale green along the midrib.

Seguîne, Schott. Lvs. green, with white, more or less confluent stripes and spots, oblong or ovate-oblong, rounded or slightly cordate or subacute at the base, narrowed toward the apex, short cuspidate; primary veins 9–15, the lower spreading, the upper remote and ascending. Lowe 14 (as var. *maculata*). W. Indies.—Called "dumb plant" because those who chew it sometimes lose the power of speech for several days.

Var. **Baraquiniàna,** Engler (*D. Baraquiniàna*, Versch. & Lem. *D. gigantèa*, Versch. *D. Verschaffèltii*, Hort. Petioles and also midribs almost entirely white; blade with scattered white spots. I.H. 11:387; 13:470, 471. G. 2:238.

Var. **nóbilis,** Engler (*D. nóbile*, Hort.). Fig. 1262. Blade elliptical, acute, dull green with dirty green spots. Brazil.

Var. **liturâta,** Engler (*D. liturâta*, Schott. *D. variegàta*, Hort. *D. Lèopoldii*, Bull. *D. Wállisii*, Lind.). Blade dark green, with a rather broad, yellowish green, ragged-margined stripe along the midrib: spathe glaucous-green. Province Para, Brazil. I.H. 17:11. S.H. 1, p. 455. G.Z. 25, p. 250.

Var. **irroràta,** Engler (*D. irroràta*, Schott. *D. Baùmannii*, Hort.). Lvs. large and bright green, blotched and sprinkled with white. Brazil.

The above are the recognized two type species. The following are or have been in the American trade. Probably some or all of them belong to the foregoing species:

Chélsonii, Bull. Lvs. deep, satiny green, the middle gray-feathered, and the blade also blotched yellow-green. Colombia.

ebûrnea, Hort. Compact: lvs. light green, freely spotted with white, the sts. reddish and white-ribbed. Brazil.

Fournièri, Hort. Vigorous: lvs. large, leathery, with spots and blotches of white on a blackish green background. Colombia.

illústris, Hort. See *D. latimaculata.*

imperàtor, Hort. Lvs. 16–18 in. long, 5–6 in. wide, olive-green, fantastically blotched, marbled and spotted with pale yellow and white. Colombia.



1262. Dieffenbachia Seguine var. nobilis.

insígnis, Hort. Lvs. dark green, with irregular, angular blotches of pale yellowish green, 6 or more in. wide, ovate and short-acuminate in form and with pale green petiole. Colombia,

latimaculàta, Lind. & André (*D. illústris,* Hort.). Lvs. glaucous-green, profusely white-barred and white-spotted and blotched with yellow-green, the petioles also glaucous. Brazil. I.H. 23:234.

Jénmanii, Veitch. Lvs. rich, bright, glossy green, relieved by a milk-white band at every lateral nerve, and by a few white spots interspersed between the bands. Guiana. G.Z. 28, p. 218.

magnífica, Lind. & Rod. Lvs. ovate-acuminate, large, dark green, attractively blotched and spotted with white along the veins; sts. and petioles also variegated. Venezuela. I.H. 30:482. S.H. 2, p. 383. G. 13:643.

marmòrea, Hort. See *D. Parlatorei.*

meleàgris, L. Lind. & Rod. Lvs. with the long petioles green, marked with ivory-white, the blades dark green above, paler beneath, marked on both sides with a few white spots. Ecuador. I.H. 39:559.

memòria-Córsii. A hybrid raised in the garden of the late Marquis Corsi.

Parlatòrei, Lind. & André, var. **marmòrea,** André (*D. memòria, D. mormòra* and *D. Córsii,* Hort.). Lvs. long-oblong, acuminate, the midrib white and the blades blotched white, the green deep and lustrous. Colombia. I.H. 24:291.—Engler refers this plant to the genus Philodendron.

Regìna, Bull. Lvs. oblong-elliptical, rounded at base, short-acuminate at apex, greenish white, profusely mottled and blotched with alternate light and green tints. S. Amer. G.Z. 28, p. 26.—The vari-colored and margined lvs. are very attractive.

Réx, Hort. Compact: lvs. oblong-lanceolate, the two sides not equal, deep green, but the white angular blotches and midrib occupying more space than the green. S. Amer. G.Z. 28, p. 97.

Sánderæ, Hort. Lvs. very broad-oval, green, mottled with cream-color.

spléndens, Bull. St. faintly mottled with dark and light green: lvs. have a thick, ivory-white midrib, and the ground-color is of a deep, rich, velvety bottle-green, with a resplendent, lustrous surface, freely marked with whitish striate blotches. Colombia. G.Z. 25, p. 193.

triúmphans, Bull. Lvs. dark green, ovate-lanceolate and acuminate, 1 ft. long, irregularly marked with angular yellowish blotches. Colombia.

JARED G. SMITH
GEORGE V. NASH. †

DIELÝTRA: *Dicentra.*

DIERÀMA (a *funnel,* alluding to shape of fls.). *Iridàceæ.* S. African cormous plants, related to Sparaxis and Ixia. Fls. large, white to purple and red, in panicled spikes: lvs. long, linear, rigid: perianth short-tubed, expanded at throat, with oblong nearly equal segms.; stamens 3, inserted on the perianth throat; ovary 3-celled, oblong, with many ovules, the style exserted: fr. a 3-valved caps. There are 2 or 3 species, of which **D. pulchérrima,** Baker, was intro. into S. Calif. many years ago: scape 2–6 ft., with remote branches: lvs. narrow-sword-shaped and with a very slender point: fls. 1½ in. long, pendulous, blood-red-purple, bell-shaped. B.M. 5555 (as *Sparaxis pulcherrima*). Requires the treatment given Ixia.

DIERVÍLLA (after Diereville, a French surgeon, who took *D. Lonicera* to Europe early in the eighteenth century). *Caprifoliàceæ.* WEIGELA. Ornamental deciduous shrubs, grown for their showy flowers appearing profusely in spring and early summer.

Leaves opposite, petioled or nearly sessile, serrate: fls. in 1- to several-fld. axillary cymes, often panicled at the end of the branches, yellowish white, pink or crimson, epigynous; calyx 5-toothed or 5-parted; corolla tubular or campanulate, 5-lobed, sometimes slightly 2-lipped; stamens 5; style slender with large capitate stigma; ovary inferior, elongated, 2-celled: fr. a slender, 2-valved caps. with numerous minute seeds.—About 10 species in E. Asia and N. Amer.

Diervillas are shrubs of spreading habit, with more or less arching branches, rather large leaves, and, especially the Asiatic species, with very showy flowers from pure white to dark crimson, appearing in spring. A very large number of hybrids between the different Asiatic species have been raised and have become great favorites in gardens on account of their profusely produced and delicately tinted flowers. The earliest to bloom are *D. præcox* and its hybrids and also *D. florida* var. *venusta,* which begin to flower in Massachusetts about the middle of May; the latest is *D. rivularis.* The American species are hardy North and prefer moist and partly shaded positions. Of the Asiatic species *D. Middendorffiana* is the hardiest, but rarely does well; it seems to grow best in humid sandy or peaty soil and in positions sheltered from strong winds; it dislikes hot and dry air; *D. florida* also is rather hardy and one of the handsomest species of the genus. The other Asiatic species require protection during the winter or sheltered positions. They thrive well in any humid garden soil. Propagation is readily effected by greenwood cuttings or hardwood cuttings; the American species usually by suckers and by seeds sown in spring.

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Intermedia, 9.
japonica, 7.
Kosteriana variegata, 9.
Lavallei, 9.
Lonicera, 1.
Looymansii aurea, 9.
Lowei, 9.
Luteo-marginata, 9.
Middendorffiana, 10.
multiflora, 8.
Nana variegata, 9.
nivea, 7.
pauciflora, 4.
præcox, 5.
rivularis, 3.
rosea, 4.
sessilifolia, 2.
Sieboldii argenteo-marginata, 9.
sinica, 7.
Steltzneri, 9.
Styriaca, 9.
trifida, 1.
Van Houttei, 9.
Venosa, 9.
venusta, 4.
Verschaffeltii, 9.
versicolor, 8.

A. *Fls. yellow, slightly 2-lipped, small, about ½in. long. (Diervilla proper).*

B. *Lvs. glabrous or nearly so.*

1. **Lonicèra,** Mill. (*D. trífida,* Moench. *D. canadénsis,* Willd.). Shrub, to 3 ft.: branchlets nearly terete, glabrous: lvs. distinctly petioled, ovate-oblong, acuminate, serrate, nearly glabrous, finely ciliate, 1½–4 in. long: cymes usually 3-fld.; limb nearly equal to the tube: caps. about ½in. long. June, July. Newfoundland to Sask., south to Ky. and N. C. B.M. 1796.

2. **sessilifòlia,** Buckl. Shrub, to 5 ft.: branchlets quadrangular: lvs. nearly sessile, ovate-lanceolate, serrate, nearly glabrous, of firmer texture, 2–6 in. long: cymes 3–7-fld., often crowded into dense, terminal panicles; limb shorter than the tube: caps. about ½in.



1263. Diervilla japonica. (×⅓)

long. June, July. N. C. and Tenn. to Ga. and Ala. G.C. III. 22:14; 42:427.—Hardy in Canada.

BB. *Lvs., branchlets and infl. pubescent.*

3. **rivulàris,** Gattinger. Shrub, to 6 ft.: lvs. short-petioled, ovate to oblong-lanceolate, acuminate, truncate or cordate at the base, doubly serrate, pubescent on both sides, 1½–3½ in. long: cymes few- to many-fld., crowded into terminal panicles; limb of corolla about as long as tube: caps. ¼in. long. July, Aug. N.C. to Tenn., Ga. and Ala. G.C. III. 38:339.

AA. *Fls. showy, white, pink, or crimson, rarely yellowish.*

B. *Anthers not connected with each other. (Weigela.)*

C. *Calyx-lobes lanceolate, connate to or nearly to the middle; stigma 2-lobed: seeds almost wingless.*

4. **flórida,** Sieb. & Zucc. (*Weigèla ròsea,* Lindl. *W. amábilis,* Hort. *D. pauciflòra,* Carr.). Shrub, to 6 ft.: branchlets with 2 hairy stripes: lvs. short-petioled or nearly sessile, elliptic or ovate-oblong to obovate, serrate, glabrous above except at the midrib, more or less pubescent or tomentose on the veins beneath, 2–4 in. long: calyx nearly glabrous, with lanceolate teeth; ovary slightly hairy; fls. 1–3, pale or deep rose, 1¼ in. long; corolla broadly funnel-shaped, abruptly narrowed below the middle. May, June. N. China. B.M. 4396. F.S. 3:211. B.H. 1:577. Gt. 54, p. 86. R.H. 1849:381. H.F. 1854:21. V. 18:37.—This is one of the most cult. species, very free-flowering and rather hardy. Var. **álba,** Moore. Fls. white, changing to light pink. R.H. 1861:331. Var. **venústa,** Rehd. Lvs. smaller, usually obovate, 1½–2½ in. long, usually nearly glabrous: fls. in dense clusters with small lvs. at the base; corolla slender, about 1½ in. long, rather gradually narrowed toward the base, lobes oval to oval-oblong, rosy pink. Korea, N. China.—Recently intro.; very floriferous, early and hardy.

5. **præcox,** Lemoine. Shrub, to 6 ft.: branchlets glabrous: lvs. short-petioled, elliptic or elliptic-ovate, acuminate, serrate, hairy above, soft-pubescent below, 2–3½ in. long: fls. clustered, 3–5, nodding; calyx with subulate lobes; ovary hairy; corolla abruptly narrowed below the middle, purplish pink or rose-carmine. Japan. May. Gt. 46:1441; 53, p. 522. R.H. 1905:314.—The earliest of all species to bloom; has given rise to a race of early-flowering hybrids as Avalanche, Gracieux, Vestale, Conquerant, Esperance, Seduction, which see under *D. hybrida.*

CC. *Calyx-lobes linear, divided to the base: seeds winged: stigma capitate.*

D. *Plant nearly glabrous.*

6. **coræénsis,** DC. (*D. grandiflòra,* Sieb. & Zucc. *D. amábilis,* Carr.). Shrub, 5–10 ft.: lvs. rather large, obovate or elliptic, abruptly acuminate, crenately serrate, sparingly hairy on the veins beneath and on the petioles: fls. in 1–3-fld., peduncled cymes; corolla broadly funnelform, abruptly narrowed below the middle, changing from whitish or pale pink to carmine. May, June. Japan. S.Z. 31. F.S. 8:855. H.U. 1:19.—Vigorously growing shrub, with large lvs. and fls., but less free-flowering, and the type not common in cult. Var. **arbòrea,** Rehd. (*W. arbòrea grandiflòra,* Hort.). Fls. yellowish white, changing to pale rose; of vigorous growth.

DD. *Plant more or less pubescent: corolla finely pubescent outside.*

7. **japónica,** DC. Fig. 1263. Shrub, to 6 ft.: lvs. oblong-obovate or elliptic, acuminate-serrate, sparingly pubescent above, tomentose beneath: fls. usually in 3-fld., short-peduncled cymes, often crowded at the end of short branchlets; corolla broadly funnelform, narrowed below the middle, whitish at first, changing to carmine, slightly pubescent or nearly glabrous outside; style somewhat exserted. May, June. Japan, China. G.F. 9:405 (adapted in Fig. 1263). Gn. 21, p. 184. Var. **hortènsis,** Rehd. (*D. hortènsis,* Sieb. & Zucc.). Lvs. nearly glabrous above, densely grayish tomentose beneath: cymes usually rather long-peduncled; fls. usually carmine. S.Z. 29, 30. More tender and slower-growing than the type. Var. **sínica,** Rehd. Lvs. slender-petioled, soft-pubescent beneath: fls. campanulate, abruptly contracted below the middle into a narrow tube, pale pink. Cent. China. Var. **álba,** Makino (*D. hortènsis* var. *álba,* Sieb. & Zucc. *D. japónica* var. *nívea,* Rehd.). Like var. *hortensis* but fls. white. G.C. II. 10:80. Gn. 22, p. 185; 34, p. 352. G. 28:392.

8. **floribúnda,** Sieb. & Zucc. (*D. multiflòra,* Lem.). Shrub, to 8 ft.: lvs. oblong-ovate or elliptic, acuminate, serrate, sparingly pubescent above, more densely beneath: fls. 1–3, usually sessile, mostly crowded at the end of short branchlets; corolla rather gradually narrowed toward the base, pubescent outside, brownish crimson in the bud, changing to dark or bright crimson; lobes about 5 times shorter than the tube; style exserted. May, June. Japan. S.Z. 32. I.H. 10:383.—Vigorously growing shrub, with rather small but abundant fls. Var. **grandiflòra,** Rehd. (*W. arboréscens,* Hort.). Fls. rather large, brownish crimson. Var. **versícolor,** Rehd. (*D. versícolor,* Sieb. & Zucc.) Fls. greenish white at first, changing to crimson. S.Z. 33.

9. **hýbrida,** Hort. (Fig. 1264), may be used as a collective name for the different hybrids between *D. florida, D. præcox, D. floribunda, D. japonica* and *D. coræensis,* which are now more commonly cult. than the



XXXVI. A border of dianthus and digitalis.

typical species. Some of the best and most distinct are the following, arranged according to the color of the fls. The numbers in parenthesis after the name refer to the number of the species and indicate the origin or probable origin of these hybrids:



1264. Diervilla hybrida. (×⅓)

Fls. white or nearly white: *Avalanche*, Lemoine (5×?). Fls. pure white; early. *Dame Blanche* (6×7). Fls. large, white, slightly pinkish outside, yellowish white and bluish in bud. *Gracieux*, Lemoine (5×?). Fls. white, yellow in throat, buds light salmon-pink; early. *Isoline*, Van Houtte (4×?). Fls. white or slightly pink outside, yellow in throat. *Madame Couturier*, Billiard (4×6). Fls. yellowish white changing to pink. *Madame Lemoine*, Billiard (4×6). Fls. white with delicate blush, changing to pink. *Madame Tellier*, Billiard (4×6). Fls. large, white, with delicate blush. *Vestale*, Lemoine (5×?). Fls. pure creamy white. *Mont-blanc*, Lemoine (4×7). Fls. pure white, greenish white in bud, fading to pinkish. *Pavillon Blanc*, Lemoine. (4×7). Similar to the preceding. *Candida* (4×6). Fls. pure white. R.H. 1879:130.

Fls. pink or carmine: *Abel Carrière* (4×7). Fls. rose-carmine, purple-carmine in bud, with yellow spot in throat. *André Thouin* (4×6). Fls. pink, carmine in bud. *Conquérant*, Lemoine (5×?). Fls. very large, rose-colored, carmine outside and in throat; early. *Conquete* (4×7). Fls. very large, deep pink. *Dr. Buillard* (4×7). Fls. carmine. *Espérance*, Lemoine (5×?). Fls. very large, pinkish white tinged with salmon-red, buds pale salmon; early. *Gratissima* (4×7). Fls. light pink. *Grænewegenii* (4×?). Fls. red outside, whitish within, slightly striped with yellowish red. *Gustave Mallet*, Billiard (4×6). Fls. light pink, bordered white. *Hendersonii* (4×8). Fls. light crimson. *Intermedia* (4×7). Fls. carmine, buds darker. *Othello* (4×8). Fls. carmine, darker outside. *Seduction*, Lemoine (5×?). Fls. vinous carmine-red, early, very floriferous. *Steltzneri*, Van Houtte (4×7). Fls. dark red, abundant. *Styriaca*, Klenert (4×8). Fls. pink, changing to pinkish carmine, very floriferous. M.D. 1912:1. *Van Houttei* (4×7). Fls. carmine. F.S. 14:1447. *Venosa* (4×6). Fls. carmine-pink, carmine in bud, orange to crimson in throat. *Verschaffeltii* (4×6). Fls. carmine-pink, limb bordered whitish.

Fls. crimson or dark crimson: *Congo* (6×8). Fls. large, purplish crimson, abundant. *Desboisii* (8×7). Fls. small, dark crimson. *E. André* (8×6). Fls. very dark, brownish purple. *Eva Rathke* (8×6). Fls. deep carmine-red, erect; very free-flowering. R.B. 19:126. G. 14:1350. *Hendersonii* (4×8). Fls. light crimson, crimson in bud. *Incarnata* (6×8). Fls. deep red. *Lavallei* (6×8). Fls. bright crimson. H.F. 1870:5. G.W. 1, p. 60 (habit). *Lowei* (8×4). Fls. dark purplish crimson. H.F. 1870:8. *P. Duchartre* (4×8). Fls. deep amaranth, very dark; free-flowering.

Lvs. variously colored: *Kosteriana variegata*. Lvs. bordered yellow: fls. pink, paler in bud, dwarf. *Looymansii aurea*. Lvs. yellow; of slow growth. R.B. 2:173. *Luteo-marginata* (Weigela amabilis fol. var. Van Houtte). Lvs. bordered yellow. F.S. 12:1189. *Nana variegata* (Weigela rosea nana fol. var. Van Houtte). Lvs. variegated with white: fls. nearly white: dwarf. *Sieboldii argenteo-marginata* (4×7). Lvs. bordered white: fls. rose.

BB. *Anthers connected with each other.* (*Calyptrostigma.*)

10. **Middendorffiàna**, Carr. Shrub, to 3 ft.: lvs. short-petioled, ovate-oblong or oblong-lanceolate, serrate, glabrous at length: fls. in 2–3-fld. axillary and terminal clusters; corolla campanulate-funnelform, yellowish white, spotted orange or purplish inside 1½ in. long; calyx-teeth partially connate. May, June. E. Siberia, N. China, Japan. Gt. 6:183. R.H. 1854:261. F.S. 11:1137. I.H. 4:115. G.C. III. 7:581.—Hardy, but rarely does well; it demands a cool and moist climate and a position sheltered from strong winds.

D. spléndens, Carr. (D. Lonicera×D. sessilifolia). Intermediate between the parents; more similar to L. sessilifolia, but lvs. short-petioled. Garden origin.—*D. suàvis*, Komarov. Allied to D. japonica. Lvs. ovate-lanceolate, ciliate, otherwise glabrous, sparingly serrate, 1–2 in. long: corolla white, pink outside; style not exserted. Manchuria. Recently intro.; presumably quite hardy.—*D. Wágneri*, Kusnezov (D. japonica×D. Middendorffiana). Lvs. ovate-oblong, glabrous except on the veins below: fls. axillary on short branchlets; sepals lanceolate, distinct or partly connate, pink, tinged yellowish. Garden origin. Gt. 48:1461.—Doubtful whether still in cult.

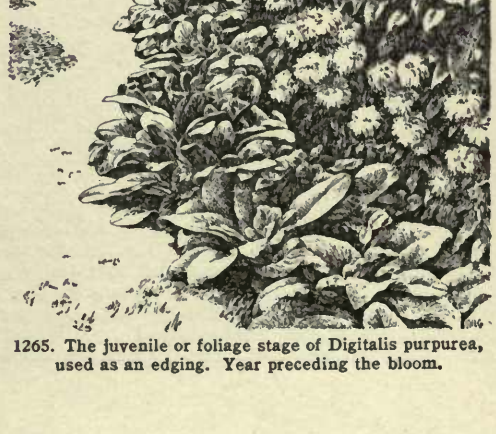
ALFRED REHDER.

DIÈTES: *Moræa*.

DIGITÀLIS (Latin, *digitalis*, finger of a glove, referring to the shape of the flowers). *Scrophulariàceæ*, FOXGLOVE. A fine genus, numbering several species, and some hybrids, of hardy or half-hardy herbaceous plants, well known for their long racemes of inflated flowers, which suggest spires or towers of bells. Plate XXXVI.

Upright herbs, sometimes woody at the base, glabrous or tomentose or woolly, mostly simple: lvs. alternate or scattered or crowded, entire or dentate: fls. showy, in a long terminal raceme or spike which is usually 1-sided, purple, ochroleucous or white; corolla declined, more or less campanulate, often constricted above the ovary, the limb erect-spreading and somewhat 2-lipped, spotted and bearded at the throat; stamens 4, didynamous, usually included; style slender, 2-lobed: fr. an ovate dehiscent caps.—About 25 species, Eu. and W. and Cent. Asia.

The foxgloves are old-fashioned and dignified, clean of growth and wholesome company in the choicest garden. The strong vertical lines of their flower-stalks, rising from rich and luxuriant masses of cauline leaves, give always an appearance of strength to the rambling outlines of the usual herbaceous border. For a week or two the foxgloves usually dominate the whole border. The usual species in cultivation is *D. purpurea*, which is one of the commonest English wild flowers. The name "foxglove" is so inappropriate that much ingenious speculation has been aroused, but its origin is lost in antiquity. The word "fox" is often said to be a corruption of "folk," meaning the "little folk" or fairies. Unfortunately, etymologists discredit this pretty suggestion. In the drugstores, several preparations of *D. purpurea* are sold. They are diuretic, sedative, narcotic. For medicinal purposes, the leaves of the second year's



1265. The juvenile or foliage stage of Digitalis purpurea, used as an edging. Year preceding the bloom.

growth are used.—Foxgloves are of the easiest culture. The common species and hybrids can be grown as biennials from seed. The perennial species are propagated by seeds or by division. The common *D. purpurea* is best treated as a biennial, although it may sometimes persist longer. Seeds sown one spring (or fall) will give good blooming plants the following season. The large root-leaves before the flower-stems appear are decorative (Fig.1265).

A. *Middle lobe of the lower lip longer than the others.*

ferrugínea, Linn. (*D. aùrea,* Lindl.). Biennial or perennial, 4–6 ft. high: sts. densely leafy: lvs. glabrous or ciliate: racemes long, dense; fls. rusty red, reticulate-marked, downy outside; lower lip of corolla ovate, entire, bearded, July. S. Eu. B.M. 1828.

lanàta, Ehrh. Perennial, or biennial, 2–3 ft. lvs. oblong or lanceolate, ciliate: fls. rather small, 1–1½ in. long, grayish or creamy yellow, sometimes whitish or purplish, downy, in a dense, many-fld. raceme, with bracts shorter than the fls. July, Aug. Danube River and Greece. B.M. 1159 (poor fig.).—A fine species.

sibírica, Lindl. Has the habit of *D. ambigua,* with fls. like those of *D. lanata*: lvs. downy, ovate-lanceolate, serrate or the upper entire: fls. ventricose, villose, yellowish; calyx-segms. linear, villose. Siberia. —This is a rare trade name, and it is doubtful whether this little known plant is really in cult.

Thápsii, Linn. Plant much like *D. purpurea:* perennial, 2–4 ft. high: lvs. ovate-lanceolate or oblong, rugose, decurrent: fls. purple, throat paler, marked with red dots in a lax raceme; calyx-segms. ovate or oblong. June–Sept. Spain. B.M. 2194 (as *D. tomentosa*).



1266. Digitalis purpurea. (×½)

AA. *Middle lobe of the lower lip shorter or hardly longer than the others.*

ambígua, Murr. (*D. grandiflòra,* Lam. *D. ochroleùca,* Jacq.). Perennial or biennial, 2–3 ft. high: lvs. ovate-lanceolate, toothed, sessile or clasping, downy below: fls. large, 2 in. long, yellowish, marked with brown; lower bracts about as long as the fls. Eu., W. Asia. B.R. 64.

purpùrea, Linn. (*D. tomentòsa,* Link & Hoffmgg.). Common Foxglove. Fig. 1266. The species most commonly cult.: mostly biennial, but sometimes perennial: height 2–4 ft.: lvs. rugose, somewhat downy, the radical ones long-stalked and ovate to ovate-lanceolate, the st.-lvs. short-stalked and becoming small toward the top of the st.: fls. large, 2 in. long, ranging from purple and more or less spotted, rather obscurely lobed. On dry hills and roadsides, Great Britain, W. and Cent. Eu., to Scandinavia, running into white and modified forms in cult.; sometimes escaped in this country. Gn. 34:488. Var. **gloxiniæflòra,** Hort. (*D. gloxinioìdes,* Carr. *D. gloxiniæflòra,* Hort.). Of more robust habit, longer racemes, larger fls., which open wider, nearly always strongly spotted. Var. **álba,** Hort. Fls. white. Var. **monstròsa,** Hort., is a double peloric form. P.G. 4:151. **D. maculàta supérba** is a trade name for highly improved spotted forms. Var. **campanulàta,** Hort., is a monstrous form with the upper fls. united into a bell-shaped large bloom.

D. Buxbaùmii is offered as a yellow-fld. species.—*D. dùbia,* Rodr. Perennial, woolly: fls. slender, hanging, purplish, spotted inside. Balearic Isls. G. 30:309.—*D. laciniàta,* Lindl. Perennial, woody, 2 ft. high: lvs. lanceolate, jagged: fls. yellow, downy, with ovate, bearded segms.; bracts much shorter than the pedicels. Spain. B.R. 1201.—*D. lævigàta,* Waldst. & Kit. Perennial, 2–3 ft. high: lvs. linear-lanceolate, radical ones obovate-lanceolate: fls. scattered, glabrous, yellow. Danube and Greece.—*D. lùtea,* Linn. Perennial, glabrous: lvs. oblong or lanceolate, denticulate: raceme many-fld., secund; corolla yellow to white, glabrous; calyx-segms. lanceolate, acute. Eu. B.R. 251.—*D. marìàna,* Boiss. Lvs. radical, very downy, ovate-oblong: fls. rose; corolla bearded. Spain.—*D. purpurascens,* Roth. Biennial: fls. yellow or sometimes purplish, pale inside, spotted at the mouth; lower lobe of corolla short. Eu.—*D. purpùreo-ambígua* is a hybrid of D. purpurea var. gloxiniæflora and D. ambigua.

F. A. Waugh.
L. H. B.†

DILIVÀRIA: *Acanthus.*

DILL (*Anèthum gravèolens,* Linn.), an annual or biennial plant of the *Umbellíferæ,* the seeds of which are used as a seasoning, as are seeds of caraway and coriander. It is of the easiest cult. from seeds. It should have a warm position. The plant grows 2–3 ft. high: the lvs. are cut into thread-like divisions: the st. is very smooth: the fls. are small and yellowish, the little petals falling early. It is a hardy plant. The foliage is sometimes used in flavoring, and medicinal preparations are made from the plant. The seeds are very flat and bitter-flavored. Native of S. E. Eu.

DILLÈNIA (named by Linnæus for J. J. Dillenius, 1684–1747, botanist and professor at Oxford, author of important botanical works). *Dilleniàceæ.* Tall tropical trees from Asia, Indian Archipelago, Philippines, and Australia.

Leaves large, with pronounced pinnate parallel venation: fls. showy, white or yellow, lateral, solitary or clustered; sepals and petals 5, spreading; stamens many, free or somewhat united at base, the anthers linear, opening by 2 slits, the interior ones erect and introrse and the exterior ones recurved and extrorse: carpels 5–20, many-ovuled, in fr. becoming a fleshy body inclosed in the enlarging calyx.—Probably 40 species; allied to the Magnolia family. *D. indica* is said to be the showiest of the whole family, being attractive in foliage, fl. and fr. Dillenias may be grown in light sandy loam. Prop. readily by seeds, but with difficulty from cuttings.

índica, Linn. (*D. speciòsa,* Thunb.). Trunk stout, not high: branches numerous, spreading, then ascending: lvs. confined to the ends of branches, on short, broad, channelled sheathing petioles, the blade 6–12 in. long, oblong, or oblong-lanceolate, acuminate, narrowed at the base, strongly serrate: sepals 5, thick, fleshy, enlarging and inclosing the fr.; petals obovate, white, large, making a fl. fully 9 in. across; stamens very numerous, forming a large yellow globe crowned by the white, slender, spreading rays of the stigma: fr. edible, acid, the size of an apple, many-celled and many-ovuled. Trop. Asia. Intro. in Fla. and S. Calif. B.M. 5016 (B.M. 449=*Hibbertia volubilis*). H.F. 1867 p. 119.

Wilhelm Miller.

DIMORPHÁNTHUS: *Aralia.*

DIMORPHOTHÈCA (Greek, *two-formed achenes*). *Compósitæ.* CAPE MARIGOLD. Annual and perennial herbs or sub-shrubs, some of which are excellent flower-garden plants.

Leaves alternate or radical, entire, toothed, or incised, often narrow: heads solitary, long-peduncled; disk-fls. yellow or brown or purple, the rays yellow, purple, or white with purple beneath. The genus is closely allied to Calendula but has straight instead of incurved frs. The fls. usually close up, like those of Gazania, unless they have sunlight; their backs have as great a variety of coloring as their faces.—About 20 species in S. Afr.

The flowers are often 3 inches across, and their long, slender rays (20 or more) give a distinct and charming effect. A dozen kinds are grown abroad, representing a wide range of colors and foliage. They are wintered in coolhouses and flowered in spring or else transplanted to the open, where they flower freely during summer. The shrubby kind, *D. Ecklonis*, has been grown as a summer bedding plant, flowering from July to frost, and as a coolhouse plant, making a much-branched subject 3 feet high, and flowering freely all spring.

ánnua, Less. (*Caléndula pluviàlis*, Linn.). Erect or diffuse, simple or branched annual, rough with jointed and gland-tipped hairs (seen with a small lens): lvs. narrowly oblong or obovate-oblong, tapering to the base, with a few distant teeth, pilose, the uppermost smaller and narrower: peduncles terminal, nodding in fr.; fls. white above, purple or discolored beneath. J.H. III. 57:501. Var. **liguldsa,** Voss (*Caléndula Póngei*, Hort.), is a double form (the heads full of rays) with heads white on upper side and yellow or violet beneath.

sinuàta, DC. Annual, branched from the base, nearly glabrous: lvs. oblong, obtuse, sinuate, narrowed at base: involucre-scales lanceolate-acuminate, quite glabrous, longer than disk: achenes of ray trigonous, everywhere tubercled; of disk flat with thickened rim; rays orange.—Grows 12–15 in. high. Fls. shading to blue in center.

aurantìaca, DC. Perennial, the st. natively more or less shrubby, erect, glabrous, with rod-like branches: lvs. linear-oblong or spatulate, thickish, obtuse, entire: fl.-heads large, rays orange-yellow; involucre-scales linear-acuminate, exceeding the disk, with a central line of hairs and paler margins. This brief botanical description does not in all ways fit the plant now in common cult. as *D. aurantiaca*, which is treated as a half-hardy annual, and which is apparently more or less modified by cult.; it is a very showy plant (Fig. 1267), 12–16 in. high, from a short-decumbent base, with notched acute lvs., and terminal heads 2–2¾ in. across, and with curving rays of a rich glossy apricot-orange and a disk of brown-black; it is one of the best flower-garden subjects of recent years, the fls. opening in the sun and making a brilliant display in summer and till frost; of simple culture from seeds. Although long described in horticultural literature, it appears not to have come really into cult. until within the past few years, having been offered in Eu. in the fall of 1908. Recent forms under the name of *D. aurantiaca hybrida* (hybrids with *D. annua*), intro. in 1912, range in color from white and bluish-white to red, yellow, orange and salmon. B.M. 408 (as *Calendula Tragus*). G.C. III. 38:127. G. 31:205. J.H. III. 57:37. F.E. 31:308. Winter-flowering in S. Calif.

Ecklònis, DC. Shrubby at base, robust and erect, branching at top, 2 ft. or more: lvs. crowded, linear-lanceolate or lanceolate, entire or somewhat denticulate, acute: fl.-heads terminal, the rays 1½ in. long, white above and purplish beneath; involucre-scales long-acuminate. B.M. 7535. Gn. 75, p. 444. G. 24: 424; 25:565.—Not hardy north of Washington. It is grown as a summer bedding plant in England.

D. Bárberiæ, Haw. Perennial: fls. purple above, paler beneath; disk all purple, with corollas of 2 forms. B.M. 5337. H.F. II. 5:78. Var. *rósea*, Hort., has rose-colored fls.—*D. chrysanthemifólia*, DC. Lvs. cut like a chrysanthemum: fls. yellow, reverse reddish. B.M. 2218.—*D. cuneàta*, DC. Lvs. strongly cut: fls. scarlet-orange. B.M. 1343.—*D. nudicaùlis* var. *grammifólia*, Harv. & Sond. Fls. white, with a purple ring at the base, and orange-brown on the back, the disk purple. B.M. 5252.—*D. Tràgus*, DC. Perennial: lvs. narrower than in D. Ecklonis, linear: fls. white, veined purple, the rays narrower at the base, reverse orange purplish, the disk purplish. B.M. 1981 (as Calendula). L. H. B.†

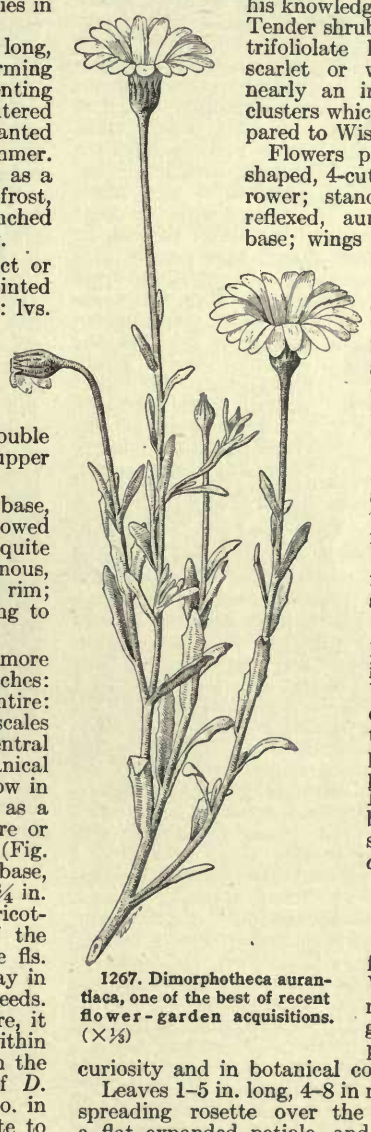
DIOCLÈA (after Diocles of Carystos, said to be second only to Hippocrates among the ancients for his knowledge of plants). *Leguminòsæ.* Tender shrubby twiners, with delicate trifoliolate leaves and blue, violet, scarlet or white flowers, sometimes nearly an inch long, and borne in clusters which have been roughly compared to Wistaria.

Flowers papilionaceous; calyx bell-shaped, 4-cut, 2 lobes shorter and narrower; standard orbicular or ovate, reflexed, auricled or appendaged at base; wings obovate or oblong, free; keel incurved, beaked or obtuse; ovary nearly sessile: pod wide, the upper suture thickened or 2-winged. — Perhaps 20 species in tropical regions, chiefly in the western hemisphere. What is said to be the following species is cult. in S. Calif., where it has a moderate growth, shining foliage, and clusters of 10 or more large fls. of a splendid scarlet (to be considered with reference to Camptosema).

glycinoìdes, Hort. Fls. 1 in. long, bright scarlet, in racemes, somewhat like Wistaria: will stand some cold. Prop. by seeds, cuttings, or suckers, freely produced on grown-up plants. Rio de la Plata.—Imperfectly understood botanically; said to be the same as *Camptosema rubicundum*, Hook. & Arn.

L. H. B.†

DION: *Dioon.*

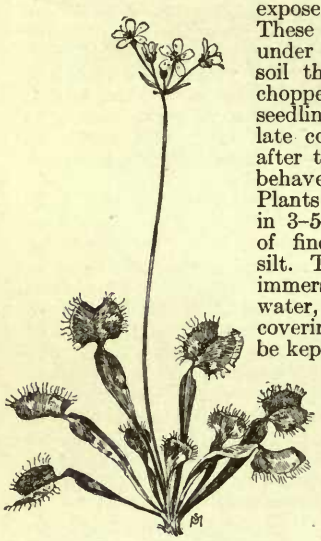


1267. Dimorphotheca aurantiaca, one of the best of recent flower-garden acquisitions. (×⅓)

DIONÆA (Greek name for Venus). *Droseràceæ.* VENUS FLY-TRAP. A remarkable monotypic genus of insectivorous plants, often grown for curiosity and in botanical collections.

Leaves 1–5 in. long, 4–8 in number, are arranged in a spreading rosette over the soil, each consisting of a flat expanded petiole, and terminal bilobed blade; midrib of the blade contractile, the margins prolonged into bristles that interlock when the halves close, while each half bears 3 jointed and highly irritable hairs arranged in triangular manner over its upper surface; abundant sessile glands, usually of a crimson color, cover this surface and render it attractive to insects; but when grown in shade the glands and therefore the lvs. are quite green: a single neat touch of a hair fails to cause closure, but when one of the hairs is touched twice, or when two adjacent hairs are touched once within a short interval apart, the halves close. Owing

to continued and repeated stimuli caused by a caught insect, or to chemical stimuli caused by its tissues, the glands exude an acid and peptonizing digestive fluid after a few hours; this starts digestive disintegration of the insect's tissues, and the dissolved products are then absorbed by the lf.-halves: the fl.-stalk lengthens in May to 8–10 in. and bears 4–10 white fls. which expand in June, and which must be cross-pollinated for seed-production. By the end of June the caps. burst, and expose small black shining seeds. These germinate in abundance under a bell-jar on moist sandy soil that is mixed with finely chopped sphagnum moss. Each seedling, after forming 2 lanceolate cotyledons, produces thereafter tiny fly-trapping lvs. that behave like the adult ones. Plants thrive well when grown in 3–5-in. pots amid a mixture of fine silver-sand and black silt. The pots should be kept immersed for about an inch in water, should have a slight top-covering of sphagnum, and must be kept near the glass in a greenhouse with southeastern exposure. Inhabits the edges of moist sandy savannah "bottom" lands, is found wild over a narrow strip of territory about 10 miles in width and 40 miles north, also to an equal distance south of Wilmington, N. C., and grows well only when the tips of its roots reach a moist substratum, and when active transpiration proceeds. The perennial underground part is a bulbous swelling that can readily be dug and distributed from Nov. to March.



1268. The Venus' Fly-trap—Dionæa muscipula.

It is seldom that this wonderful little plant is seen in a good state of cultivation any length of time after removal from its native haunts. Its cultivation in a greenhouse is usually attended with more or less difficulty, owing to unsuitable conditions, such as too much dry air, shade or unfriendly soil. It delights in full sunshine, with a very humid atmosphere. When the plants can be secured and transplanted with considerable of the soil in which they grow attached to the bulb-like rootstalks, they are quite easily dealt with, and may be kept in a healthy growing state for years. I find a round hanging earthenware receptacle most useful to grow them in; the bottom is carefully drained, first with large pieces of broken pots, then smaller pieces, and the upper layer is quite fine. Some chopped fibrous peat is placed above this, when the plants are built in with live sphagnum moss used to fill the spaces between the clumps. Arranged in this way, it is hardly possible to give them too much water, and they revel in abundant supplies. If kept in the sun the leaves take on a reddish tinge, but when grown in the shade they are always green. Flowers will develop about the middle of June, but they should be nipped off as they make their appearance, for they are apt to weaken the plant.—The dionæa has been grown successfully in a dwelling-house by a very different method. The plants were in a wide, shallow dish, without any drainage, and simply placed, not too firmly, in loose live sphagnum moss, with a glass covering. Water was given every other day by filling the space above the plants until the dish was filled, and then it was poured off. In this way the potting material never became sour. From the luxuriant condition in which these plants remained for years, I am inclined to think this was a close imitation of the conditions under which they thrive in a wild state. Some years ago, owing to Asa Gray's endeavor to have the Government purchase a strip of land on which this plant grows, there existed a widespread idea that it was gradually becoming extinct. There seems to be little likelihood of this calamity, however, as Dionæa is found abundantly in some places. (G. W. Oliver, in Garden and Forest, 10:237 [1897]).

muscípula, Ellis. Fig. 1268. St. short, subterranean, coated by the swollen bases of lvs.: lvs. 1–5 in. long in radial rosette, divided into winged petiole and bilobed lamina: infl. umbellate; fls. ¾–1 in.; petals white; stamens usually 15; pistil of 5 united carpels, stigmas 5 penicillate: fr. a caps. B.M. 785. F.S. 3:280. Mn. 1, p. 69. J. M. Macfarlane.

DIÒON (Greek, *two* and *egg;* each scale covers two ovules and the seeds are in pairs). *Cycadàceæ.* Handsome foliage plants suitable for warm or temperate palm houses and for planting in the open far South.

This genus is said to be the closest to the fossil forms of any living representative of the family. It has the cones and twin seeds of Zamia and Encephalartos, with the flat woolly scales of Cycas, but without the marginal seeds and loose infl. of the latter.—*D. edule* has a flat rigid frond which is more easily kept free from scale insects than *Cycas revoluta,* the commonest species of the family in cult. A specimen at Kew had a trunk 3–4 ft. high and 8–10 in. thick, the crown spreading 8–10 ft. and containing 50 fronds, each 4–5 ft. long and 6–9 in. wide. Specimens of *D. spinulosum* are reported with trunk 24 ft. high. Both sexes make cones frequently, the male cone being 9–12 in. long and the female 7–12 in. The seeds, which are about the size of Spanish chestnuts are eaten by the Mexicans. There are a few species in Mex. Prop. by seeds. Cult. same as Cycas.

edûle, Lindl. Lvs. pilose when young, finally glabrous, 3–5 ft. long, pinnatifid, rigid, narrowly lanceolate segms., about 100 on each side, linear-lanceolate, sharp-pointed, widest at the base, rachis flat above, convex beneath: male cones cylindrical, female cones ovoid. Mex. B.M. 6184. G.C. III. 40:289. Gn. 55, p. 365. Gt. 48, p. 157. Var. **lanuginòsum,** Hort., is a very woolly kind. Gt. 48, pp. 154, 155. Variable.

spinulòsum, Dyer. Plants 6–50 ft. high, crowned by a noble rosette of spreading lvs.: lvs. 4–6 ft. long, often with 100 lfts. on each side, these bearing 5–8 spines on each margin. This is one of the tallest of all the cycads, and is excelled only by the Australian *Cycas media.* It is very unlike *D. edule,* which has a stocky trunk and straight rigid lvs. Mex. G.W. 4, p. 326; 5, p. 331. A.F. 7:461.

D. Dohènii, Hort. Discovered in mts. of Guatemala and named for Edward L. Doheney of Los Angeles. Pacific Garden, Nov. 1912: 13.—*D. pectinàtum,* Hort. Like C. spinulosum: foliage described as "very handsome, owing to the very numerous pinnæ and their close and regular arrangement. The texture is also firm and leathery, with a sharp spiny point to each pinna." Gn. W. 24:5.—*D. Púrpusii,* Rose. Trunk short, crowned with numerous stiff and ascending lvs. 3 ft. or more long; pinnæ 2-4 in. long, sharp-pointed, entire on the lower margin but usually with 1, 2, or 3 spine-like teeth on the upper margin: male cones 6–8 in. long, the bracts with recurved ovate tips; female cones ovate, about 18 in. long, the bracts very woolly. S. Mex. Wilhelm Miller.
L. H. B.†

DIOSCORÈA (Dioscorides, Greek naturalist of the first or second century of the Christian era). *Dioscoreàceæ.* Twining herbs from tuberous or thickened rootstocks, grown as arbor vines or under glass for the foliage, and also for the edible rhizomes and aërial tubers.

Type genus of a small family (of about 9 genera) allied to Liliaceæ. It contains more than 200 widely dispersed and confused species, most of them native to tropical regions. Sts. herbaceous and twining or long-procumbent, usually from a large tuberous root,

and sometimes bearing tubers in the axils: lvs. broad, ribbed and netted-veined, petiolate, alternate or opposite, sometimes compound: fls. dicœcious, small; calyx 6-parted; anthers 6; styles 3; ovary 3-loculed and calyx adherent to it: fr. a 3-winged caps.; seeds winged.—The great subterranean tubers of some species are eaten in the manner of potatoes. Some of the kinds have handsome colored foliage and are good glasshouse subjects. Numbers of species are more or less cult. in different warm countries (see, for example, Paillieux & Bois, "Le Potager d'un Curieux," and for Japanese species Georgeson, A.G. 13:80); but it is not known that many of them have appeared in the U. S. The tuber-bearing species need to be worked over thoroughly from living plants. For an inquiry into the prehistoric cult. of dioscoreas in Amer., see Gray & Trumbull, Amer. Journ. Sci. 25:250.

All the species are of very easy cultivation from seeds or tubers or cuttings. The tubers keep a long time, like potatoes.

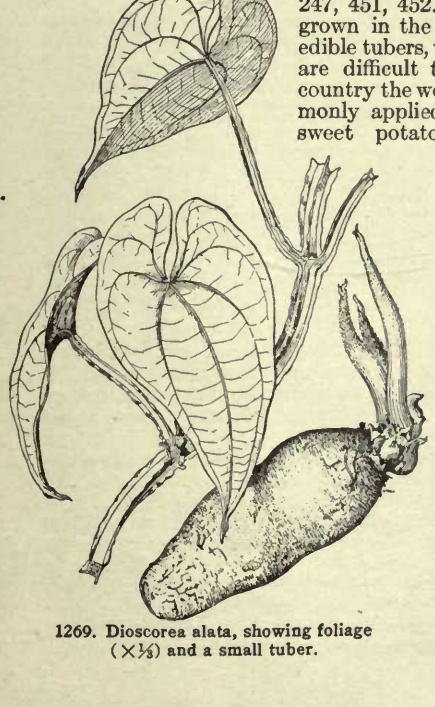
A. *Sts. strongly winged.*

alàta, Linn. Fig. 1269. St. 4-winged or angular: lvs. opposite, cordate-oblong, or cordate-ovate, with a deep, basal sinus, glabrous, devoid of pellucid dots, 7-nerved (sometimes 9-nerved), with the outer pair united: staminate spikes compound, special ones whorled, short, flexuose; pistillate spikes simple; fls. distant, anthers subglobose, about as long as the filament: caps. leathery, elliptical. India and the South Sea Isls.—Widely cult. in the tropics under many vernacular names. Tubers reach a length of 6–8 ft., and sometimes weigh 100 lbs.; edible. The roots continue to grow for years. Variable.

AA. *Sts. terete (cylindrical).*

B. *Lvs. plain green.*

Batātas, Decne. (*D. divaricàta,* Auth., not Blanco). Yam. Chinese Yam. Chinese Potato. Cinnamon-Vine. Tall climbing (10–30 ft.), the lvs. 7–9-ribbed, cordate-ovate and shining, short-petioled, bearing small clusters of cinnamon-scented white fls. in the axils: root-tubers deep in the ground, 2–3 ft. long, usually larger at the lower end. Philippines. F.S. 10:971. R.H. 1854, pp. 247, 451, 452.—This is often grown in the tropics for its edible tubers, which, however, are difficult to dig. In this country the word yam is commonly applied to a tribe of sweet potatoes (see *Sweet Potato*). The yam is hardy. The root will remain in the ground over winter in New York, and send up handsome tall twining shoots in the spring. The plant bears little tubers in the lf.-axils, and these are usually planted to produce the cinnamon vine; but it is not until the second year that plants grown from these tubercles produce the large or full-grown yams. A form with short and potato-like tubers is *D. Decaisneàna,* Carr. (R.H. 1865:110).—A vine widely cult. since 1910 under the name "air potato" or "giant yam vine" has large potato-shaped bitter tubers. Its identity is in doubt. It is not *D. divaricata,* under which name it was intro. from Hawaii, nor *D. bulbifera,* which has angular and edible aërial tubers. In order to distinguish it from the latter, it has recently been called the "Hawaiian bitter yam." The yampi is apparently a form of *D. alata.* This and other forms of this species are grown in Fla. and La., for the excellent edible tubers, which compare favorably with the potato.



1269. Dioscorea alata, showing foliage (×⅛) and a small tuber.



1270. Air potato.—Aerial tuber of Dioscorea bulbifera. (×¼)

bulbífera, Linn. Air Potato. Fig. 1270. Tall-climbing: lvs. alternate, cordate-ovate and cuspidate, 7–9-nerved, the stalks longer than the blade: fls. in long, lax, drooping, axillary racemes. Trop. Asia. G.C. III. 52:313.—Somewhat cult. S. as an oddity and for the very large angular axillary tubers (which vary greatly in size and shape). These tubers sometimes weigh several pounds. They are palatable and potato-like in flavor. The root-tubers are usually small or even none.

BB. *Lvs. variously marked and colored, at least beneath (greenhouse "foliage plants").*

díscolor, Hort. Lvs. large, cordate-ovate, cuspidate, with several shades of green, white-banded along the midrib and purplish beneath: fls. greenish and inconspicuous: root tuberous. S. Amer. Lowe 54. F.W. 1877:353.—Useful for the conservatory. Suggestive of *Cissus discolor.*

multícolor, Lind. & André. Probably only a form of the last: lvs. variously marked and blotched and veined with silvery white, red, green and salmon. S. Amer. I.H. 18:53.—Very decorative glasshouse plant of several well-marked forms (some of them under Latin names).

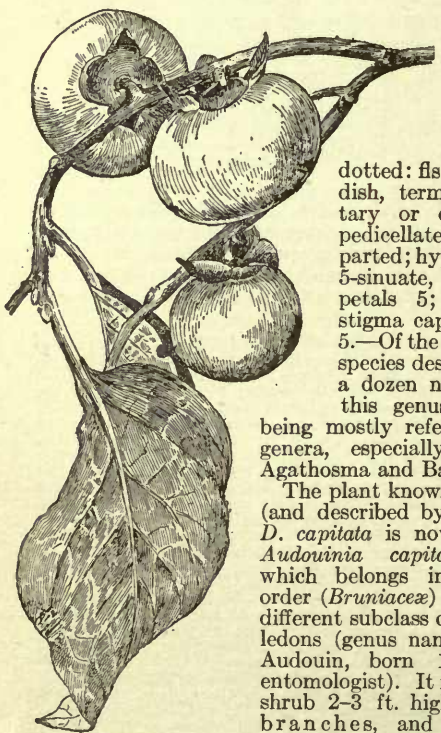
D. villòsa, Linn., a native dioscorea, is offered. Bartlett has recently worked over the species native to the U. S. (Bull. 189, Bur. Pl. Ind., U. S. Dept. of Agric., 1910) and has recognized 5 species in the material formerly passing as D. villosa; and the name villosa itself he finds to be untenable because of the confusion attending it (a similar case lies with D. sativa, Linn., a name applied to oriental species). The 5 species are as follows: *D. quaternàta,* Gmel. Rhizomes stout, ⅜in. diam., straight or forked, with few or no lateral branches: sts. 3–8 ft. long, rigid and erect at base but requiring support above: lvs. mostly 5 and 6 at a node, alternate above, cordate, repand, green on both sides, glabrous: staminate fls. panicled, the clusters solitary in the axils; pistillate fls. few in the cluster: fr. variable, ⅖–1½ in. long. Woods and banks, N. C. to Fla., La., Mo. and Ark.—*D. glaùca,* Muhl. Rhizomes ⅜in. or more diam., often forked and with many short lateral branches (the source of the drug "dioscorea"): st. 3–10 ft. long, rigid and erect at base but requiring support above: lvs. in whorls of 5–7, the upper ones alternate, larger than in D. quaternata and less or not at all repand glabrous or hirtellous, glaucous at maturity: staminate infl. solitary in all axils, paniculate; pistillate infl. few-fld.: fr. to 1¼ in. long. Pa. southward along the mts. to S. C. and west to E. Mo.—*D. paniculàta,* Michx. Rhizomes long and slender, simple or rarely forked, less than ⅜in. diam., with a few short thinner laterals: st. 3–14 ft., flexuose, glabrous: lvs. all alternate or nearly so, pubescent beneath: staminate infl. solitary in the upper axils; pistillate infl. densely many-fruited: fr. less than 1 in. Var. *glabrifòlia,* Bartlett, has glabrous lvs. Mass. to Minn., south to Texas in the middle region.—*D. hirticaùlis,* Bartlett. Rhizome less than ⅜in. diam., simple or rarely forked, nearly

striaght, with short thin laterals: st. 3–10 ft., weak and flexuose, pubescent: lvs. all alternate (except perhaps at lowest node), grayish pubescent: staminate infl. solitary in upper axils, the upper ones paniculate; pistillate infl. with 1–4 frs., which are nearly 1 in. long. Carolinas and Ga.—*D. floridàna*, Bartlett. Rhizomes undescribed: st. flexuose and twining: lvs. alternate, wholly glabrous, green above and paler beneath: staminate infl. paniculate, in the upper axils and also terminal; pistillate infl. solitary, 5–7-fld.: fr. similar to those of D. paniculata, nearly 1 in. long, S. C. to Fla.

Of the many names appearing in horticultural literature, the following are recent: *D. argyræa*, Hort. Lvs. with silver-gray angular patches along the main nerves. Colombia. Probably one of the D. discolor-multicolor group.—*D. bicolor*, Hort. Greenhouse climber, with ovate and cordate lvs., variegated above and deep purple beneath. G.W. 13, p. 254. Perhaps a garden form of some species, although there is a D. bicolor, Prain & Burkill described in a Bengal journal.——*D. Fárgesii*, Franch. Twining, with spherical aërial tubers: lvs. of 3–5 parts or lfts., ternate or digitate, the parts oval or oval-lanceolate, more or less acuminate: female fls. in a very long cluster, sessile, subtended by lanceolate bracts; female fl. oblong, with 6 short segms.: subterranean tuber globular, said to be edible; plant produces aërial tubers. W. China. R.H. 1900, p. 685.—*D. globòsa*, Roxbg. Cult. by Hindoos: tubers large, round and white: sts. 6-winged, prickly toward the root: lvs. sagittate-cordate, ensiform, 5–7-nerved, the long petiole 5-winged: staminate infl. long-pendulous and compound, and verticillate; pistillate infl. simple and erect in the axils, few-fld. India. This name is listed in Eu.—*D. illustràta*, Hort., appears in European lists: lvs. satiny green with a central band of gray, transverse lines of white, and gray patches, under surface purple. Brazil. Probably one of the D. discolor group.—*D. japónica*, Thunb. St. slender, climbing 10–12 ft.: lvs. ovate with tapering apex and deeply cordate base, with some of the axils bearing small oblong tubers or bulbels: pistillate fls. small, white, racemose near the top of the plant: fr. triangular, winged: root 3–4 ft. long, 1–2 in. diam., often branched. Japan. Cult. forms have thicker and more condensed roots, and are eaten after the manner of potatoes. Offered abroad.—*D. macroùra*, Harms. Lvs. simple, alternate, glabrous, stalked, cordate-orbicular, 1 ft. each way, undulate, with an apical cusp 1½–2 in. long: male fls. in a large panicle, the racemes reaching 2 ft., the fertile stamens 6 and very short. Upper Guinea (Trop. Afr.).—*D. retùsa*, Mast. Sts. slender, much twining, finely pubescent: lvs. alternate, compound; lfts. 5, stalked obovate, retuse, to 2 in. long, green and glabrous: male fls. few, in short-peduncled racemes; perianth-segms. oblong and connivent; fertile stamens 3 and staminodea 3. S. Afr. G.C. 1870: 1149. G.Z. 22, p. 242.

L. H. B.

DIÓSMA (Greek, *divine odor*). *Rutàceæ*. Small tender heath-like shrubs from southwestern Africa.



1271. Native persimmon, Diospyros virginiana. (×¾)

Leaves alternate or opposite, linear-acute, channeled, serrulate or sometimes ciliate, glandular-dotted: fls. white or reddish, terminal, subsolitary or corymbose, pedicellate; calyx 5-parted; hypogynous disk 5-sinuate, 5-plaited; petals 5; style short; stigma capitate: carpels 5.—Of the more than 200 species described, barely a dozen now remain in this genus, the others being mostly referred to allied genera, especially Adenandra, Agathosma and Barosma.

The plant known to gardeners (and described by Linnæus) as *D. capitata* is now referred to *Audouinia capitata*, Brongn., which belongs in a different order (*Bruniaceæ*) and even in a different subclass of the Dicotyledons (genus named for J. V. Audouin, born 1797, famous entomologist). It is a heath-like shrub 2–3 ft. high, with erect branches, and somewhat whorled, mostly clustered branchlets: lvs. spirally arranged, stalkless, overlapping, linear, 3-angled, roughish, with 2 grooves beneath: fls. crimson (according to Flora Capensis), crowded into oblong spike-like, terminal heads. Generic characters are: calyx adhering to the ovary, 5-cleft, segms. large, overlapping; petals with a long, 2-keeled claw, and a spreading, roundish limb; stamens included; ovary half inferior, 3-celled, cells 2-ovuled; style 3-angled, with 3 small, papilla-like stigmas.—One species.

In America, *D. ericoides* is more or less well known, and is put to various uses in floral decorations, in sprays, or branchlets cut to the required length, and stuck in formal designs as a setting for other flowers in the same manner and for the same purpose as Stevia is used, to give that necessary grace and artistic effect to the whole. This species, like most of the genus, has an agreeable aromatic fragrance in the foliage. It is a strong grower, loose and heath-like in habit and foliage, as the specific name indicates; flowers white and small, one or more on the points of tiny branchlets. While diosmas undoubtedly do best in soil suitable for heaths, that is, soil composed largely of fibrous peat, they are not nearly so exacting in their requirements in this respect, and can be grown in good fibrous loam and leaf-mold in equal parts, with considerable clean sharp sand added thereto. The plants should be cut back rather severely after flowering to keep them low and bushy; this refers more particularly to the above species, other members of the genus being of more compact growth and needing very little corrective cutting to keep them in shape. *D. capitata* (properly *Audouinia capitata*) is a fine example of the latter class, and is much better than *D. ericoides* for exhibition and show purposes; flowers pinkish lilac, in corymbs. The propagation of diosmas by cuttings is similar to that of heaths, but much easier. The best material for cuttings is young wood. (Kenneth Finlayson.)

ericoìdes, Linn. Much-branched, 1–2 ft., leafy: branches and twigs quite glabrous: lvs. alternate, crowded, recurved-spreading, oblong, obtuse, keeled, pointless, glabrous: fls. terminal, 2–3 together, with very short pedicels; calyx-lobes ovate, obtuse; petals reddish, elliptic-oblong or obovate, obtuse, narrowed to a short claw, twice as long as the calyx; disk free and 5-lobed. B.M. 2332 under this name is in reality *D. vulgaris* var. *longifolia*. G. 33:501.

The plant cult. in Calif. as *Diosma purpurea* belongs to Agathosma (Greek, *good odor*), differing from Diosma chiefly in the presence of 5 staminodes and in the 3 or 4 carpels; it is *A. villòsa* Willd., a shrub about 1 ft. high with upright branches, spirally arranged upright and imbricate lvs. oblong-lanceolate, ciliate, pubescent beneath, ⅛–¼in. long: fls. light purple, in dense terminal heads; pedicels unequal, at least the outer ones not exceeding the lvs. S. Afr. R.B. 5:369 (as Diosma hirta), H.I. 1:4. Another species sometimes cult. as D. purpurea is *Agathosma Ventenatiana*, Bartl. & Wendl. differing from the preceding species chiefly in the spreading lvs. and in nearly equal pedicels exceeding the lvs. L.B.C. 12:1122 (as Diosma hirta).

D. frágrans, Sims=Adenandra fragrans.—*D. vulgàris*, Schlecht., has narrower lvs. than D. ericoides, and they are acute: branchlets minutely pubescent: lvs. scattered, rarely opposite, linear, convex-carinate, subulate-acuminate: fls. corymbose, the petals white, or red on the outside: plant 1–2 or more ft. There are well-marked botanical varieties.

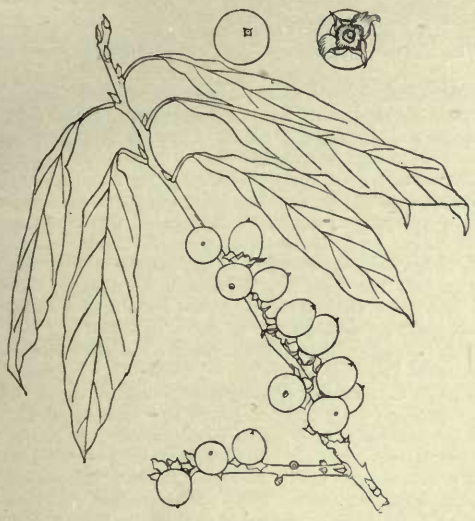
Wilhelm Miller.
L. H. B.†

DIOSPÝROS (*Dios*, Jove's, *pyros*, grain; alluding to its edible fruit). *Ebenàceæ*. Persimmon. Ebony. Woody plants grown partly for the handsome foliage and partly for their edible fruits; some species are valuable timber trees.

Deciduous or evergreen trees or shrubs, with alternate, rarely opposite, entire lvs., without stipules: fls. dicœcious or polygamous in few- or many-fld., axillary cymes, the pistillate often solitary, yellowish or whitish; calyx and corolla 3–7-, usually 4-lobed; stamens usually 8–16, included; styles 2–6; ovary 4–12-celled: fr. a large, juicy berry, 1–10-seeded, bearing usually the enlarged calyx at the base; seed flat, rather large.—About 190 species in the tropics, few in colder climates.

The few cultivated species are ornamental trees,

with handsome lustrous foliage, rarely attacked by insects and with decorative and edible fruit. The only species which is tolerably hardy North is *D. virginiana*, while *D. Kaki*, much cultivated in Japan for its large edible fruits, is hardy only in the southern states. Most species have valuable hard and close-grained wood,



1272. Diospyros Lotus. (×⅔)

and that of some tropical species is known as ebony. They thrive in almost any soil, but require, in cooler climates, sheltered and sunny positions. Propagated by seeds to be sown after maturity or stratified and sown in spring, and by cuttings of half-ripened wood or by layers; the tropical species by cuttings of mature wood in spring, with bottom heat; the fruit-bearing varieties are usually grafted or budded on seedling stock of *D. virginiana*. See *Persimmon*.

A. *Lvs. acuminate.*

B. *Fr. ½–1½ in. across, not ribbed: branches usually glabrous.*

virginiàna, Linn. Common Persimmon. Fig. 1271. Tree, to 50 ft., rarely to 100 ft., with round-topped head and spreading, often pendulous branches: lvs. ovate or elliptic, acuminate, shining above, glabrous at length or pubescent beneath, 3–6 in. long: fls. short-stalked, greenish yellow, staminate in 3's, ½in. long, with 16 stamens; pistillate solitary, larger, with 4 2-lobed styles, connate at the base: fr. globose or obovate, plum-like, with the enlarged calyx at the base, 1–1½ in. diam., pale orange, often with red cheek, edible, varying in size, color and flavor. June. Conn. to Fla., west to Kans. and Texas. S.S. 6:252, 253. G.F. 8:265. Mn. 4:21. Gn. 57, p. 146. A.G. 11:651. V. 4.20. G.W. 16:230.

Lôtus, Linn. Fig. 1272. Round-headed tree, to 40 ft.: lvs. elliptic or oblong, acuminate, pubescent, often glabrous above at length, 3–5 in. long: fls. reddish white, staminate in 3's, with 16 stamens, pistillate solitary: fr. yellow at first, black when fully ripe, globular, ½–¾in. diam., edible. June. W. Asia to China. A.G. 12:460. Gn. 32, p. 68. S.I.F. 1:79.

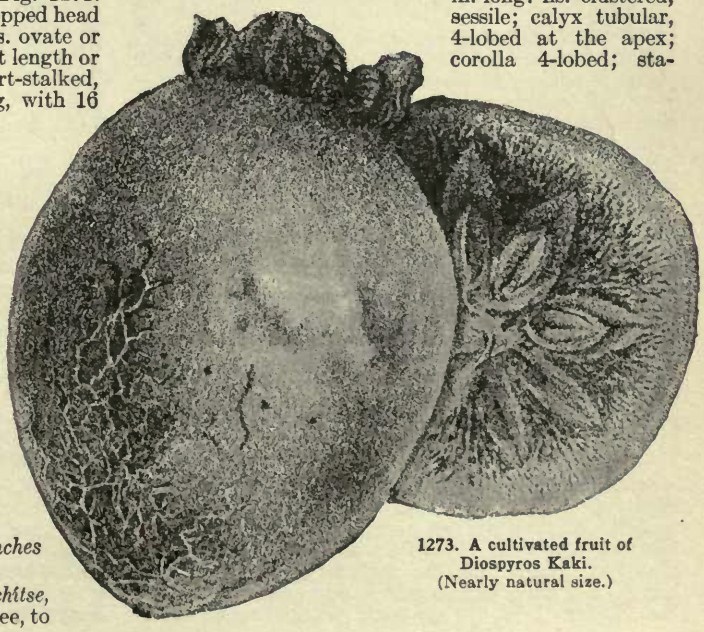
BB. *Fr. 1½–3 in. across, usually ribbed: branches with appressed brownish pubescence.*

Kâki, Linn. f. (*D. chinénsis*, Blume. *D. Schîtse*, Bunge. *D. Róxburghii*, Carr.). Fig. 1273. Tree, to 40 ft., with round head: lvs. ovate-elliptic, oblong-ovate or obovate, acuminate, subcoriaceous, glabrous and shining above, more or less pubescent beneath, 3–7 in. long: fls. yellowish white, staminate with 16–24 stamens, pistillate to ¾in. long; styles divided to the base, pubescent: fr. large, 1½–3 in. across, very variable in shape and size, mostly resembling a tomato, orange or reddish. June. Japan, China. R.H. 1870, pp. 412, 413; 1872, pp. 254, 255. B.M. 8127. G.C. III. 41:22. Gn. 27, pp. 168, 169; 49, p. 171. M.D.G. 1909: 409. Var. **costàta**, André. Fr. large, depressed, globular, orange-red, with 4 furrows. R.H. 1870:410, and p. 133. I.H. 18:78. G.C. II. 4:777; III. 9:171; 13:51. Gn. 49, p. 171. Var. **Mazélii**, Mouillef. Fr. orange-yellow, with 8 furrows. R.H. 1874:70. Other varieties are figured in R.H. 1872, p. 254; 1878:470; 1887:348; 1888:60. A.G. 12:331–8, 459–462.—A very desirable and beautiful fruit-bearing tree for the southern states, where a number of different varieties intro. from Japan are cult., but the hardier varieties from the north of Japan and China, which are likely to be hardy north to New England, seem hitherto not to have been intro. Fig. 1273 is from Georgeson's articles in A. G. 1891. —The plant cult. in Eu. as *D. chinensis*, which is apparently the same as *D. Roxburghii*, differs from the Japanese forms of Kaki, which usually have elliptic and glabrescent lvs., in the narrower usually oblong lvs. densely pubescent beneath, less so above, and in the greenish yellow subglobose fr.; it is tenderer than the common Kaki. It must not be confused with *D. sinensis*, Hemsl., an entirely different species from Cent. China, not in cult.

AA. *Lvs. obtuse or emarginate.*

texàna, Scheele (*D. mexicàna*, Scheele. *Brayodéndron texànum*, Small). Small tree, intricately branched, rarely to 40 ft.: lvs. cuneate, oblong or obovate, pubescent below, 1–2 in. long: fls. with the lvs., pubescent, on branches of the previous year; calyx and corolla 5-lobed; staminate fls. with 16 stamens, pistillate with 4 pubescent styles connate at the base: fr. black, ¾–1 in. diam. Spring. Texas, New Mex. S.S. 6:254.

tessellària, Poir. (*D. reticulàta*, Willd.). Tree or shrub: lvs. coriaceous, oval or oblong, rounded at both ends, lustrous above, glabrous and reticulate below, 3–6 in. long: fls. clustered, sessile; calyx tubular, 4-lobed at the apex; corolla 4-lobed; sta-



1273. A cultivated fruit of Diospyros Kaki. (Nearly natural size.)

mens 12–13, glabrous: fr. ovoid, sericeous or glabrate, 1¼–1½ in. long, edible. Mauritius.—Yields the ebony of Mauritius. Cult. in S. Calif.

D. armàta, Hemsl. Spiny tree, to 20 ft.: lvs. persistent, oval-oblong, obtuse, 1–2 in. long: staminate fls. in short panicles, creamy white, fragrant: fr. usually solitary, ¾in. across. Cent. China. Tender.—*D. Ebenáster*, Retz. The "guayabota" and "zapote negro," from Mex. and W. Indies, has been catalogued in S. Calif. It is a tall tree, with very sweet frs. the size of an orange, green outside and almost black inside: lvs. elliptic or oblong, usually obtuse, 3–12 in. long: fls. white, fragrant.—*D. Ébenum*, Koenig. Tree, to 50 ft.: lvs. elliptic-oblong, bluntly acuminate, glabrous: fls. white, staminate, in short racemes. E. Indies, Ceylon. For cult. in hothouses or tropical climates. This species is said to yield the best ebony.—*D. Morrisiàna*, Hance. Evergreen shrub or small tree, glabrous: lvs. oval, obtusely acuminate, 2–3½ in. long: fls. whitish, drooping, on hairy stalks: fr. yellow, subglobose, ½–¾in. across. Hongkong, Formosa. The edible fr. ripens in Dec.—*D. ùtilis*, Hemsl. Evergreen large tree: branchlets silky-pubescent: lvs. oblong, short-petioled, glabrous above, whitish and silky-pubescent beneath, 5–8 in. long: fr. depressed-globose, pubescent, nearly 2 in. across. Formosa. The edible fr. is called Mao-shih.

ALFRED REHDER.

DIOSTÈA (probably *two stones* or *seeds*). *Verbenàceæ*. Once referred to Baillonia, but now kept distinct; closely allied to Lippia, but differing widely in habit, in the slender green branches, in the branchlets having very long internodes and being cylindric and hollow. *D. júncea*, Miers, of the Andes of Chile and Argentina, is a bush or small tree, with the long branches constricted when dry: lvs. opposite, 1 in. or less long, sessile, oblong or ovate-oblong, obtuse, crenate, rather fleshy: fls. small, pale lilac, in peduncled axillary or terminal spikes; corolla tubular, inflated above the middle, hairy inside, with 5 very short rounded spreading lobes; stamens 4, didynamous. B.M. 7695.

DIÒTIS (*two-eared*, denoting the structure). *Compósitæ*. One cottony perennial on sea sands of Eu., sometimes planted in rock-gardens and for edgings. **D. candidíssima,** Desf. (*D. maritima*, Smith). COTTON-WEED. Usually less than 1 ft. high, has hard sts. almost woody at base, arising from a creeping rootstock: lvs. alternate, oblong, entire or slightly toothed, about ½in. long: fl.-heads nearly globular, ⅓in. across, in dense terminal clusters, in Aug. and Sept. It is readily prop. by seeds or cuttings. Diotis is closely allied to Achillea, being distinguished by the florets being all tubular and having 2 ears at the base of the corolla which persist and inclose the achene.

DIPCÀDI (meaning uncertain). Including *Tricharis* and *Uropétalum*. *Liliàceæ*. Tender bulbous scapose plants of minor importance, allied to Galtonia.

Leaves radical, thickish, narrowly linear: scape simple and leafless, bearing loose racemes of odd-colored fls.; perianth with a cylindrical tube, the lobes mostly equaling or exceeding the tube, the 3 exterior ones spreading or flaring and the 3 interior usually shorter and erect; stamens 6, on the throat of the perianth, the anthers linear and attached by the back; ovary sessile, ovoid or oblong, becoming a 3-sided dehiscent caps.: bulb tunicated.—About 50 species in S. Eu., Trop. and S. Afr. and India. During the winter, their resting time, the bulbs should be kept dry. A compost of light, sandy loam and leaf-mold has been recommended. Many species have been described in recent years from Trop. and S. Afr., and some of them may be expected to appear in the trade, and in lists of novelties.

A. *All perianth-segms. equally long.* (*Tricharis.*)

serótinum, Medikus. Lvs. 5–6, fleshy-herbaceous, glabrous, narrowly linear, 6–12 in. long, 2–3 lines wide near the base, channeled on the face: scape 4–12 in. long; raceme loose, 4–12-fld.; bracts lanceolate, 4–6 lines long, longer than the pedicels; perianth greenish brown, 5–6 lines long; ovary sessile or subsessile. S. Eu., N. Afr. B.M. 859 (as *Scilla serotina*).

AA. *Outer perianth-segms. longer than the inner and tailed.* (*Uropetalum.*)

filamentòsum, Medikus (*D. víride*, Moench). Lvs. 5–6, fleshy-herbaceous, narrowly linear, glabrous, 1 ft. long, 1½–3 lines wide near the base: scape 1–2 ft. high; raceme loose, 6–15-fld.; bracts linear-acuminate, 4–6 lines long; perianth green, 12–15 lines long, outer segms. 4–6 lines longer than the inner: caps. sessile or nearly so. S. Afr.

WILHELM MILLER.
L. H. B.†

DIPÉLTA (Greek *dis*, twice, and *pelte*, shield; two of the floral bracts are shield-like). *Caprifoliàceæ*. Ornamental deciduous shrubs, grown for their handsome pinkish or purple flowers.

Leaves opposite, short-petioled, entire or denticulate, without stipules: fls. solitary or in leafy few-fld. racemes, with 4 unequal conspicuous bracts at the base; calyx-lobes linear or lanceolate, 5; corolla tubular-campanulate, 2-lipped; stamens 4, inclosed; style slender, shorter than corolla; ovary inferior, elongated, 4-celled, 2 of the cells with 1 fertile ovule each and 2 cells with several sterile ovules: fr. a caps. inclosed by the enlarged, usually shield-like, bracts.—Four species in Cent. and W. Asia.

Dipeltas resemble diervillas in habit, with handsome pinkish or purple flowers in clusters along last year's branches; the flowers in shape are like those of a large-flowered abelia. *D. floribunda* has proved hardy at the Arnold Arboretum, while *D. ventricosa* seems to be somewhat tenderer. They are apparently not particular as to the soil. Propagation is by seeds sown in spring and probably, like Abelia and Diervilla, by greenwood and hardwood cuttings.

floribúnda, Maxim. Shrub, to 15 ft.: lvs. ovate to lanceolate, acute or acuminate, rounded or narrowed at the base, entire, puberulous at first, soon glabrous, 2–4 in. long: fls. 1–6, on slender nodding pedicels, tubular-campanulate, pale rose, lower lip with orange marks, 1¼in. long; ovary inclosed by the 2 upper large shield-like bracts persisting on the fr. and ¾–1 in. across. May. Cent. China. B.M. 8310. G.C. III. 42:3. M.D.G. 1912:27.

ventricòsa, Hemsl. Shrub, to 18 ft.: lvs. ovate-lanceolate to lanceolate, long-acuminate, usually rounded at the base, remotely glandular-denticulate, sparingly hairy above and villous along the veins beneath, 2–6 in. long: fls. 1–4 on drooping slender pedicels, campanulate, ventricose and scarcely tubular at the base, outside purple, whitish inside and marked with orange, 1¼ in. long; ovary hidden by 2 large unequal auriculate bracts on the fr. about ¾in. across. May, June. W. China. B.M. 8294. G.C. III. 44:101.

D. yunnanénsis, Franch. Allied to D. ventricosa. Lvs. entire: corolla distinctly tubular at the base. W. China. R.H. 1891, p. 246. Not yet intro.—*D. élegans*, Batal, is another handsome species not yet in cult.

ALFRED REHDER.

DIPHYLLÈIA (Greek, *double leaf*). *Berberidàceæ*. UMBRELLA-LEAF. An interesting hardy perennial herb, sometimes transferred to the wild-garden.

Plant with thick creeping jointed knotty rootstocks, sending up a huge peltate cut-lobed umbrella-like radical lf. on a stout stalk, and a flowering st. bearing 2 similar (but smaller and more 2-cleft) alternate lvs., which are peltate near one margin, and a terminal cyme of white fls.: sepals 6, fugacious; petals and stamens 6; ovules 5 or 6: berries globose, few-seeded. This is one of the genera having only 2 species, one of which is found in N. E. N. Amer., the other in E. Asia or Japan, of which there are two others in this family.

cymòsa, Michx. Root-lvs. 1–2 ft. across, 2-cleft, each division 5–7-lobed; lobes toothed: st. 1–4 ft. tall: berries blue. May. Wet or springy places in mountains from Va. to Ga. B.M. 1666.—Grows readily in dry soil under cult. but is dwarf.

DIPHŸSA (*two bladders*, because of the structure of the pod). *Leguminòsæ*. Shrubs or trees, usually glandular, with odd-pinnate lvs. and papilionaceous fls., of about 10 or 12 species in Mex., Cent. Amer., to Venezuela, rarely seen in cult. abroad in warmhouses: calyx with 5 unlike teeth, the 2 upper short; standard of the corolla orbicular, clawed, with 2 callosities inside; wings obovate or oblong or nearly lanceolate; keel as long as the wings or somewhat longer: fr. a stipitate more or less inflated pod: fls. yellow, in short racemes or fascicles. *D. carthagenénsis*, Jacq., is a shrub or small unarmed tree, with 2–3-fld. axillary peduncles, and about 5 pairs of lfts. **D. floribúnda**, Peyr., has been offered in S. Calif.: much-branching shrub: lvs. alternate; lfts. 7–13, elliptic or broad-oblong, the mid-nerve ending in a mucro: fls. yellow, in short secund racemes; standard strongly reflexed, ½in. broad. S. Mex. L. H. B.

DÍPIDAX (*double fountain*, from the pair of nectaries at the base of the perianth-segms.). *Liliàceæ*. Two species in S. Afr., with tunicated corms, simple sts. and small whitish more or less tinted fls. in spikes, of little horticultural importance: perianth deciduous, polyphyllous; stamens 6, included; ovary sessile, 3-celled and 3-lobed, many-ovuled; styles 3, awl-shaped: fr. a turbinate 3-valved caps. *D. ciliàta*, Baker. St. 6–12 in.: lvs. usually 3, ciliate, the lower 4–6 in. long and lanceolate-acuminate and the upper much shorter and amplexicaul: spike 2–6 in. long, densely many-fld.; fls. whitish more or less tinged red: there are several botanical vars., differing in lvs., number and color of fls. *D. triquètra*, Baker. St. 12–18 in.: lvs. 3, not ciliate, the lowest at base of st. and the upper near the spike (which is 1–6 in. long): fls. with numerous brown veins and 2 purple nectar-spots. B.M. 558 (as *Melanthium triquetrum*). The species are treated as greenhouse perennials.

DÍPLACUS: *Mimulus*.

DIPLADÈNIA (Greek, *double gland*, referring to the two glands at base of ovary, which distinguish this genus from Echites). *Apocynàceæ*. A charming genus of greenhouse twiners (sometimes erect), mostly from Brazil.

Flowers large, showy, more or less funnel-shaped, having a remarkable range of color, rarely white or dark red, but especially rich in rosy shades and with throats often brilliantly colored with yellow; the buds, also, are charming; calyx 5-parted, the lobes lanceolate, with glands or scales in the inside; corolla without scales at the throat, the 5 lobes spreading, twisted in the bud; stamens 5, affixed in the top of the tube, included, the acuminate anthers connivent around the 5-lobed stigma; disk of 2 fleshy scales, alternating with the 2 distinct ovaries: fr. of 2 terete more or less spreading follicles.—Species 30–40, in Trop. S. Amer., woody (rarely herbaceous) and mostly at first erect but becoming scandent, the lvs. mostly opposite and entire and usually with bristles or glands at base; fls. usually in terminal or axillary racemes. The genus is fully as interesting as Allamanda, which belongs to another tribe of the same family. Other allied genera of garden interest are Echites, Odontadenia, Mandevilla and Urechites. Some species are naturally erect bushes, at least when young, and many can be trained to the bush form. The group is a most tempting one to the hybridizer. Many names appear in European catalogues, but they are confused. Very many pictures are found in the European horticultural periodicals.



1274. Dipladenia atropurpurea. (×⅙)

Of the twining glasshouse flowering subjects, dipladenias are amongst the best and ought to be in all collections of greenhouse plants. An erroneous idea is held by many that it is necessary to have a very high temperature to grow these plants successfully. This, however, is not the case. Except when started into active growth in the early spring, they do better in an intermediate temperature. Dipladenias have been known to live, and thrive well, after having been subjected to 7° of frost. A good time of the year to secure cuttings of dipladenias is about February 1. At that time they show signs of starting into growth and the weak wood should all be pruned back to the normal thickness of the stem. The thickest part of these prunings make good cuttings. Take a piece with two leaves attached, with about an inch of the stem under the leaves. Pot them singly in small pots, half filled with equal parts osmundine, broken up rather fine, sand, and charcoal. Fill the upper part of the pot with sand. Place the pots in a tight propagating bed, in a night-temperature of 70.° Allow the temperature to run up to 80° or more by day, but be sure and admit air several times during the day by opening up the case the plants are in for a few minutes. The cuttings will have the small pots filled with roots in about a month, when they may be shifted into larger pots. From now on, use for potting equal parts of osmundine, the fiber of loam out of which all the fine part has been shaken, sphagnum moss, sand and charcoal. When the plants reach a 6-inch pot, a sixth part of sheep-manure may be added and a sprinkling of chicken-bone. It is a good plan, provided one has a good sheltered border with a southern aspect, to plant small plants of dipladenia outdoors from June until the middle of September. It is astonishing how vigorously they start into growth and flower when potted after this treatment. Fifty-five degrees is a good night temperature to grow dipladenias in when possible. During the summer, if grown indoors, admit all the air that can be admitted day and night. They will stand the full sun under glass, but they do slightly better under a very light shade during the hotter part of the day, when the sun is shining. When the pots are filled with roots, and it is desired that they should remain in that pot for the rest of the season, feed with manure-water, a handful of cow-manure to a two-and-a-half-gallon watering-pot. The same amount to an equal quantity of water if a fertilizer such as "Clays" is used, is sufficient. Horse urine may also be used for a change, a 3-inch potful to two and one-half gallons of water. Be sure to water three times in between with clean water. Dipladenias show signs of completing their growth toward the end of November, at which time water should be gradually withheld, but never so as to allow the wood to shrivel. They may be treated in this manner until the end of January, when, as stated above, they will show signs of starting the season's growth. At this season they should have a general overhauling. Large plants should be turned out of their pots, and the loose dirt all washed out of them with a hose with a gentle pressure on it; and if possible repot in the same size of pot. After disturbing the roots in this manner, they are better to be placed for a few weeks in a temperature of not less than 65.° When they have gripped the new soil, they do better in 55° night temperature. Give each break a piece of thread attached from the plant to the roof to climb on until they set flower. A few breaks, near the highest part of the plant, will

start climbing ahead of the others, and after they show a flower-stem pinch the shoot immediately ahead of the flower. This will encourage the belated breaks to start and catch up to these leaders. When they have all set flower, they may be trained evenly over a globe trellis if they are desired for a specimen plant. By the above treatment ninety-five open flowers, all at one time, have been secured on a plant in a 12-inch pot. Dipladenias are subject to mealy-bug, scale, thrips, and red-spider. Fumigate with hydrocyanic gas during the cold months, and syringe regularly and thoroughly during the summer, and these pests will give no trouble. (George F. Stewart.)

A. *Fls. white; throat yellow inside.*

boliviénsis, Hook. Plant everywhere glabrous: sts. slender: lvs. petioled, 2–3½ in. long, oblong, acuminate, acute at base, bright green and glossy above, pale beneath; stipules none: racemes axillary, 3–4-fld.; peduncles much shorter than the lvs., about as long as petioles and pedicels; bracts minute at the base of the twisted pedicels; calyx-lobes ovate, acuminate, 3 lines long; corolla almost salver-shaped, tube and throat slender and cylindrical, the former ½in. long, the latter twice as long and half as broad again; limb 1½ in. across; lobes broadly ovate, more acuminate than in *D. atropurpurea*. Bolivia. B.M. 5783. Gn. 44: 140. Gng. 7:342.



1275. Dipladenia splendens. (×½)

AA. *Fls. dark purple.*

atropurpùrea, DC. (*D. Marie Henriéttæ,* Hort.). Fig. 1274. Glabrous: lvs. ovate-acute, about 2 in. long, acute at the very base: racemes axillary, 2-fld.; peduncles a little longer than the lvs.; pedicels twisted, bracted; calyx-lobes lanceolate-acuminate, a little shorter than the pedicel, and a third as long as the cylindrical part of the corolla (of which the tube is about 2 in. long); corolla dark purple inside and out, tube funnel-shaped above the middle; lobes triangular, wavy, spreading, shorter than the dilated part of the tube. Brazil. B.R. 29:27 (as Echites). Gn. 44:488. I.H. 42:33. Gt. 43, p. 548. Var. **Clárkei,** Hort. Lvs. rather small: fl. deep crimson shaded velvet-black, about 2½ in. across, the tube paler. Gn. W. 8:661.—*D. atropurpurea* is a handsome species, but considered to be a shy bloomer.

AAA. *Fls. rose; throat deep rose or purple within, whitish outside.*

spléndens, DC. (*Echìtes spléndens,* Hook.). Fig. 1275. St. glabrous, the branches terete: lvs. subsessile, 4–8 in. long, elliptic-acuminate, cordate at the base, wavy, pubescent, especially beneath, veins elevated, numerous: racemes axillary, longer than the lvs., 4–6-fld.; calyx-lobes red-tipped, awl-shaped, as long as the cylindrical part of the corolla-tube, which is half the length of the funnel-shaped portion; limb flat, 4 in. across, the lobes rotund, subacute, almost as long as the tube; corolla-tube 1½ in. long, white outside, lobes rosy, throat deeper, almost purple. Brazil. B.M. 3976. F.S. 1:34 shows a yellow-throated form. Var. **profùsa,** Rod. (*D. profùsa,* Hort.), has larger and brighter rosy fls., lined with yellow inside, the outside of the tube rosy except at the base, which is yellow. J.H. III. 57:277. I.H. 30:491.—Intro. by B. S. Williams. *D. amábilis,* Hort., is said to be a hybrid of *D. crassinoda* and *D. splendens.* Lvs. short-stalked, oblong, acute: fls. rosy crimson, 4–5 in. across; corolla-lobes very round and stiff. Gn. 51, p. 227. G. 12:89; 14:461. I.H. 27:396, shows a 12-fld. raceme with exceptionally bright red fls.

AAAA. *Fls. salmon-colored; throat yellow inside and out.*

urophýlla, Hook. Glabrous erect bush, not a vine: branches numerous, swollen at the joints: lvs. ovate-oblong, obtuse at the base, suddenly narrowed at the apex into a narrow point ¾in. long: peduncles long, drooping, flexuose; racemes axillary, 4–6-fld.; calyx-segms. awl-shaped; corolla dull yellow outside, deeper and brighter yellow within; tube cylindrical in lower third, then swelling into an almost bell-shaped throat; lobes of the limb salmon inclined to purple, acute. Brazil. B.M. 4414. P.M. 16:66. F.S. 5:425.

D. amàna, Moore. Free-flowering, with good foliage: lvs. oblong-acuminate: fls. pink tinted with rose; corolla-lobes rounded and not reflexed. Of garden origin (D. splendens ×D. amabilis); offered abroad. F. 1868:73. G.6:391; 11:43.—*D. Brearleyàna,* Hort. Lvs. oblong, acute, dark green: fls. pink at first, changing to rich crimson, very large. Gn. 51, p. 226. F.W. 1875:161. G. 8:92; 12:703. Probably a form of Odontadenia speciosa.—*D. carissima,* Hort. Fls. very large (about 5 in. diam.), delicate pink lined with bright rose. Garden origin. G.Z. 27, p. 49.—*D. crassinòda,* DC. Glabrous: st. much branched, with many nodes: lvs. lanceolate, acute or almost acuminate, acute at the base, shining and leathery on both sides: racemes axillary, about 6-fld.; calyx-lobes lanceolate, acuminate, a little shorter than the cylindrical part of the corolla-tube, 2 or 3 times shorter than the pedicel; corolla-tube bell-shaped above the middle; lobes obovate-orbicular. Brazil. The above is the original description by De Candolle, who adds that the lvs. are 3–3½ in. long, ¾–1 in. wide; petiole 2–3 lines long: stipules interpetiolar, with 4 short cuspidate teeth. The plant pictured in B.R. 30:64 was renamed D. Lindleyi by Lemaire chiefly for its pilose st. and stellate-lobed stipules. Later authorities refer B.R. 30:64 to D. Martiana. F.S. 22:2310 may be the same plant as B.R. 30:64, but with variable lvs. and stipules. The plant was prized for its delicate colors, being white at first, then shot with soft rose like a flame tulip, and finally a deep rose. Only 1 fl. in a raceme was open at a time, and each lasted 8 or 9 days; throat orange inside.—*D. eximia,* Hemsl. Very slender, twining, nearly glabrous, the st. rose-red: lvs. opposite, very short-stalked, 1–1½in. long, orbicular-ovate to elliptic: fls. 6–8 in a cyme, 2½–3 in. across, rose-colored, the tube nearly 2 in. long, corolla-lobes orbicular and obtusely cuspidate. Probably Brazil. B.M.7720.—*D. flàva,* Hook. Fls. size and color of common yellow allamanda; climbing: lvs. opposite, short-stalked, ovate to elliptic: fls. 4–6 in a lax cyme, yellow, the tube very hairy on the outside and suddenly enlarged above. Colombia. B.M. 4702. J.F. 4:373. See Urechites, to which this is properly referred.—*D. Hárrisii,* Hook. = Odontadenia speciosa.—*D. hýbrida.* Lvs. large, stout, bright green: fls. flaming crimson-red. Garden form. G. 32:647.—*D. illústris,* DC. Glabrous or pubescent: lvs. oblong or rotund, obtuse or nearly acute, rounded or subcordate at the base, many-nerved; stipules none; petiole short: racemes terminal, 4–8-fld.; fls. rosy, throat yellow inside, purple at the mouth; corolla-tube cylindrical to the middle, then funnel-shaped; limb 3–3½in. across, lobes rosy, orbicular-ovate, obtuse. Brazil. F.S. 3:256. Var. *glàbra,* Muell. Arg. B.M. 7156.—*D. insígnis,* Hort. Stout-growing: foliage strong: fls. rosy purple. Of garden origin. R.H. 1904, p. 419. G.Z. 16:145.—*D. pastòrum,* Mart., var. *tenuifòlia,* Hook. f. A very slender tuberous-rooted glabrous twining herb with very narrow (⅛in. or less broad) lvs. 2–3 in. long, and rose-colored fls. 1½ in. across and bearing a golden 5-cleft ring at the throat. Brazil. B.M. 7725.—*D. Sánderi,* Hemsl., has flesh-colored, fls. with throat yellow inside, and outside at the base, has smaller lvs. than D. illustris, and no circle of purple at the mouth of the fl. Gn. 51:226.

WILHELM MILLER.
L. H. B.†

DIPLARRHÈNA (Greek, *two anthers;* the third being imperfect). *Iridàceæ.* Tender rhizomatous plants from Australia and Tasmania, with white and variegated flowers. Herbs: rhizome short: sts. erect, simple or somewhat branched: lvs. mostly radical, narrow, rigid, acuminate, equitant: spathe terminal, rigid, acuminate; perianth without any tube above the ovary; segms. unequal, inner ones shorter, connivent; upper stamen imperfect; fls. usually more than 1 to a spathe, not lasting.

Morǽa, Labill. Sts. 1½–2 ft. long, with a single terminal cluster, and several sheathing bracts: lvs. 6–8 in a tuft, 1–1½ ft. long, ¼–½in. wide: spathes cylindrical, 2–3-fld., 2 in. long; fls. whitish: caps. 1 in. long. New S. Wales, Victoria, and Tasmania. This species has been offered. The only other species is *D. latifòlia*, Benth. (*D. Morœa* var. *latifòlia*, Baker), from Tasmania, with longer and broader lvs. (nearly 1 in. wide), longer spathes which are 5–6-fld., and fls. variegated with lilac and yellow. L. H. B.

DIPLÀZIUM (Greek, *doubled*). *Polypodiàceæ*. Rather large, coarse ferns, of greenhouse culture.

Allied to Asplenium, but with the indusia often double, extending along both sides of some of the free veins. The dividing line between Diplazium and Asplenium is technical. In general appearance and in cultural requirements, the two genera are practically identical.—Eighty or more species are found, mostly in the warmer portions of the world.

A. *Lvs. simple.*

lánceum, Presl. Lvs. 6–9 in. long, ¾–1 in. wide, narrowed upward and downward, the margin mostly entire; sori reaching nearer to the edge than the midrib. India, China, Japan.

AA. *Lvs. pinnate, with the pinnæ deeply lobed: rootstock not rising to form a trunk.*

arbòreum, Presl (*Asplènium arbòreum*, Linn.). Lvs. 12–18 in. long, 6–8 in. wide, with a distinct auricle or lobe at the base. The habit is not arboreous, as originally supposed, and as the name would indicate; quite near the next, but less deeply cut. W. Indies and Venezuela.

Shépherdii, Link (*Asplènium Shépherdii*, Spreng.). Lvs. 12–18 in. long, 6–9 in. broad, deeply lobed, the lobes at the base sometimes reaching down to the rachis, somewhat toothed and often ¼in. broad; sori long-linear. Cuba and Mex. to Brazil.

AAA. *Lvs. bipinnate: trunk somewhat arborescent.*

máximum, C. Chr. (*D. latifòlium*, Moore. *Asplènium latifòlium*, Don). St. erect, somewhat arborescent: lvs. 3–4 ft. long, 12–18 in. wide, with about 12 pinnæ on either side. India, China and the Philippines.

L. M. Underwood.

DIPLOGLÓTTIS (*double-tongued*, referring to the divided scale inside the petals). *Sapindàceæ*. Australian tree; one species: *D. austràlis*, Radlk. (*D. Cúnninghamii*, Hook. f.), mentioned in recent horticultural literature. Lvs. large (1–2 ft. or more), pinnate, more or less villous; lfts. 8–12, oblong-elliptic to ovate-lanceolate, sometimes more than 1 ft. long: fls. greenish, many, in a large panicle; calyx deeply 5-lobed, small; petals about twice as long as calyx (¼in.), 4, thin, orbicular, ciliate, about equaled by the 2 inner scales; stamens 8, exserted or included; ovary 3-celled, the style short and incurved, stigma entire or somewhat 3-lobed: fr. a nearly globular 3-valved caps., tomentose, about ½in. diam. B.M. 4470 (as *Cupania Cunninghamii*).

DIPLOLÆNA (*double cloak*, in allusion to the double involucre). *Rutàceæ*. W. Australian tomentose shrubs, sometimes cult., but apparently not in American trade. Lvs. simple and entire, stalked, alternate: fls. red from the appearance of the many stamens in the terminal heads which are flower-like and short-peduncled or sessile and surrounded by an involucre of broad bracts in 3 or 4 series of which the inner ones are large and petal-like; calyx wanting; petals 5, small and narrow; disk small; stamens 10, much exserted, the filaments bearded; ovary 5-lobed, the styles united into 1: fr. 2-valved cocci, resulting from the division of the ovary. —About 4 species. *D. grandiflòra*, Desf., 5–6 ft., with rigid spreading branches, the ovate or broad-oblong very obtuse lvs. tomentose or hoary on both sides. *D. Dampièri*, Desf., distinguished chiefly by the lvs. being green and smooth on the upper surface. B.M. 4059. B.R. 27:64. H.U. 5:42. L. H. B.

DIPLOPÁPPUS: *Aster.*

DIPLOSTÈPHIUM (*double crown* or *pappus*). *Compósitæ*. This genus as now defined comprises upward of a dozen species in Venezuela, Colombia and to Peru, probably not in cult.; the *D. amygdálinum*, Cass., of gardens is *Áster umbellàtus*, Mill., under Gray's treatment, and *Dœllingèria umbellàta*, Nees, of some other authors. Dœllingeria differs from Aster proper in its double pappus, the inner bristles long and capillary and the outer short and rigid; involucre-bracts short and lacking herbaceous tips; heads corymbose or solitary; rays rather few, white or rose-tinged: lvs. veiny, not stiff. (Named for Th. Dœllinger, botanical explorer.)

Aster umbellatus is a stout plant (2–7 ft.) of low grounds from Newfoundland to Ga. and Ark., variable, and lower forms occurring: very leafy, with numerous crowded heads: lvs. lanceolate to oblong-lanceolate (to 6 in. long), tapering to both ends: involucre short; rays white. A good plant for the wild garden.

L. H. B.

DIPLOTHÈMIUM (Greek, *double sheathed*). *Palmàceæ*, tribe *Cocoíneæ*. Spineless pinnate palms, low or stemless, or often with ringed, stout, solitary or fascicled trunks.

Leaves terminal, pinnatisect; segms. crowded, lanceolate or ensiform, acuminate, glaucous or silvery beneath, margins recurved at the base, midnerve prominent; rachis 2-faced, strongly laterally compressed; petiole concave above; sheath fibrous, open: spadices erect, long or short-peduncled, strict, thickish; spathes 2, the lower coriaceous, the upper cymbiform, beaked, ventrally dehiscent; bracts short, coriaceous; fls. rather large, cream-colored or yellow, more showy than almost any other palm: fr. ovoid or obovoid, small.—Species 5. Brazil.

Diplothemium is a group of very handsome palms. In size the members of this genus seem to vary as much as those included in the Cocos group. *D. maritimum*, which is found along the coast of Brazil, is but 10 feet in height when fully developed. This genus is without spines, the leaves being pinnate, very dark green on the upper side and usually covered with white tomentum on the under side, the pinnæ being clustered along the midrib in most instances. In a very young plant of this genus the ultimate character is not at all apparent from the fact that the seedling plants have undivided or simple leaves, this characteristic frequently obtaining in the case of *D. caudescens* until the plant is strong enough to produce leaves 4 or 5 feet long or about one and one-half years from germination. Frequently the plant bears both sorts of leaves while young. A warm greenhouse, rich soil and a plentiful supply of water are among the chief requisites for the successful culture of diplothemiums. *D. caudescens* is the best known of the genus, and when space may be had for its free development it is one of the handsomest palms in cultivation. See G.C. II. 24:394 for horticultural account of the group.

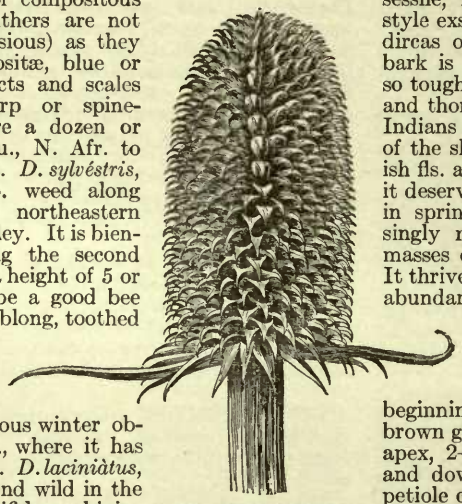
caudéscens, Mart. (*Ceróxylon níveum*, Hort.). Wax-Palm. St. 12–20 ft. high, 10–12 in. thick, remotely ringed, often swollen at the middle: lvs. 9–12 ft., short-petioled; segms. 70–90 on each side, ensiform, densely waxy white below, the middle ones 24–28 in. long, 1¾ in. wide, the upper and lower ones shorter and narrower, all obtuse at the apex. Brazil. R.H. 1876, p. 235.

D. littorâle, Mart. A small graceful palm with finely dissected lvs. and very bright yellow fl.-clusters making it attractive during the spring months. B.M. 4861.—Hardly in cult. in Amer.

Jared G. Smith.
N. Taylor.†

DÍPSACUS (*to thirst*, from the Greek, because the bases of the connate lvs. in some species hold water). *Dipsacàceæ*. TEASEL. Stout tall biennial or perennial herbs of the Old World, two or three of which are weeds; and one of them is cultivated for fuller's teasels.

The plants are prickly or rough-hairy: lvs. opposite, entire, toothed or pinnatifid: fls. small and in dense heads, like those of compositous plants, but the anthers are not united (or syngenesious) as they are in the Compositæ, blue or lilac; involucre-bracts and scales of receptacle sharp or spine-pointed. There are a dozen or more species in Eu., N. Afr. to Abyssinia, and Asia. *D. sylvéstris*, Huds., is an intro. weed along roadsides in the northeastern states and Ohio Valley. It is biennial, the st. arising the second year and reaching a height of 5 or 6 ft. It is said to be a good bee plant. Lvs. lance-oblong, toothed and more or less prickly on the margin. The dead stiff stalks of this teasel are conspicuous winter objects in the E. U. S., where it has run wild extensively. *D. laciniàtus*, Linn., has been found wild in the U. S.: lvs. pinnatifid or bipinnatifid, ciliate. The fuller's teasel, *D. fullònum*, Linn. (Fig. 1276), is probably derived from the first, and differs from it chiefly in the very strong and hooked floral scales. These scales give the head its value for the teasing or raising the nap on woollen cloth, for which no machinery is so efficient. This plant is grown commercially in a limited area in Cent. N. Y.; see Cyclo. Amer. Agric., Vol. II, p. 636.



1276. Fuller's teasel—Dipsacus fullonum. (×½)

L. H. B.

DIPTERÒNIA (Greek *dis*, twice and *pteron* wing: the fruit consists of two winged carpels). *Aceràceæ*. Ornamental deciduous tree with handsome large pinnate foliage.

Leaves opposite, petioled, odd-pinnate, with 9–15 serrate lfts.: fls. polygamous, small, in large terminal panicles; sepals 5, longer than the short and broad petals; staminate fls. with usually 8 stamens and a rudimentary ovary in the center; pistillate fls. with a 2-celled compressed ovary; style cylindric with 2 slender recurved stigmas: fr. consisting of 2 1-seeded compressed nutlets connate only at the base and with the wing extending all around.—Two species in Cent. and S. W. China.

The species in cultivation is a small tree with handsome foliage, insignificant flowers, but conspicuous winged fruits in large panicles. It is apparently not hardy North. It grows well in any good soil. Propagation is by seeds.

sinénsis, Oliver. Tree, to 30 ft.: lvs. ¾–1½ ft. long; lfts. 9–15, short-petioled, the upper nearly sessile, the lowest pair sometimes 3-parted, ovate-lanceolate to lanceolate, long-acuminate, coarsely serrate, glabrous or sparingly hairy, 2–4 in. long: panicles loose, 6–12 in. long; fls. whitish, minute, slender-pedicelled: each carpel (samara) of the fr. broadly obovate or nearly orbicular, light brown, about 1 in. long, with the seed near the middle. June; fr. in Sept. Cent. China. J.H. S. 28:60. H.I. 19:1898.

ALFRED REHDER.

DÍRCA (*Dirke*, mythological name; also a spring near Thebes). *Thymelæàceæ*. LEATHERWOOD. Two North American small early-blooming shrubs, sometimes planted.

Bushes with tough fibrous bark, alternate, thin short entire petiolate deciduous lvs., apetalous perfect fls. in peduncled fascicles of the previous season's growth, the branches developing subsequently from the same nodes: calyx corolla-like, yellowish, campanulate, undulately obscurely 4-toothed, bearing twice as many exserted stamens as its lobes (usually 8); ovary nearly sessile, free, 1-loculed, with a single hanging ovule; style exserted, filiform: fr. berry-like, oval-oblong. The dircas often have the habit of miniature trees. The bark is of interlaced strong fibers, and branches are so tough and flexible that they may be bent into hoops and thongs without breaking, and were so used by the Indians and early settlers. The leatherwood is not one of the showiest of hardy shrubs, but its small yellowish fls. are abundant enough to make it attractive, and it deserves cult. especially for the earliness of its bloom in spring. It is of slow growth, and when planted singly makes a very shapely specimen; planted in masses or under shade it assumes a straggling habit. It thrives in any moist loam. Prop. by seeds, which are abundant and germinate readily; also by layers.

palústris, Linn. LEATHERWOOD. MOOSEWOOD. WICOPY. Fig. 1277. Two to 6 ft. high, with numerous branches having scars which make them appear as if jointed, at the beginning of each annual growth, and with yellow-brown glabrous twigs: lvs. oval or obovate, with obtuse apex, 2–3 in. long, green and smooth above, whitish and downy below, becoming smooth, the base of the petiole covering buds of the next season: fls. yellowish, abundant enough to be attractive, nearly sessile, ¼in. long, falling as the lvs. expand: fr. hidden by the abundant foliage, egg- or top-shaped, ⅓in. long, reddish, or pale green. Woods and thickets, mostly in wet soil Canada to Fla. and Mo. B.R. 292.—Common.

D. occidentàlis, Gray. A similar species found on northerly slopes of cañons in Calif., differs mainly in the deeper calyx-lobes, lower insertion of the stamens, sessile fls., and white involucre; blooms Nov.–Feb. Not in the trade, but worthy of cult.

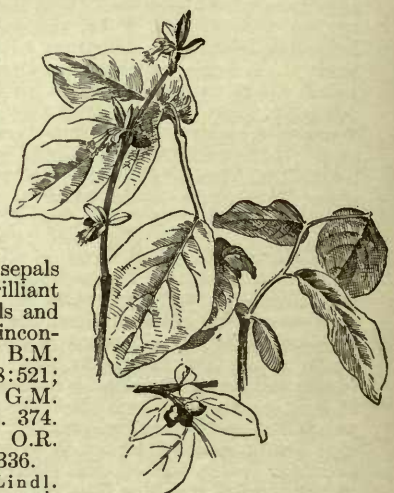
A. PHELPS WYMAN.

DÌSA (origin of name unknown). *Orchidàceæ*. Terrestrial orchids, mostly South African, of which several are known to fanciers, but only one of which is in the American trade.

Sepals free, spreading, upper one galeate, produced in a horn or spur at the base; petals inconspicuous, small, adnate to the base of the column.—Sixty or more species. *D. grandiflora* is undoubtedly one of the most beautiful of known orchids, but as yet difficult to manage under artificial conditions.

grandiflòra, Linn. FLOWER OF THE GODS. Rootstock tuberous: sts. 1 ft. or more high, unbranched: lvs. dark green: fls. several; upper sepal hood-like or galeate, 3 in. long, rose-color, with branching crimson veins; lateral sepals slightly shorter, brilliant carmine-red; petals and labellum orange, inconspicuous. S. Afr. B.M. 4073. G.C. II. 18:521; III. 9:365; 33:37. G.M. 54:608. Gt. 59, p. 374. J.H. III. 52:339. O.R. 6:241; 9:273; 20:336.

D. crassicórnis, Lindl. Spike few-fld.; lateral sepals oblong, the dorsal smaller; reflexed petals, and lip lan-



1277. Leatherwood—Dirca palustris. (×⅓)

ceolate. S. Afr. Gn. 73, p. 187.—*D. Élwesii*, Hort. A garden hybrid, probably between D. kewensis and D. Veitchii.—*D. equéstris*, Reichb. f. Dorsal sepal funnel-shaped, pale blue; petals white. Rhodesia.—*D. erubéscens*, Rendle. Fls. large and handsome, somewhat resembling D. grandiflora in color. Trop. Afr.—*D. kewénsis*, Hort. Hybrid between D. grandiflora and D. tripetaloides. Spike few-fld.; fls. 1½ in. across; lateral sepals rosy pink, the dorsal paler, red-spotted; lip yellowish, crimson-spotted. Gt. 52:1510. O.R. 6:24; 9:273; 20:336.—*D. longicórnu*, Linn. f. Plant ½–1 ft. high, producing a single fl. about 2 in. long resembling a light blue delphinium. S. Afr.—*D. lùgens*, Bolus. Spike 10–15-fld.; fls. dull purple, the lip green, lacerated. S. Afr. B.M. 8415.—*D. Lùna*, Hort. A garden hybrid between D. racemosa and D. Veitchii.—*D. púlchra*, Sond. Spike 6–12 in. long; fls. rose. S. Afr. G. 28: 201.—*D. racemòsa*, Linn. f. Racemes 4–9-fld.; fls. deep rose-red, about 1½ in. across. S. Afr. B.M. 7021. J.H. III. 47:213.—*D. sagittàlis*, Swartz. Fls. in a short raceme, about ⅔in. long, pale lilac, the petals and lip red-streaked. S. Afr. B.M. 7403. G.C. III. 51:312.—*D. Veitchii*, Hort. Hybrid between D. racemosa and D. grandiflora. Fls. about 2½ in. across, rose-lilac. J.H. III. 43:145. C.O. 1. O.R. 6:241; 9:273; 20:336.—*D. venùsta*, Bolus. A slender species with grass-like lvs. S. Afr.

GEORGE V. NASH.†

DISÁNTHUS (Greek, *dis*, twice, and *anthos*, flower; the fls. being in 2-fld. heads). *Hamamelidàceæ*. Ornamental shrub, grown for its handsome foliage, assuming beautiful autumnal tints.

Deciduous, glabrous: lvs. alternate, long-petioled, entire, palmately veined: fls. perfect, axillary, in pairs on erect peduncles and connate back to back; calyx 5-parted; petals 5, spreading; stamens 5, shorter than sepals; ovary superior, with 2 short styles: fr. a dehiscent caps. with several black glossy seeds in each cell.—One species in Japan. Hardy ornamental shrub of elegant habit, with distinct, handsome foliage, turning to a beautiful claret-red or red and orange in fall. Prop. by seeds, germinating the second or third year, and by layers; possibly also by grafting on Hamamelis.



1278. Disanthus cercidifolius. (×⅛)

cercidifòlius, Maxim. Fig. 1278. Shrub, to 10 ft., with slender branches: lvs. roundish-ovate, obtuse or acutish, truncate or cordate at the base, leathery at maturity, dark bluish green above, paler below, 2–4 in. long: fls. dark purple, about ¾in. across, with linear-lanceolate petals. Oct.: fr. ripens the following Oct. High Mountains of Cent. Japan. G.F. 6:215 (adapted in Fig. 1278). R.H. 1910:363. Demands a light peaty soil.

ALFRED REHDER.

DISEASES AND INSECTS. Under one head it is thought best to bring together the discussions of the so-called enemies of plants,—the parasitic fungi and the depredating insects, together with the means of control. This composite article therefore comprises:

	Page
Diseases due to parasitic fungi	1021
Fungicides, or remedies for these diseases	1027
Catalogue of diseases, with advice	1029
Insects and their depredations on plants	1034
Insecticides and fumigation	1042
Catalogue of insect depredators, with advice	1047
Spraying	1057

The reader now has before him a comprehensive survey of the subject. It is impossible, of course, to list all the plant diseases and all the insect pests in a compilation of this kind; but it is desired that the catalogues shall comprise the most important depredators of the leading horticultural plants. The reader should keep himself informed of the new knowledge and new practice by consulting current publications of the government and the experiment stations.

Diseases of plants.

Disease in plants may be defined as any derangement or disorganization of the normal structure or physiological functions of the plant, as for example the formation of galls, cankers or distortions, rotting of plant parts, or disturbances in the sap system resulting in wilting, or in the nutritive processes resulting in such symptoms as dwarfing, chlorosis, and the like. Forms of plant diseases are shown in Figs. 1279–1292.

It is often very difficult to distinguish clearly between diseased conditions and abnormalities of other types. Bud-sports, doubling of blossoms, fasciations and many other similar abnormalities, while often the result of reaction to some pathogen, are not apparently always so and they are often spoken of as teratological phenomena. While the reaction of plants to insect attacks in the formation of galls, cankers, and so on, is to be regarded as symptom of disease, the injuries produced by the mere eating away of parts of leaf, stem or fruit are not usually so to be regarded. Even here, however, it is often difficult to draw a sharp line of demarkation. While disease may usually be said to result in ultimate injury, there are apparently certain marked exceptions, as in the case of the root tubercles of legumes caused by the attacks of certain nitrogen-fixing parasitic bacteria. Here increased growth and crop-yield are generally held to result.

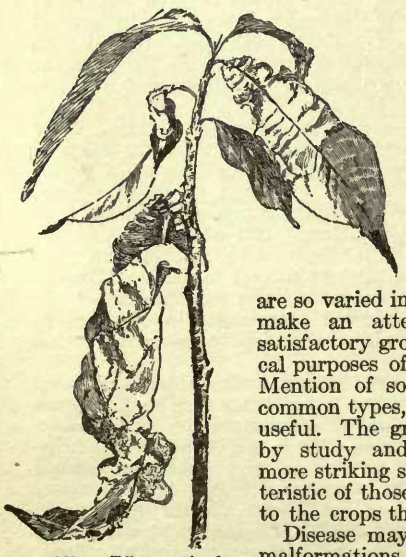
Diseases of plants are not something new or of recent development, as the grower is often inclined to think. The crops of the husbandman, from the earliest recorded history of his art, have been afflicted with diseases. In the historical writings of the Hebrews, the Bible, and in the writings of the Greeks and Romans, frequent mention is made of such diseases as rusts, smuts and mildews of grain and canker of trees. To be sure, the extensive and intensive crop-cultivation of modern times, together with the extraordinary world-wide transportation and exchange of crop-products, have greatly favored the distribution of plant pathogens (insects, fungi and bacteria), and afford them exceptional opportunities for destructive development. Nor are cultivated plants alone subject to disease. Disease epidemics among weeds and the wild flowers of the woods may be observed any season in localities in which weather conditions especially favor the causal organisms.

The study of the nature and control of plant diseases, however, is of recent development. The first man really to study plant diseases from the true modern economic point of view, that is, with the object of helping the grower to understand and combat or control diseases in his crops, was Julius Kühn. This German, the son of a German land-owner and for many years himself the manager of a large agricultural estate, was the founder of an early German agricultural college. He interested himself, among other phases of agriculture, in plant diseases and their control and his

book, "Die Krankheit der Kulturgewächse," published in 1858, is to be regarded as the first book of real economic importance on the subject of diseases in plants. In this remarkable volume is given a concise statement of the thoroughly digested and personally tested knowledge of his time, on the nature and control of plant diseases. He also describes a number of new methods, especially for seed treatment of cereals against smuts, which have become the foundation for many of our present-day practices.

Since Kühn's day there have been remarkable developments in the control of plant diseases. The discovery of bordeaux mixture by the Frenchman Millardet in 1882; the discovery of the formaldehyde treatment of seed for smut by the American plant pathologist, Arthur, in 1896; and the recent development of the use of lime-sulfur solutions and mixtures as a substitute for bordeaux in the spraying of apples and peaches, are but the most noteworthy of the many discoveries and developments in the remarkable growth of this economic science within the last half century.

The economic importance of plant diseases can scarcely be overestimated, as they constitute one of the chief losses in our agricultural resources. The loss from 5 to 25 per cent of many crops from diseases alone each year is so common as to be the general rule. The loss from potato diseases each season in the United States has been carefully estimated at not less than $36,000,000. Yet, it has been conclusively demonstrated by extensive experiments among potato-growers during a continuous period of ten years, that an annual average increase of over forty bushels per acre may be expected from spraying the crop with bordeaux mixture, from three to five times in the season at a total average cost of about $5 per acre. The loss from oat-smut commonly averages from 5 to 25 per cent of the crop, yet it may be absolutely prevented by seed treatment at almost insignificant cost. The loss from scab in the apple crop of New York State often totals not less than $3,000,000 and for the United States a corresponding loss of over $40,000,000. In 1900, the peach-growers of Georgia lost $5,000,000 by brown rot, while the average annual loss from the same disease in the entire United States is never less. Yet in each case here mentioned, as well as in most of the other of our common and destructive diseases, cheap and effective means of control are within the reach of every grower. The value and efficiency of these means have been established beyond doubt. Their profitable application requires only intelligence and practice on the part of the grower.



1279. Effects of the leaf-curl fungus on peach foliage. (×½)

Symptoms of disease in plants are so varied in character as to make an attempt at wholly satisfactory grouping for practical purposes of doubtful value. Mention of some of the more common types, however, may be useful. The grower must learn by study and experience the more striking symptoms characteristic of those diseases peculiar to the crops that he grows.

Disease may be exhibited in malformations of the leaf, stem, root or fruit, as for example, knots, galls, tubercles, curling, wrinkling or other distortions. There are such symptoms in crown-gall of trees, black-knot of plums and cherries and leaf-curl of the peach (Fig. 1279). Another type are cankers, dead sunken or roughened areas in the bark of trees or the outer rind of herbaceous stems, as for example in the New York apple-tree canker, the brown-rot canker of peaches, frost cankers of many trees, and anthracnose of beans, melons, and others. The blight type of lesion is also very common. Here are the more or less sudden death of leaves, stems, shoots or blossoms, usually turning dark and drying up. Such symptoms characterize fire-blight of fruit trees, potato-blight (Fig. 1280, from Vt. Sta.), alternaria blight of ginseng and similar diseases, especially in their last stages. The leaf- or fruit-spot type is also very common. Brown or black spots appear in foliage or fruit. They may be brown dead or rotted areas, or spots due to the growth of the parasite on or under the surface. Bordeaux-injury spots on apple foliage, shot-hole leaf injury of stone fruits, leaf-spot of the currant (Fig. 1281), celery or alfalfa, the tar-spot of the maple, the black-spot of the rose and the apple-scab are of this type. Another not uncommon type is that exhibited in certain bacterial and fungous diseases, where the pathogen infests the sap-tube regions of the stems or petioles, resulting in a sudden wilting of leaves and shoots. The wilt diseases of cotton, cucumber, ginseng, watermelon and cowpeas are characterized by this symptom. The yellowing of the foliage, either suffused or localized as spots, rings, and blotches and often accompanied by dwarfing and wrinkling of the affected organs is a common symptom of certain so-called physiological diseases like the peach yellows (Figs. 1282, 1283), little-peach, mosaic disease of tobacco, infectious chlorosis and nitrogen-poisoning of greenhouse cucumbers (Fig. 1284) and other plants.



1280. Early blight of potato.

The causes of disease in plants.

Etiology, or the cause of disease, has been more generally and carefully investigated than any other phase of the subject, so that we now know much regarding the agents primarily responsible for most plant diseases. These agents may be grouped as follows:

Slime molds, lowly organisms having characters of both plants and animals (see article *Fungi*). The club-root of cabbage, cauliflower and other crucifers, is the best known slime-mold disease.

Bacteria, microscopic unicellular plants which multiply very rapidly by simple fusion (see article *Fungi*). While most species are harmless scavengers of dead organic matter, and a few are known to cause diseases of men and animals, not less than 150 different diseases of plants are now known to be due to the attacks of parasitic bacteria. Some of the commonest bacterial diseases of plants are, fire-blight, crown-gall, olive-knot, soft-rot of vegetables, potato-scab, cucumber-wilt and black-leg of potatoes.

Fungi (see Vol. III) are perhaps responsible for far the greater number of the diseases of plants. They are the causal agents in such well-known diseases as apple-scab, brown-rot of plums and peaches (Fig. 1285), black-rot of grapes, (Fig. 1286) bitter-rot of apples, brown-rot of lemons, late blight of potatoes, peach-

DISEASES AND INSECTS

leaf-curl, heart-rot and canker of trees, mildew of many plants, rusts and smuts of cereals (Figs. 1287, 1288, Kansas Experiment Station); in fact the mere enumeration of the more common fungous diseases of plants would fill many columns in this volume.

Algæ, low forms of green plants, most of them living in water or very damp places. Few are known to produce disease in plants. The red rust of tea is one of the best known algal diseases.



1281. Currant foliage attacked by the leaf-spot fungus. (×½)

Parasitic angiosperms,—flowering plants, of which there is no inconsiderable number, causing more or less injury to the plants upon which they live. These parasites are usually markedly degenerate in one or more respects, as a result of their parasitism, being often without true roots, or without leaves and frequently without chlorophyl green. As examples we may mention the mistletoes, dodders and broom rapes.

Insects (see page 1034) cause such diseases as galls and similar malformations.

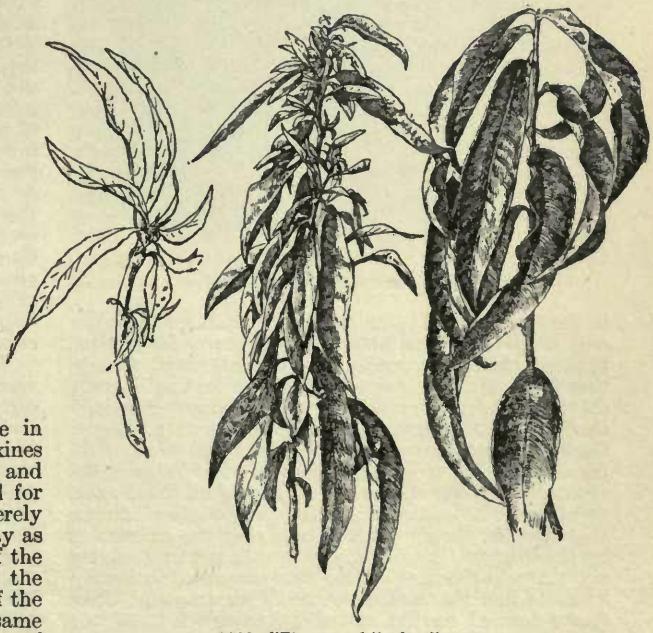
Nematode worms,—minute all but microscopic in size and multiplying rapidly, they constitute one of the greatest crop pests, especially in warm or tropical countries. They usually infest the roots, causing galls or swellings. Some species injure the plants by destroying the fine feeding roots as in the case of the nematode parasites of oats so destructive in certain countries of northern Europe. Over 400 different plants are known to be subject to the nematode root-gall disease. (See pp. 1041–2.)

Physiological disease is a term under which is included all those diseases the cause of which cannot be attributed to some parasitic organism. Their origin is variously attributed to abnormal enzymic activity, disturbed nutrition, and the like. The best-known of these are peach-yellows, chlorosis of the vine, tip-burn (Fig. 1291), mosaic disease of tobacco and leaf-roll disease of potatoes.

The various parasitic organisms cause disease in one of two ways, either by the secretion of toxines and enzymes which at once kill the plant tissues and change them into forms readily available as food for the invader; or the toxins and enzymes secreted merely stimulate or irritate the plant tissues in such a way as to result in abnormal tissue growth or diversion of the food substances of the host to the advantage of the parasite making its home between or in the cells of the host. Both types of disease-production have the same ultimate result, the serious injury or destruction of the infested plant, although the former is usually the more rapid and destructive. Of the first type, rots, blights and leaf-spots are the best examples, and are characterized by the rapid death and destruction of the affected tissues; of the second type, galls, leaf-curls, rusts and smuts are good examples and are characterized by a rather long period of association of the parasite with the living tissues of its host before marked injury or death of the plant results.

The causal agent is usually associated with the tissues of the host, either the dead or living, during its entire cycle of development. The apple-scab pathogen, *Venturia inæqualis*, will serve admirably to illustrate. It passes the summer on the surface of leaf and fruit. In the autumn when the infested leaves fall to the ground, the fungus, which as a parasite has invaded only the cuticle of the leaf or fruit, now penetrates the dead tissues and develops there during the autumn the winter form of fruit bodies, the minute globose black perithecia, in which during the warm days of early spring the ascospores are rapidly developed. These ascospores (Fig. 1292), eight in a sac, ripen and are discharged by the spring rains that come during the blossoming period. The old leaves on the ground are filled with millions of these minute perithecia with many sacs of ascospores in each perithecium. The spores are shot into the air during the rain and being exceedingly light are carried to the opening leaves and forming fruits, where they germinate, sending out mycelial threads into the cuticle of leaf or fruit forming the characteristic dense dark green or black mats or crusts, the scab-spots. The leaves become crumpled and injured, the young fruits grow one-sided, or if the stem be attacked, soon drop from the tree, thus giving no set of fruit. On the scab-spots the conidia or summer spores cut off from the tips of upright branches in great numbers, are carried by the wind to other leaves and fruits where, with the next rain, they germinate and give rise to new scab-spots and more conidia.

The life-cycle as given for the apple-scab fungus is typical of many of the fungous pathogens of our crops. It must be remembered, however, that each pathogen has habits peculiar to itself; hence the necessity for the most careful study of each that we may know its habits and peculiarities and thus be able successfully to



1282. "Tip growth" of yellows.

Left-hand specimen shows two small-leaved tips appearing in October, two or three of the normal leaves still remaining near the top. The middle specimen shows numerous tips appearing in August. Right-hand specimen is a healthy twig, for comparison.

combat it. The following illustrations will serve to explain and impress this point.

Plowrightia morbosa, the fungus causing black-knot of plums and cherries, requires two seasons to complete its life-cycle. The first season there appears on the knots only conidia, followed the second season by a crop of ascospores, produced in perithecia, which form a black crust on the surface where the conidia were earlier produced. Other pathogens like *Exoascus cerasi*, the "witches broom" pathogen of the cherry, lives from year to year as mycelium in the branch and twigs of the broom-like growths it excites, producing each season a crop of spores on the under sides of the leaves. The blister-rust fungus of the white pine, *Cronartium ribicolum*, also lives from season to season



1283. The tufted shoots of peach yellows.

in the tissues of the pine, producing each spring a new crop of spores. This pathogen exhibits another habit peculiar chiefly to certain of the rust fungi, namely that it has another stage or spore form on an entirely different host plant, in this case, the currant, especially the European black currant. The apple-rust pathogen, *Gymnosporangium macropus*, exhibits the same habit, passing the winter in galls formed on the twigs of the red cedar. In the spring spores appear on these galls, which germinating in situ give rise to other minute spore bodies, the sporidia. These sporidia are carried by the wind to the young apple leaves and fruit, giving rise there to the rust disease so destructive to certain varieties like the McIntosh and York Imperial. The spores formed on the rusted leaves and fruit of the apple are carried to the cedar, originating a new crop of galls and thus completing the life-cycle.

While some pathogens may develop in both living and dead tissues of their host, as we have seen in the case of the apple-scab fungus, other pathogens like the rust organism just described or the potato-blight pathogen, *Phytophthora infestans*, require to be constantly associated with the living tissues of their host The last-mentioned fungus passes the winter as mycelium in the tissues of diseased tubers, grows from thence up through the new shoots, slowly killing them and forming thereon the first crop of conidia, which, carried by the wind to nearby healthy plants, produce the primary infections of the season. The successive crops of conidia produced during the season on the blighted tops are washed into the soil by the rains, find their way to the newly formed tubers, and, infecting them, complete the seasonal cycle of the parasite.

Many fungous pathogens are now known to pass from one generation of the host plant to the next through the seed. The smut parasites of cereals afford remarkable examples of this habit. In the case of the oat-smut fungus, *Ustilago avenæ*, the spores ripen as dusty black masses in the panicles of affected plants just as the healthy plants are in blossom. At this time the two hulls inclosing the grain are open. The wind-scattered spores lodge in the open flowers against the young kernel where they are soon safely housed by the closing hulls. They lie dormant along with the ripened seeds until they are planted. Then as the oat kernels germinate, the smut spores do likewise, sending forth their germ tubes which penetrate the young oat sprouts before they emerge from the hull. The mycelium grows along up through the growing oat straw, finally giving rise to the black spore masses in the unfolding panicle. In the case of stinking smut of wheat the seasonal life-cycle of the pathogen, *Tilletia tritici*, is much the same, except that the spores are disseminated at threshing time. Some very important differences in the habits of the loose smut pathogens of wheat, *Ustilago tritici* and of barley, *Ustilago nuda*, have recently been discovered (1902). The spores of these pathogens are also ripened and disseminated at blossoming time, but on falling within the open blossom they germinate at once, sending their germ-tubes into the tender young kernels. The affected kernels are apparently not injured but continue to develop and ripen. The mycelium of the pathogen within remains dormant until the seeds are planted and begin to grow, at which time the mycelium also becomes active. It grows out into the young shoots and up through the lengthening culms eventually to give rise to the black spore masses of the smutted heads. The bean anthracnose fungus, *Colletotrichum lindemuthianum*, is also carried over in the seed. Here the fungus in the black spots or cankers on the pods penetrates into the tender cotyledons of the seed within, goes into a dormant condition as the seed ripens, to become active again when the germinating seed lifts these cotyledons from the soil. A new crop of spores is produced, which, if the season be rainy, are splattered on to the stems and leaves of nearby healthy plants and the pathogen becomes established for another season.

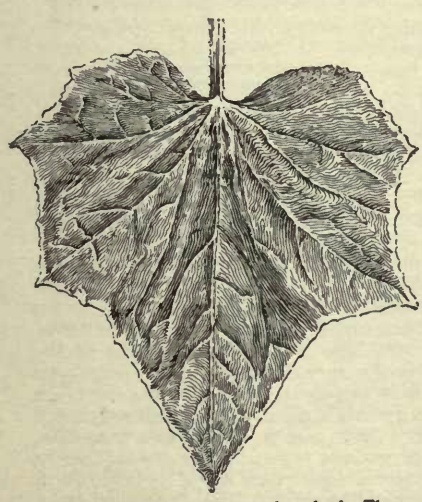
While the wind is the most common disseminating agent of fungus spores, often carrying them for great distances, such agents as rain, flowing water, insects and even man himself, are frequently responsible. It is in the dissemination of bacterial pathogens, however, that insects most generally function. The dreaded fire-blight bacteria are disseminated only by insects or man. They pass the winter in a semi-active state in the half-living tissues along the margins of cankers on limbs or twigs, multiply rapidly with the rise of sap and the heat of spring. They ooze from the affected bark in sticky, milky drops. This ooze is visited by bees and flies, which with besmeared legs and mouthparts fly away to visit the opening apple or pear blossoms. Here they leave some of the bacteria in the nectar where they rapidly multiply, to be more widely distributed by each succeeding visitor. They soon pene-

trate into the tender tissues of the blossom, causing the blossom blight. From these blighted blossoms, sucking insects like the aphids carry the bacteria to the tips of the rapidly growing shoots when in sucking sap they introduce the organisms and twig blight follows. The striped cucumber beetle is probably the chief disseminator of *Bacillus tracheiphilus*, which causes the cucumber-wilt.

Ecological conditions as affecting disease.

By ecology is meant the influence of such environmental factors as climate, weather, soil and fertilizers, on the disease, its severity, epidemic occurrence, and the like. These factors may influence the severity of the disease by their effect on either the pathogen or the host, or both. For example, most fungous parasites require the presence of water on the host plant in which their spores may germinate, hence severe epidemics of such diseases as potato-blight, apple-scab, brown-rot of stone fruits and black-rot of grapes usually appear in wet seasons. Moreover, the attacking pathogen is especially favored by wet weather at certain seasons or periods in its development, especially the infection period. Continued spring rains about blossoming time favor apple-scab and peach leaf-curl. Late summer rains bring with them epidemics of late blight of potatoes, brown-rot of peaches or late infections of apple-scab. Frequent or continuous rains during June and July in grape regions are usually accompanied by severe attacks of the black-rot pathogen. The relation of rainfall to the pathogen explains why, when there has been a severe epidemic the previous season, the crop may escape if the following season be dry. There is ever a critical period in the development of the pathogen, usually when it is passing from its resting or winter stage to the active vegetative period of the growing season. Moisture and temperature conditions at such periods largely determine whether the disease will be epidemic or not. Of course the necessary abundance of spores to be disseminated is an evident necessity. Favorable weather alone cannot bring on disease as the grower too often believes.

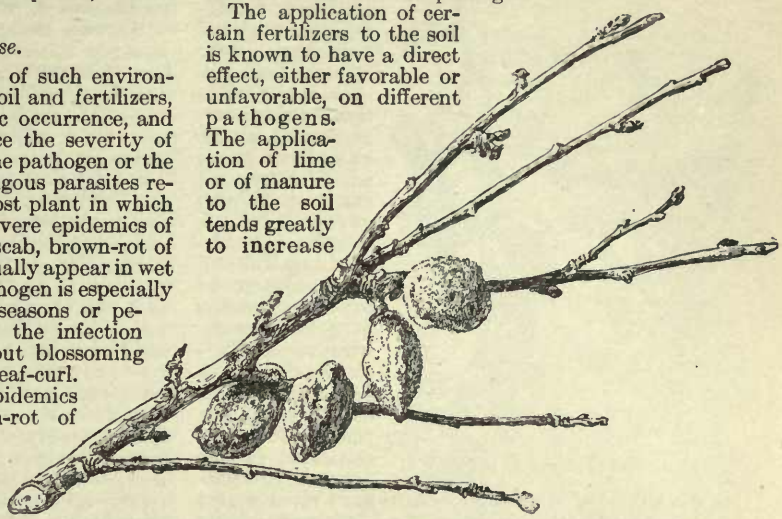
The absence of rains at certain stages in their development is for other pathogens equally essential. The loose smuts of cereals afford good examples. Their spores are powdery and wind-borne and if rains fall when they are being disseminated, they are washed to the ground and perish instead of finding their way into the open blossoms of their host. Thus, clear sunny weather during the blossoming period of wheat and oats one season usually means a more or less severe epidemic of smuts the next, while rains at this time, even though there be an abundance of the disease, may mean a clean crop the following year.



1284. Disease of cucumber leaf. The dying margin indicates that the trouble is due to some interference with the food supply. (×½)

On the other hand, weather conditions may determine the severity or absence of certain diseases by its effect on the host. Long-continued cold rainy weather in the spring, especially following a warm spell, results in a slow succulent growth of the developing peach leaves, rendering them especially susceptible to the attacks of the leaf-curl pathogen.

The application of certain fertilizers to the soil is known to have a direct effect, either favorable or unfavorable, on different pathogens. The application of lime or of manure to the soil tends greatly to increase the scab of potatoes planted thereon; while, on the other hand, liming the soil prevents infection of cabbage and cauliflower by the club-root pathogen. Lime likewise favors the development of the root-rot of tobacco and ginseng caused by *Thielavia basicola*, while applications of acid phosphate tend to prevent infection by this pathogen. The effect of fertilizers on the susceptibility of the host has also been shown to be marked in certain cases. Barley, when fertilized with nitrogenous manures, becomes very susceptible to attacks of the mildew *Erysiphe graminis*. Certain varieties of wheat have been observed in Denmark to suffer severely from attacks of the rust *Puccinia glumarum* only when nitrogenous manures are applied. Excessive applications of barnyard manure to greenhouse cucumbers often cause a physiological disease, the symptoms of which are a curling, and dying of the margins of the leaves, accompanied by marked chlorosis or yellowing. Fertilizers or late continued cultivation of pear trees, by lengthening the period of active twig-growth, favor fire-blight, the bacteria of which infect only tender actively growing tissues.



1285. Peaches of last year's crop still hanging on the tree, attacked by monilia. The branch is dead from the effects of the fungus. (×½)

Control of diseases.

By the term control is meant the profitable reduction of the losses ordinarily sustained from a given disease. The absolute prevention of many plant diseases is either impossible or unprofitable.

There are four fundamental principles upon which all methods of plant-disease control are based, viz.: (1) *exclusion*, (2) *eradication*, (3) *protection* and (4) *immunization*. Upon the first two are based those measures which are directed primarily against the pathogen, upon the last two those which are directed merely toward the protection of the host from pathogens commonly present in the environment. The order in which these principles are here presented represent the logical, though unfortunately not the historical or usual order of their development and application. We will consider briefly under each some of the more important methods now employed for the control of plant diseases.

1. *Exclusion* measures are directed toward keeping disease organisms, usually insects, fungi and bacteria, out of areas, regions or countries in which they do not occur. This is commonly attempted by the passing of laws forbidding the importation of plants affected with such parasites. As means of enforcing such regulations, some sort of inspection, either at port of entry or at point of destination, is provided. Inspection in the country from which they are exported is also often required. Absolute quarantine against all importation of certain plants from those countries in which dangerous diseases are known to occur is also being practised in some countries, as, for example, prohibiting the importation of potatoes into the United States from those countries in which the black-scab is now known to occur. Exclusion measures, often undertaken when it is too late, are at best under present conditions of doubtful efficiency. Those interested in these methods of control should consult the various pest and disease acts of the different countries of the world. See *Inspection*, in Vol. III.



1286. Grapes ruined by black-rot.

2. *Eradication.*—On the principle of eradication are based those measures which are directed to the elimination of pathogens already established. While absolute eradication is seldom to be effected, the pathogen may often be eliminated to such an extent as to reduce losses therefrom to a profitable minimum. In Denmark, the destruction of all barberry bushes, the alternate host of the grain-rust fungus, *Puccinia graminis*, has decidedly reduced the severity of this disease in recent years. The careful eradication of all diseased plants is often quite effective even in a small area, like a raspberry or blackberry plantation suffering from the red rust. Here the mycelium of the pathogen lives from year to year in the roots of diseased plants, which each spring send up diseased shoots. On the under side of the leaves of these shoots, the orange-red spores are produced in great abundance, and serve to spread the pathogen to healthy plants. As diseased plants are readily detected in early spring by the pale clustered shoots, they may be removed before spores appear and the pathogen thus eradicated. The black-knot of plums and cherries is most readily and profitably controlled in a similar manner, the knot-affected limbs and twigs being cut out and burned early in the spring before spores appear. The fire-blight of pears is to be controlled only by systematic eradication, first of all cankers in autumn or early spring, then of all blossom blight as fast as it appears and later of the affected twigs when twig-blight comes on. To be effective, the trees must be inspected two or three times each week throughout the growing season and all diseased parts removed *at once* as soon as discovered.



1287. Smut of oats.

Another method of eradication especially applicable to seeds, tubers or bulbs, on which spores of the pathogen pass the dormant period, is disinfection. This is accomplished by the application of chemical poisons, either in solution, as powder or as gas, at a strength and for a period of time sufficient to destroy the pathogen without injury to the host. When the pathogen lives over as mycelium in the seed or tuber, the application of heat is sometimes effective. Formaldehyde, as a gas or in solution in water, is now generally employed for the eradication of the smut of oats, the stinking smut of wheat and the potato-scab. (For details of method, see *Formaldehyde*, p. 1028). The spraying of peach trees with copper-sulfate solution, lime-sulfur solution or bordeaux, just before the buds start in the spring, disinfects the trees by destroying the spores of the leaf-curl fungus which pass the winter on the buds.



1288. Loose smut of barley.

Pathogens which attack the underground parts of plants may sometimes be eradicated by disinfection of the soil before planting. Drenching the soil with a formaldehyde solution of a strength sufficient to distribute one gallon of the strong 40 per cent solution to each 100 square feet of surface, wetting the soil to a depth of 6 to 8 inches, has been found to be very effective against damping-off, root-rot and similar diseases in forest tree seed-beds, ginseng seed-beds and in the benches in greenhouses. It is also often effective in the eradication of nematodes in greenhouses. Steaming of the soil is also very effective, destroying insects and weed seeds as well as pathogenic fungi. It is not always conveniently applied.

3. *Protection* measures are to be employed in those regions in which the pathogen is very generally and very thoroughly established, or in which for one reason or another eradication is impossible or unprofitable. They aim to protect the crop against attacks of the parasite by means of some external barrier. Spraying is the most commonly employed protective measure. In spraying, the susceptible surfaces of the plant are coated with some slowly soluble poison, known as a fungicide. Fungicides are of various types. They are applied in suspension in water, in solution or dry, *i.e.*, in the form of a fine impalpable powder. The fungicide most generally applied in liquid spraying is bordeaux, a colloidal compound formed by the union of lime-milk and copper-sulfate solution. Minute blue gelatinous

membranes are formed which remain for a time suspended in the liquid. When sprayed upon the plants the water soon evaporates, leaving a coating of these dried membranes. The active fungicidal principal in these bordeaux membranes is the copper. When leaves or fruit are rewetted by rains enough of the copper in these membranes comes into solution to prevent the germination of the spores of the parasite that may have been deposited thereon. (See under *Bordeaux*, p. 1028.)

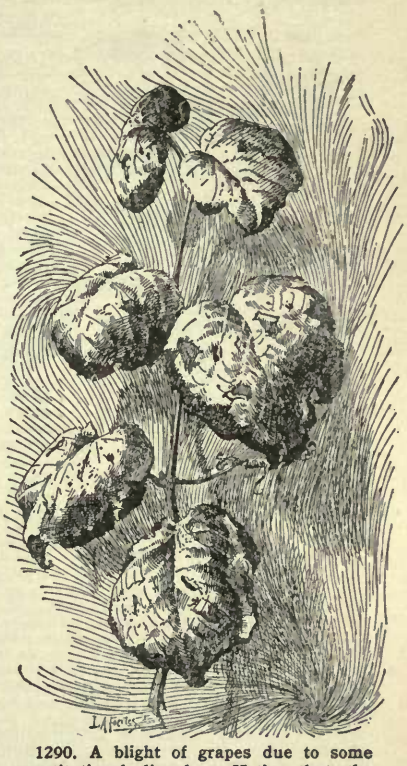
Bordeaux, however, is sometimes injurious to such plants as peaches, plums and apples, and has, within the last few years, been largely replaced as a summer spray, especially for apples. Lime-sulfur, unlike bordeaux, is a solution. It is made by boiling together in water, lime and sulfur. A concentrated solution of certain poly-sulfides of calcium, chiefly penta- and tetra-sulfide, is thus obtained which, when properly diluted is applied in the same way as the bordeaux. (For method of preparation, see *Lime-sulfur*, p. 1028). When this solution dries on the leaves and fruit, it is rapidly converted by the action of the atmosphere into other calcium compounds and free sulfur. The sulfur is in a very finely divided state and is the active principal of lime-sulfur. It becomes oxidized in the presence of moisture probably as sulfuric or sulfurous acid, which prevents the germination of the spores of the pathogen. Flowers of sulfur and sulfur-flour, when very finely ground and applied dry by dusting or sprayed on in suspension in water, alone or with lime-milk (the so-called self-boiled lime-sulfur) are also quite effective against certain diseases. Dusting with sulfur is employed in combating powdery mildews of grapes, hops, roses and the rust of asparagus.

Lime-sulfur may not be used on potatoes and grapes, as it dwarfs the plants and reduces the yield, while bordeaux has just the opposite effect on these crops. Bordeaux, as already pointed out, is, however, injurious to leaves and fruit of the apple and to the foliage of peaches and certain varieties of plums. It will thus be seen that there is no universal fungicide and also that both the effect on the host and on the parasite must be considered. It is now known for example that while lime-sulfur is very effective against the apple-scab fungus, it has little fungicidal effect on the spores of the bitter-rot pathogen.

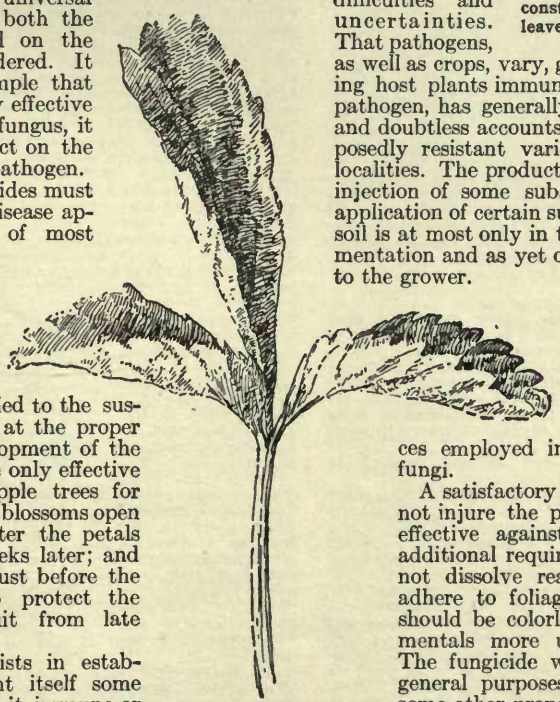
To be effective, fungicides must be applied before the disease appears. As the spores of most parasitic fungi germinate during the period of rainy cloudy weather, the fungicide, to be effective, must be applied *before* and not after such periods. They must not only be thoroughly applied to the susceptible parts but also at the proper stage of growth or development of the plant. To illustrate: the only effective periods for spraying apple trees for scab are: just before the blossoms open (not dormant); just after the petals fall; ten days or two weeks later; and again in late summer just before the late summer rains, to protect the rapidly developing fruit from late infection.

4. *Immunization* consists in establishing within the plant itself some condition which renders it immune or resistant to the attacks of the pathogens. Immune crops may be developed by selection and propagation of individuals naturally immune, whose immunity has been evidenced by their coming through an epidemic unscathed. Immune varieties may be crossed with susceptible ones having other especially desirable qualities and then by segregation and propagation strains of the crop may be developed combining the resistance or immunity of the one parent with the desirable qualities of the other. Some striking results have been obtained in this line of disease control as witness the wilt-resistant cotton, cowpeas and watermelon, the nematode-free Iron cowpea, rust-resistant wheat, barley, and asparagus, and the anthracnose-resistant clover. Nevertheless, this method of control, while the most ideal, is beset with many difficulties and uncertainties. That pathogens, as well as crops, vary, giving strains capable of attacking host plants immune to other strains of the same pathogen, has generally been overlooked by breeders, and doubtless accounts for the frequent failure of supposedly resistant varieties when transferred to new localities. The production of artificial immunity by the injection of some substance into the plant or by the application of certain substances (fertilizers, etc.) to the soil is at most only in the preliminary stages of experimentation and as yet offers but little of practical value to the grower.

H. H. WHETZEL.



1290. A blight of grapes due to some constitutional disorder. Notice that the leaves die first at the edges. (×⅓)



1289. Strawberry leaf rolled up from the attack of the mildew.

Fungicides.

A fungicide is any material or substance that kills fungi or their spores. The word is used particularly for those substances employed in the warfare against parasitic fungi.

A satisfactory fungicide must be one that does not injure the plants and at the same time is effective against the parasite. For spraying, additional requirements are imposed: it should not dissolve readily in rain-water; it should adhere to foliage and fruit; in some cases it should be colorless in order not to make ornamentals more unsightly than when diseased. The fungicide which has been used most for general purposes is bordeaux mixture. Lately some other preparations, particularly lime-sulfur combinations, have come into use, and in many cases are supplanting bordeaux. There are in

DISEASES AND INSECTS

addition a large number of other substances which have fungicidal value and are in more limited use for specific cases. The following directions are taken, with modifications, from the author's part in Bailey's "Farm and Garden Rule-Book."



1291. Tip-burn of potato leaf.—A physiological difficulty or disease, due to some so-called "constitutional" disorder or obstruction (Vermont Experiment Station).

Practices.

Destroying affected parts.—It is important that all affected parts should be removed and burned, if possible. In the fall all leaves and fruit that have been attacked by fungi should be raked up and burned. Diseased branches should be severed at some distance below the lowest visible point of attack. Fungous diseases often spread rapidly, and prompt action is usually necessary. Practise clean and tidy culture.

Rotation of crops.—This is one of the most effective and practical means of heading off fungous diseases. It is especially applicable to diseases of roots or root-crops, but also to many other diseases of annual plants.

Sterilizing by steam.—This is an effective fungicidal practice for several soil-inhabiting organisms which attack roots and stems. This includes nematode worms. It is especially applicable in the greenhouse, where it may be applied (*a*) through sub-irrigation tile or through specially laid perforated steam pipes in the bottom of the bed. Cover the beds with blankets, introduce steam under pressure of forty to eighty pounds for two hours. Insert thermometers at various places to see that the soil is being uniformly heated. (*b*) A large galvanized iron tight box may be constructed with finely perforated trays 4 to 6 inches in depth. Soil placed in these trays and steamed for two hours as above will be freed from parasitic organisms. In this case the frames should be sprayed with a solution of formaldehyde, one pint in twelve gallons of water. Steam sterilization of soil may be used on intensively cultivated areas or extensive seed-beds. A portable boiler is necessary. The beds are sterilized after they have been prepared for seed, and just before the seed is sown. A galvanized pan of convenient dimensions and 6 to 8 inches deep is inverted, and the edges are pushed down into the soil 1 or 2 inches. The pan is connected with the steam boiler by means of a steam hose and live steam is run into the pan from twenty to forty minutes under a pressure of eighty pounds and up. The higher the pressure the deeper the soil will be sterilized. The pan must be weighted. Paths should be disinfected by spraying with copper sulfate one pound to fifty gallons of water or with formaldehyde solution one pint to twelve gallons of water. The cost of sterilizing is approximately three-fourths of a cent the square foot. It should be noted that soil-sterilization has an invigorating effect on many plants, and it will be necessary to run greenhouses at a lower temperature (5° to 10°) both night and day. Field-sterilization also kills weed seeds, and with the reduction of the cost of weeding makes the process practicable.

Substances.

Bordeaux mixture.—A bluish green copper compound that settles out when freshly slaked lime and a solution of copper sulfate (blue-stone) are mixed. Many formulas have been recommended and used. The 5–5–50 formula may be regarded as standard. In such a formula the first figure refers to the number of pounds of copper sulfate, the second to the stone or hydrated lime, and the third to the number of gallons of water. Bordeaux must often be used as weak as 2–2–50, on account of injury to some plants.

To make fifty gallons of bordeaux mixture, proceed as follows:

(1) Pulverize five pounds of copper sulfate (blue vitriol), place in a glass, wooden, or brass vessel, and add two or three gallons of hot water. In another vessel slake five pounds of quicklime in a small amount of water. When the copper sulfate is all dissolved, pour into a barrel and add water to make forty or forty-five gallons. Now strain the lime into this, using a sieve fifty meshes to the inch or a piece of cheese-cloth supported by ordinary screening. Stir thoroughly, and add water to the fifty-gallon mark. The flocculent substance which settles is the effective fungicide. Always stir vigorously before filling the sprayer. Never add the strong lime to strong vitriol. Always add a large amount of water to one or the other first. Blue vitriol used alone would not only wash off quickly in a rain, but cause a severe burning of fruit and foliage. Lime is added to neutralize this burning effect of the copper. If the lime were absolutely pure, only slightly more than one pound would be required to neutralize this burning effect. For many purposes an excess of lime is not objectionable and may be desirable. For nearly ripe fruit and ornamentals an excess of lime augments spotting. In such cases the least amount of lime possible should be used. Determine this by applying the cyanide test (2).

(2) Secure from the druggist 10 cents' worth of potassium ferrocyanide (yellow prussiate of potash) and dissolve it in water in an eight-ounce bottle. Cut a V-shaped slit in one side of the cork, so that a few drops of the liquid can be obtained. Now proceed as before. Add lime with constant stirring until a drop of the ferrocyanide ceases to give a reddish-brown color.

(3) When bordeaux mixture is desired in large quantities, stock solutions should be made. Place one hundred pounds of copper sulfate in a bag of coffee-sacking, and suspend in the top of a fifty-gallon barrel, and add water to the fifty-gallon mark. In twelve to fifteen hours the vitriol will be dissolved and each gallon of solution will contain two pounds of copper sulfate. Slake a barrel of lime, and store in a tight barrel, keeping it covered with water. Lime so treated will keep all summer. It is really hydrated lime. This is often dried, pulverized, and offered on the market in paper bags of forty pounds each, under such names as ground lime, prepared lime, hydrated lime, and the like. If the paper is not broken, the lime does not air-slake for a long time. One and one-third pounds of hydrated lime equals in value one pound of quicklime. Air-slaked lime cannot be used in preparing bordeaux mixture.

Arsenical poisons can be combined with bordeaux mixture.

Ammoniacal copper carbonate.—For use on nearly mature fruit and on ornamentals. Does not discolor. Weigh out three ounces of copper carbonate, and make a thick paste with water in a wooden pail. Measure five pints of strong ammonia (26° Baumé) and dilute with three or four parts of water. Add ammonia to the paste, and stir. This makes a deep blue solution. Add water to make fifty gallons.

Copper carbonate.—For use in the above formula, it may be secured as a green powder, or may be prepared as follows: Dissolve twelve pounds of copper sulfate in twelve gallons of water in a barrel. Dissolve fifteen pounds of sal-soda in fifteen gallons of water (preferably hot). Allow the solution to cool; then add the sal-soda solution to the copper-sulfate solution, pouring slowly in order to prevent the mixture from working up and running over. A fine precipitate is formed which will settle to the bottom if allowed to stand over night. Siphon off the clear liquid. Wash the precipitate by adding clear water, stirring, and allowing to settle. Siphon off the clear water, strain the precipitate through muslin, and allow it to dry. This is copper carbonate. The above amounts will make about six pounds.

Copper sulfate.—See *Sulfate of copper*.

Corrosive sublimate (mercuric chloride).—Used for disinfecting pruned stubs and cleaned-out cankers, at the rate of one part in 1,000 parts of water. Can be secured from the druggist in tablet form in vials of twenty-five each, and costing 25 cents. One tablet makes a pint of solution. Make and store solution in glass and label "poison."

Formaldehyde (40 per cent solution of formaldehyde gas in water).—A pungent, clear liquid, very irritating to eyes and nose. Obtained at any drugstore at about 40 cents a pint. Used for potato-scab, oat smut, bunt in wheat, soil disinfection, and so on.

Lime.—Offered for sale in the following forms: (*a*) Ground rock or ground limestone; air-slaked lime is of the same composition, *i.e.* a carbonate of calcium. (*b*) Lump, barrel, stone, or quicklime; this is burned limestone, and should test at least 90 per cent oxid of calcium. (*c*) Prepared, ground, or hydrated lime; this is water- or steam-slaked quicklime, dried and pulverized. Used as an applicant to the soil to correct acidity, for club-root of cabbage, and for preparing spray mixtures.

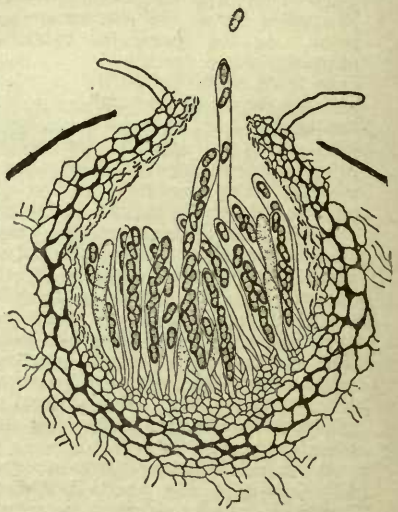
Lime-sulfur.—In the many possible combinations, lime-sulfur is coming to be equally as important as bordeaux mixture, in the control of many plant diseases.

(1) Flowers of sulfur or very finely powdered sulfur is often dusted on plants for surface mildews.

(2) A paste of equal parts of lime, sulfur, and water. This is painted on the heating-pipes in the greenhouse, and is valuable for keeping off surface mildews.

(3) Home-boiled dilute lime-sulfur. This solution has been widely used in the past as a dormant spray, particularly for San José scale and peach leaf-curl. It is likely to be supplanted by (4) or (5). For preparation see page 1043.

(4) Home-boiled concentrated lime-sulfur.—When a great deal of spraying is to be done, a concentrated lime-sulfur



1292. Perithecium of apple scab, showing spores.

solution may be boiled at home and stored in barrels to be used as needed. For method of preparation see page 1043.

Test with a Baumé hydrometer, which has a scale reading from 25° to 35°. Dilutions are reckoned from a standard solution testing 32°. If the solution tests only 28°, it is not so strong as standard, and cannot be diluted so much as a solution testing 32°. The table shows the proper dilution for solutions testing 25° to 35° Baumé:

	1-10	1-15	1-20	1-25	1-30	1-40	1-50	1-60	1-75	1-100
25°	7.4	11	14.7	18.4	22.1	29.5	36.8	44.2	55	73
26°	7.7	11.6	15.4	19.3	23.2	30.9	38.6	46.3	58	77.2
27°	8.1	12.1	16.1	20.2	24.3	32.4	40.5	48.5	60.6	80.7
28°	8.4	12.7	16.9	21.1	25.4	33.8	42.3	50.7	63.5	84.5
29°	8.8	13.2	17.6	22.1	26.5	35.3	44.2	53	66.3	88.2
30°	9.2	13.9	18.4	23	27.6	36.9	46.1	55.3	69	92
31°	9.6	14.4	19.3	24	28.8	38.4	48	58	72	96
32°	10	15	20	25	30	40	50	60	75	100
33°	10.4	15.6	20.8	26	31.2	41.5	52	62.4	78	104
34°	10.8	16.2	21.6	26.8	32.4	43.2	54	64.7	80.8	108
35°	11.2	16.8	22.4	28	33.4	44.9	56	67.4	84.2	112

Decimals are given in all cases, but for practical purposes the nearest even gallon or half gallon can be used, unless appliances for more accurate measurement are at hand. It is understood in making all dilutions that water is added to one gallon of the concentrate to make the stated amount. Do not measure out the stated amount of water and add the concentrated solution to it.

(5) Commercial concentrated lime-sulfur.—As manufactured and placed on the market is a clear amber liquid, and should test 32° to 35° Baumé. It costs about 20 cents a gallon retail, and comes ready to pour into the spray tank. For apple and pear diseases. Arsenate of lead can be used with this solution, and increases its fungicidal value.

(6) Scott's self-boiled lime-sulfur.—This is a mechanical mixture of the two substances, and is really not boiled, the heat being supplied by the slaking lime. In a small barrel or keg place eight pounds of good quicklime. Add water from time to time in just sufficient amounts to prevent burning. As soon as the lime begins to slake well, add slowly (preferably through a sieve) eight pounds of sulfur flour. Stir constantly, and add water as needed. As soon as all bubbling has ceased, check further action by adding a quantity of cold water, or pour into a barrel or tank and make up to fifty gallons. Keep well agitated. Very effective against peach scab and brown rot. Several other formulas have been used: 10–10–50 and 5–5–50. Arsenate of lead can be used with this mixture.

By using boiling water and allowing the hot mixture to stand for half an hour, a stronger spray mixture than the above can be secured. It cannot be used safely on peaches, but has been used successfully on grapes for surface mildew. The addition of sulfate of iron or sulfate of copper, one or two pounds to fifty gallons, has been used for apple rust.

Potassium sulfid (liver of sulfur).—Simple solution, three ounces in ten gallons of water. For mildew in greenhouses, on rose bushes and other ornamentals.

Resin-sal-soda sticker.—Resin, two pounds; sal-soda (crystals), one pound; water, one gallon. Boil until of a clear brown color, *i.e.* from one to one and a half hours. Cook in an iron kettle in the open. Add this amount to fifty gallons of bordeaux. Useful for onions, cabbage, and other plants to which spray does not adhere well.

Sulfate of copper (blue vitriol).—Dissolve one pound of pure sulfate of copper in twenty-five gallons of water. A specific for peach leaf-curl. Apply once before buds swell in the spring. Cover every bud. For use in preparing bordeaux mixture. Costs from 5 to 7 cents a pound, in quantity.

Sulfate of iron (copperas).—A greenish granular crystalline substance. Dissolve one hundred pounds in fifty gallons of water. For mustard in oats, wheat and the like, apply at the rate of fifty gallons an acre. Also for anthracnose of grapes as a dormant spray.

Sulfur (ground brimstone, sulfur flour, flowers of sulfur).—Should be 99 per cent pure. Valuable for surface mildews. Dust on dry or in the greenhouse used in fumes. Evaporate it over a steady heat, as an oil-stove, until the house is filled with vapor. Do not heat to the burning point, as burning sulfur destroys most plants. To prevent burning, place the sulfur and pan in a larger pan of sand and set the whole upon the oil-stove.

DONALD REDDICK.

Catalogue of diseases.

Abies. WITCHES' BROOM (*Æcidium elatinum. Melampsorella elatina*).—On fir causing swellings, cankers, and witches' brooms.
Control.—Prune off all affected parts.

Abutilon. RUST.—See under *Hollyhock.*
CONTAGIOUS CHLOROSIS.—Variegated leaves.
Control.—Remove variegated leaves and their shoots, keep in dark and remove any further variegated leaves; then the plant should remain green.

Acacia. RUSTS (*Æcidium sp.*).—Distorts branches and twigs.
Control.—Prune off diseased parts.

CATALOGUE OF DISEASES, continued.

Acer. TAR-SPOT (*Rhytisma acerinum*).—Black tar-like spots on upper side of the leaves.
Control.—Burn all old leaves in fall or winter.
SUN SCALD or SCORCH.—Maples suffer commonly from a drying up of the foliage, due to over-transpiration of water at times when hot winds occur.

Actinidia. MILDEW (*Uncinula necator*).—See under *Ampelopsis.*

Æsculus. LEAF-SPOT (*Phyllosticta paviæ*).—Irregular spots develop rapidly, the larger part of the leaf being involved. Leaves fall prematurely.
Control.—Spray with bordeaux mixture, beginning when the leaves are about half-grown and repeating the process every three weeks.

Agave. LEAF-BLOTCH (*Coniothyrium concentricum*).—Grayish, more or less circular dead patches, ranging from ½ to 1 inch in diameter.
Control.—Remove and burn diseased leaves.

Allium.—See under *Onion.*

Almond. BLIGHT. (*Coryneum beyerinkii*).—See *Peach Blight.*
YELLOWS.—See under *Peach.*

Alnus. ROOT-TUBERCLES.—Clumps of small tubercles on the roots. Not important.
WITCHES' BROOMS and BLADDERY DEFORMATIONS OF FLOWERS (*Exoascus sp.*).—Broom-like tufts of branches and irregular deforming and contortion of fruits.
Control.—See under *Peach Leaf-Curl.*

Alyssum. MILDEW (*Erysiphe polygoni*).—See under *Verbena.* Disease very similar.

Amarantus. WHITE "RUST" or MILDEW (*Albugo bliti*).—See similar disease under *Radish.*

Amelanchier. RUST (*Gymnosporangium sp.*).—Orange rust spots on leaves.
Control.—Keep junipers at a considerable distance.
WITCHES' BROOM (*Dimerosporium collinsii*).—Thick twisted broom-like growth of branches.
Control.—Cut out the brooms.

Ampelopsis. BLACK-ROT.—See under *Grape.*
MILDEW (*Uncinula necator*).—Powdery mildew growths on upper side of leaf.
Control.—Dust with sulfur.

Anemone. ROOT-DECAY (*Sclerotinia tuberosa*).—Rhizomes decayed and large lumps form on the outside.
Control.—Eradicate affected rhizomes and the cup-like fungous bodies near such plants.
RUST.—Several rusts attack species of Anemone.

Anthurium. BLIGHT (*Glomerella cincta*).—See under *Orchids.*

Apple. BLIGHT.—The same disease as *Pear Blight,* which see.
CANKER.—Smooth cankers in bark of trunk or limbs usually indicate blight (*Bacillus amylivorus*); rough ones, New York apple-tree canker (*Sphæropsis malorum*), or the nail-head canker (*Numularia discreta*).
Control.—As soon as noticed, cut away dead bark and wood to the living tissue and paint over with lead paint or coal-tar.
SCAB (*Venturia inæqualis*).—Olive-green, brownish or blackish scab-like spots on leaves and fruit.
Control.—Rake and burn or plow under old leaves very early in spring. Spray with lime-sulfur 32° Baumé, 1–40, or bordeaux, 3–3–50: (1) when blossom buds show pink; (2) when majority of petals have fallen: (3) three weeks after 2, depending upon the weather; (4) if a late attack is feared, spray before fall rains begin.

Apricot. YELLOWS.—See under *Peach.*
BLACK-SPOT or SCAB.—See under *Peach.*

Aquilegia. MILDEW (*Erysiphe polygoni*).—See under *Verbena.* Disease very similar.
BLACK-SPOT (*Bacillus delphini*).—Sunken black spots on leaves and stems.
Control.—Remove and burn diseased parts.

Artemisia. RUST (*Puccinia asteris*).—Same rust as on *Asters,* which see.

Artichoke. SOFT-ROT.—See under *Carrot.*

Arum. LEAF-SPOT (*Protomyces ari*).—Irregular bleached patches on leaves and leaf-stalks of *A. maculatum.*
Control.—Burn diseased plants.

Asparagus. RUST (*Puccinia asparagi*).—A rust of the tops which is often so severe as to kill them, thus interfering with root-development.
Control.—Dust with flowers of sulfur about every three weeks while dew is still on in the morning. Use dusting-machines.

Aspidistra. LEAF-BLOTCH (*Ascochyta aspidistræ*).—Large, irregular, bleached spots with black streaks running across.
Control.—Remove diseased leaves.

Aster. RUST (*Puccinia asteris*).—Brown rust of leaves.
Control.—Eradicate the affected leaves.

Aucuba. FREEZING.—Young leaves suffer from spring frosts.

Auricula. LEAF-BLOTCH (*Heterosporium auriculi*).—Three or four olive-green spots on each leaf. Spots become brown and fall out.
Control.—Do not have excessive moisture. Spray with potassium sulfid and ventilate well.

Avocado, or Persea. ANTHRACNOSE (*Colletotrichum glœosporioides*).—See under *Pomelo.*

DISEASES AND INSECTS

CATALOGUE OF DISEASES, continued.

Bamboo. SMUT (*Ustilago shiriana*).—Internodes and tips of young shoots attacked. Wild and cultivated bamboo attacked in Japan.
Control.—Bordeaux mixture and sprinkling soil with lime before the shoots appear.

Banana. ROT (*Bacillus musæ*).—Leaf-blades droop, turn yellow; petioles decay, letting leaves drop, and finally whole plant rots to the ground.
Control.—Practise sanitation.

Bean. ANTHRACNOSE, or POD-SPOT (*Colletotrichum lindemuthianum*).—Reddish brown, scab-like spots on stems, pods, and veins of leaves, particularly on yellow-podded snap beans. Fungus enters the beans.
Control.—Use seed only from pods without spots. Spray plants, from beneath and above, every ten days.
BLIGHT (*Bacterium phaseoli*).—Large papery spots on leaves and watery spots on pods.
Control.—As for *Anthracnose*.

Beet. HEART-ROT (*Phoma betæ*).—Leaves appear spotted late in July, then wilt, and finally a dry heart-rot appears.
Control.—Destroy affected plants. Practise long rotations. Treat seed with formalin, one pint in thirty gallons of water.
SCAB.—The same disease as *Potato Scab*, which see.

Begonia. ROOT-ROT (*Thielavia basicola*).—See under *Nicotiana*.

Berberis. RUST (*Puccinia graminis*).—Orange-colored rust spots on under side of leaf.

Betula. LEAF-SPOT (*Glœosporium betularum*).—Round spots with blackish margin.
HEART-ROT (*Fomes igniarius*).—See under *Fagus*.

Blackberry. CROWN-GALL, or ROOT-GALL (*Bacterium tumefaciens*).—Swellings, hard or soft, on roots and stem below ground.
Treatment.—Plow up and burn all bushes in a diseased patch. Plant clean roots in a new place.
ANTHRACNOSE.—See under *Raspberry*.
RED or ORANGE RUST.—See under *Raspberry*.
LEAF-SPOT.—See under *Dewberry*. Same disease.

Blueberry. RUST (*Calyptospora goeppertiana*).—Stem attacked, swollen, spongy, at first pink, changing to brown and blackish. Plants taller than healthy and leaves dwarfed.
Control.—Segregate from species of fir and spruce.

Brassica. See under *Cabbage*.

Brussels Sprouts. CLUB-ROOT.—See under *Cabbage*.

Buxus. STEM-BLIGHT (*Nectria rousseliana*).—Twigs killed, reddish pustules appearing on stems and leaves.
Control.—Remove all diseased parts and burn.

Cabbage. CLUB-ROOT, or CLUB-FOOT (*Plasmodiophora brassicæ*).—A contorted swelling of roots and sickly wilted tops.
Control.—Destroy affected seedlings. Lime the soil at least eighteen months before planting cabbage, using at the rate of two tons of quicklime to the acre.
BLACK-ROT (*Bacillus campestre*).—Sap-tubes in leaves and stem turn black and the leaves drop, thus preventing heading.
Control.—Practise crop-rotation. Soak the seed for fifteen minutes in a solution of mercuric chloride, one tablet in a pint of water.

Cactus. SPOT (*Diplodia opuntiæ*).—Sometimes a serious disease.

Calathea. LEAF-BLIGHT (*Cephaleurus parasiticus*).—The epidermal cells contain the alga, which spreads over the leaf, blackening and killing it.
Control.—Remove diseased leaves.

Calceolaria. LEAF-BLIGHT (Ascribed to a Micrococcus).—Brownish patches on lower leaves, many times bordered by the small veins of the leaf.
Control.—Burn affected plants.

Campanula. RUST (*Coleosporium campanulæ*).—Red and brown rust spots on leaves.
Control.—Segregate from *Pinus rigida*.

Capsicum. ANTHRACNOSE.—Same as on *Piper*, which see.

Carnation. RUST (*Uromyces caryophyllinus*).—Brown, powdery pustules on stems and leaves.
Control.—Spray once in two weeks with a solution of copper sulfate, one pound to twenty gallons of water. Pick off diseased leaves. Keep temperature low.

Carpinus. BLACK-MOLD (*Dimerosporium pulchrum*).—On leaves.
Control.—Spray with any good fungicide.
HEART-ROT (*Fomes fulvus*).—Red-brown decay; crumbles when crushed.
Control.—Surgery methods.

Carrot. SOFT-ROT (*Bacillus carotovorus*).—A soft-rotting of the root identical with the soft rots of other root crops.
Control.—Good drainage of soil. Steam sterilization of soil.
LEAF-SPOT or EARLY LEAF-BLIGHT (*Cercospora apii*).—See under *Celery*.

Carya.—See under *Hickory-Nut*.

Castanea.—See under *Chestnut*.

Catalpa. LEAF-BLIGHT.—Sudden blackening and dying of leaves in early summer.
HEART-ROT (*Polystictus versicolor*).—Heart-wood becomes straw-colored and finally soft.
Control.—Surgery.
ROOT-ROT of seedlings (*Thielavia basicola*).—See under *Nicotiana*.

Cauliflower.—See under *Cabbage*.

CATALOGUE OF DISEASES, continued.

Celastrus. MILDEW (*Phyllactinia corylea*).—Powdery mildew of leaves.
Control.—Dust with sulfur.

Celery. EARLY LEAF-BLIGHT (*Cercospora apii*).—A spotting and eventual blighting of leaves.
Control.—Spray with ammoniacal copper carbonate, 5–3–50, beginning in seed-bed and keeping new growth covered throughout the season.
LATE BLIGHT (*Septoria petroselini* var. *apii*).—Blight of foliage appearing late in season and in storage.
Control.—As above. Grow under half shade.

Celtis. MILDEW (*Peronoplasmopara celtidis*).—Definite spots on veins, water-soaked dark green becoming gray.
Control.—Spray with bordeaux mixture.

Cercis. LEAF-SPOT (*Ascochyta pisi*).—Spots round, yellowish with brown margin on leaves and stem.
Control.—Spray with dilute bordeaux mixture on first appearance.

Chamæcyparis. TWIG DISEASE (*Pestalozzia funerea*).—Bark of young branches killed, needles die.
Control.—Prune off affected parts and clean up litter and burn.
HEART-ROT (*Steccherinum ballonii*).—Kills tops of trees.

Chard (Beta). LEAF-SPOT (*Cercospora beticola*).—Brown, purplish bordered spots on leaves.
Control.—Pick off and destroy diseased leaves.

Cherry. BROWN-ROT (*Sclerotinia fructigena*).—The flowers decay, the leaves become discolored with irregular brown spots, and the fruit rots on the tree.
Control.—Spray with bordeaux mixture, 4–4–50, or lime-sulfur, 1–40 (1) just before the blossom buds open; (2) just after the blossoms fall; (3) one or two more applications at intervals of ten days.
POWDERY MILDEW (*Podosphæra oxycanthæ*).—Leaves and twigs affected, often causing defoliation.
Control.—Spray with lime-sulfur, 1–40, or dust heavily with powdered sulfur.
BLACK-KNOT.—See under *Plum*. Same disease.

Chestnut. CANKER, or BARK DISEASE (*Endothia parasitica*).—Sunken or swollen cankers on limbs or trunk. Limbs die and leaves and burs cling in winter.
Control.—Remove diseased parts and burn. Paint all wounds. Little chance of saving trees in infested locality.

Chicory. STEM-SPOT (*Pleospora albicans*).—Yellowish-gray spots on lower portion of the stem. Later on smaller branches and leaves. Plant destroyed.
Control.—Eradicate diseased plants.

Chrysanthemum. LEAF-SPOT (*Septoria chrysanthemi*).—Small dark brown spots, which increase in size until leaf is killed.
Control.—Pick and burn affected leaves. Spray with bordeaux mixture, 4–4–50.
RUST (*Puccinia chrysanthemi*).—Reddish brown rust pustules on leaves.
Control.—As for *Leaf-Spot*.

Cineraria. MILDEW (*Bremia lactucæ*).—Plants stunted and of a pale color, finally wilting. Same disease on lettuce.
Control.—Remove diseased plants. Do not use same soil again.
RUST.—See under *Senecio*.

Citrus.—See under *Orange*, *Lemon*, *Grapefruit*, etc. The "wither tip" disease described under *Pomelo* is common to species of citrus.

Clematis. LEAF-SPOT (*Cylindrosporium clematidis* var. *jackmanii*).—Causing loss of lower leaves at times. Not serious.

Cocoanut. BUD-ROT (*Bacillus coli*).—Rot of soft tissues of cocoanut plant and is perhaps responsible for coconut bud-rot.
Control.—Not given.

Coffea. LEAF-DISEASE (*Hemileia vastatrix* and *H. woodii*).—Circular discolored areas, turning pale yellow and becoming studded with orange-yellow spots.
Control.—Burn all diseased leaves.

Colchicum. RUST (*Uromyces colchici*).—Black spots on leaves. Looks like a smut disease.
Control.—Diseased leaves should be burned.

Colocasia. ROOT-ROT (*Peronospora trichomata*).—Sap-tubes turn yellow and finally entire tuber becomes black.
Control.—Dry tubers thoroughly before storing. Do not plant in soil in which the disease has occurred.

Convolvulus. MILDEW (*Albugo ipomœæ-panduranæ*).—Distortions and white or yellow blisters.
Control.—Remove diseased plants and spray with bordeaux mixture frequently.

Cordyline. BLIGHT.—See under *Orchids*.

Coreopsis. MILDEW (*Sphærotheca humuli* var. *fuliginea*).—Powdery mildew of the leaves.
Control.—Dust with sulfur.

Corn. SMUT (*Ustilago zeæ*).—Boils on stalks, ears or tassels, at first white, then black, and, when burst open, containing black powder, the spores.
Control.—Cut out developing smut-boils and burn.
WILT (*Pseudomonas stewartii*).—Sap-tubes turn yellow and plant wilts and drys up.
Control.—Burn affected plants. Grow varieties not affected.

CATALOGUE OF DISEASES, continued.

Cornus. TWIG-BLIGHT (*Diaporthe albocarnis*).—Twigs die, bark turns yellow and is covered with numerous small pimples.
Control.—Prune off and destroy affected parts.

Corylus.—See under *Filbert.*

Cosmos. STEM-BLIGHT (*Phomopsis stewartii*).—Brown spots rapidly enlarging on stems of mature plants. Parts above wilt and die.
Control.—Difficult and no certain methods known. Remove diseased stems and burn.

Cotoneaster. RHUS (*Gymnosporangium clavariæforme*).—Orange rust pustules on leaves.
Control.—Keep at a distance from junipers.

Cranberry. BLAST, or SCALD (*Guignardia vaccinii*).—Young flower and fruits blasted, older fruits appear scalded or watery.
Control.—Spray five or six times with bordeaux mixture, 5–5–50, to which has been added four pounds of resin fish-oil soap. Begin just before the blossoms open.

Cratægus. RUST (*Gymnosporangium sp.*).—Orange rust pustules on leaves and petioles.
Control.—Keep at a distance from junipers.

Cress. WHITE MOLD.—See under *Horse-Radish.*

Crocus. ROOT-ROT (*Rhizoctonia sp.*).—Important in France and likely occurring here.
Control.—Sanitation, new soil frequently or soil sterilization.

Cucumber. BLIGHT, or MILDEW (*Pseudoperonospora cubensis*).—A blighting and premature yellowing of the leaves.
Control.—Spray with bordeaux mixture, 5–5–50, every ten to fourteen days after plants begin to run.
WILT.—See under *Cucurbita.*

Cucurbita. WILT (*Bacillus tracheiphilus*).—Sap-tubes are clogged and destroyed, causing the plant to wilt.
Control.—Eradicate the striped beetle. Gather and destroy all wilted leaves and plants.

Cupressus. ROOT-ROT.—See under *Pine.* Same disease.
TWIG DISEASE.—See under *Chamæcyparis.*
WITCHES' BROOM (*Gymnosporangium ellisii*).—Fasciation of branches.
Control.—Prune off affected parts.

Currant. WILT, or CANE-BLIGHT (*Botryosphæria ribis*).—Canes die suddenly, the leaves wilting.
Control.—No satisfactory method known. Cut out and burn affected plants.
RUST (*Cronartium ribicola*).—Brown rust pustules and brown felt-like growth on under side of leaf. Black currants especially susceptible.
Control.—Grow at least 500 feet from white pine trees.

Cycas. LEAF-SPOT (*Mycosphærella tulasnei=Cladosporium herbarum*).—Gray spots and final death of leaves.
Control.—Remove and burn affected parts.

Cyclamen. LEAF-SPOT (*Glomerella rufomaculans* var. *cyclaminis*).—Spots circular, slightly water-logged, with sharply defined outlines.
Control.—Destroy affected leaves by burning.
BLIGHT.—Similar to *Lilium Leaf-Spot,* which see.

Dahlia. WILT (*Sclerotinia sclerotiorum*).—White mold on stem, later yellowing and wilting of plant, and finally stem collapses.
Control.—Remove and burn affected plants. Green stable manure favors the disease.

Daphne. LEAF-SPOT (*Mycosphærella laureolæ*).—Similar to *Strawberry Leaf-Spot,* which see.

Date. See under *Palms.*

Delphinium. BLACK-SPOT (*Bacillus delphini*).—Sunken black spots on stem and leaves.
Control.—Remove and burn diseased parts.

Dewberry. LEAF-SPOT (*Septoria rubi*).—Small pale spots of dead leaf-tissue finally becoming dotted with black specks.
Control.—No successful method of treatment is known.

Dianthus.—See under *Carnation.*

Digitalis. MILDEW (*Peronospora sordida*).—Broadly effused, dingy lilac patches of mildew on under surface of leaves.
Control.—Spray with bordeaux mixture.

Diospyros. MILDEW (*Podosphæra oxyacanthæ*).—Powdery mildew of the leaves.
Control.—Dust with sulfur.

Dracæna. BLIGHT.—See under *Orchids.*

Eggplant. ANTHRACNOSE (*Glœosporium melongenæ*).—Spots on fruit. Same as on *Piper,* which see.
STEM ROT (*Nectria ipomœæ*).—Spreading spots on the stem.
Control.—Spray mixtures may be of avail.

Elæagnus. ROOT-TUBERCLES.—See under *Alnus.* Not destructive.

Endive. RUST (*Puccinia endiviæ*).—Rust spots on leaves.
STEM-ROT.—See under *Chicory.*

Eucalyptus. TUMOR (*Ustilago vriesiana*).—Woody tumors at collar of tree. Production of black soot-like mass of spores between wood and bark.
Control.—Surgery methods.

Euphorbia. BLIGHT (*Glœosporium euphorbiæ*).—Causes death of floral portion just before flowering time and the parts below are soon blighted.
Control.—Burn affected plants. Spray with bordeaux mixture.

CATALOGUE OF DISEASES, continued.

Fagus. HEART-ROT (*Fomes igniarius*).—White, dry, and somewhat solid decay of heart-wood bordered by fine black lines.
Control.—See under *Arboriculture, Diseases of Trees.*

Ferns. TIP BLIGHT (*Phyllosticta pteridis*).—Brown spots at or near tips of the fronds covered with minute black dots.
Control.—Remove and burn the blighted leaves and then spray with bordeaux mixture.

Ficus. LEAF-SPOT (*Leptostromella elasticæ*).—Causes spots on leaves. See also under *Fig.*

Fig. LEAF-SPOT (*Cercospora bolleana*).—Brown spots on leaves. Leaves turn yellow and drop off.
Control.—Spray with bordeaux mixture while leaves are young.

Filbert. BLACK-KNOT (*Cryptosporella anomala*).—Serious stem disease, canker girdles the stems and kills parts above.
Control.—Prune off affected parts and burn.

Forsythia. LEAF-SPOT (*Alternaria forsythiæ*).—Forms subcircular spots.
Control.—Spray with bordeaux mixture.

Fraxinus. RUST (*Puccinia fraxinata*).—Swellings of midribs of leaves and petioles with orange rust spots on them.
Control.—Keep the common grass *Spartina cynosuroides* away from the trees.

Freesia. LEAF-SPOT and WILT (*Heterosporium gracile*).—Large brown spots with darker margin, numerous; soon the leaves wilt and die.
Control.—Spray with ammoniacal copper sulfate.

Galanthus. DECAY (*Sclerotinia galanthi*).—In place of the flower a shapeless mass is produced covered with brown mildew. Tubers decay also.
Control.—Remove all affected parts and burn. Use new soil thereafter.

Gardenia. RUST.—See under *Coffea.* Same disease.

Genista. ROOT-TUBERCLES.—Beneficial.

Gentiana. RUST (*Puccinia gentianæ*).—Lower leaves first attacked, become yellow and die. Disease gradually works upward.
Control.—Destroy affected plants.

Geranium. MILDEW (*Plasmopara geranii*).—Downy mildew of leaves.
Control.—Spray with bordeaux mixture.

Gladiolus. SMUT (*Urocystis gladioli*).—Black smut pustules on corms.
Control.—Destroy affected corms. Use new soil.

Gleditsia. LEAF-SPOT (*Leptostroma hypophylla*).—Leaflets become covered with small black specks, causing some of them to turn yellow and fall.

Gooseberry. MILDEW (*Sphærotheca mors-uvæ*).—A powdery mildew of the fruit and young growth of English varieties.
Control.—Spray with potassium sulfid, one ounce to two gallons of water, at intervals after leaves begin to unfold.

Grape. BLACK-ROT (*Guignardia bidwellii*).—Brown circular spots on leaves, black, elongated, sunken pits on petioles, canes, etc., and on the berry a brown rot with shriveling and wrinkling.
Control.—Spray with bordeaux mixture, 4–4–50, before rains. Spray (1) when the third or fourth leaf unfolds; (2) as soon as the blossoms have fallen; (3) when berries are size of a pea; (4) about two weeks later. Two more applications if wet season.
DOWNY MILDEW, or LEAF-BLIGHT (*Plasmopara viticola*).—White frost-like patches on under side of the leaf.
Control.—Same as *Black-Rot.*

Grapefruit. LEAF-SPOT (*Pestalozzia guepini*).—Large spots with dark margins. Leaves fall prematurely. On other species of Citrus also.
Control.—Destroy affected leaves.

Guava. ANTHRACNOSE (*Glomerella psidii*).—Circular brown, decayed areas on fruit. Like apple bitter-rot.
Control.—None given.

Hedera. LEAF-SPOT and LEAF BLIGHT (*Vermicularia trichella*).—Rapid blackening of the etiolated portion of the leaf.
Control.—Remove and burn affected leaves and spray with bordeaux mixture.

Helianthus. RUST (*Puccinia helianthi*).—Red rust pustules on leaves of most species of Helianthus.
Control.—No specific control measures worked out.

Helleborus. LEAF-BLOTCH (*Coniothyrium hellebori*).—Large circular brownish blotches of scorched appearance, covered with minute black dots.
Control.—Cut off and burn affected leaves.

Hemerocallis. LEAF-SPOT.—See under *Freesia.*

Hibiscus. LEAF-SPOT (*Phyllosticta idæcola*).—Indistinct brown spots with whitish centers.
Control.—Burn affected leaves.
MILDEW (*Microsphæra euphorbiæ*).—Powdery mildew of leaves.
Control.—Dust with sulfur.

Hickory-nut. LEAF-SPOT (*Marsonia juglandis*).—Large leaf-spot, causing premature dying of leaves.
Control.—Spraying with bordeaux mixture may be of value.

DISEASES AND INSECTS

CATALOGUE OF DISEASES, continued.

Hollyhock. RUST (*Puccinia malvacearum*).—All parts of plant show reddish brown pustules.
Control.—Eradicate mallow. Pick off diseased leaves and burn. Spray every week with bordeaux mixture, 4–3–50.

Horse-Radish. WHITE MOLD (*Cystopus candidus*).—Deforming and swelling of leaves and stems, with white powdery surface growth.
Control.—Hardly important enough on the radish to necessitate control.

Hyacinthus. BLIGHT (*Pseudomonas hyacinthi*).—Serious pest in the Netherlands. Sap-tubes filled with yellow slime.
Control.—Destroy all affected plants.

Hydrangea. LEAF-BLIGHT (*Phyllosticta hydrangeæ*).—Leaf-spot disease which becomes serious at times.
Control.—Destroy diseased leaves as soon as noticed.

Iberis. CLUB-ROOT.—See under *Cabbage.*

Impatiens. MILDEW (*Plasmopara obducens*).—Downy mildew of the leaves.
Control.—Remove affected leaves and spray with bordeaux mixture.

Ipomœa. RUST (*Coleosporium ipomœæ*).—Common rust spotting of leaves.
Control.—Destroy affected leaves.
MILDEW.—See under *Convolvulus.*

Iris. LEAF-BLIGHT (*Botrytis galanthina*).—First the leaves and flowers are much distorted and covered with black mold growth; later the bulb may be destroyed.
Control.—Eradicate diseased plants and grow in new soil.

Juglans. LEAF-SPOT (*Gnomonia leptostyla*).—Brown leaf-spot, causing defoliation.
Control.—Collect and burn fallen leaves. Spray with bordeaux mixture while leaves are young.

Juniperus. CEDAR APPLES (*Gymnosporangium spp.*).—Large or small red and woody growth at tips of branches. Gelatinous in wet weather.
Control.—Prune off affected parts. Keep apples, pears, and hawthorns at a distance.

Kale. BLACK-ROT.—See under *Cabbage.*

Kohlrabi. CLUB-ROOT.—See under *Cabbage.*

Laburnum. LEAF-SPOT (*Peronospora cystisi*).—Leaves become brown-spotted. Seedlings killed.
Control.—Spray with bordeaux mixture.
CONTAGIOUS CHLOROSIS.—See under *Abutilon.*

Larix. CANKER (*Dasyscypha willkomii*).—Canker of trunk and branches, usually around base of trunk.
Control.—Eradicate diseased parts, using tree surgery methods.

Laurus. WITCHES' BROOM (*Exobasidium lauri*).—Branched out growths, antler-like, 2 or 3 feet in length, springing from the leaves.
Control.—Prune off affected parts.

Lemon. BROWN-ROT (*Pythiacystis citrophthora*).—White mold on surface of fruit.
Control.—Not destructive in orchard. Add copper sulfate to water when washing lemons to prevent infection of healthy ones.
LEAF-DISEASES.—Not well understood. Probably controllable by spraying.

Lespedeza. MILDEW (*Microsphæra diffusa*).—Powdery mildew of leaves.
Control.—Dust with sulfur.

Lettuce. DROP, or ROT (*Sclerotinia libertiana*).—Base of stems or leaves rots off, allowing leaves to drop.
Control.—Sterilize soil with steam before planting.
MILDEW.—See under *Cineraria.*

Ligustrum. ANTHRACNOSE (*Glœosporium cingulatum*).—Affected areas light brown either oblong on one side of the stem or completely girdling it.
Control.—Destroy by burning affected plants.

Lilium. LEAF-SPOT (*Botrytis sp.*).—Orange-brown or buff blotches on leaves, stem and flowers of *L. candidum.* May be same as *Tulipa Mold,* which see.
Control.—Eradicate diseased plants.

Lily-of-the-Valley. STEM-ROT.—See under *Pæonia.*

Liriodendron. TWIG BLIGHT (*Myxosporium longisporium*).—Killing twigs.
Control.—Prune off diseased twigs.

Lobelia. CANKER (*Phoma devastatrix*).—Portions of the stems covered with minute black dots.
Control.—Remove diseased plants. They never bloom.

Lonicera. CANKER (*Nectria cinnabarina*).—Rough canker on limbs covered with flesh-colored or red bodies.
Control.—Prune off or cut out all affected parts and cover wounds with tar.

Lupinus.—See under *Pea.*

Lychnis. SMUT (*Ustilago violacea*).—Pollen-sacs filled with black dust which escapes and discolors the flower.
Control.—Destroy the affected plants and use new soil.

Lycopersicum.—See under *Tomato.*

Magnolia. LEAF-SPOT.—See under *Grapefruit.*

Malva. RUST.—See under *Hollyhock.* Same disease.

CATALOGUE OF DISEASES, continued.

Mangifera. BLACK BLIGHT (*Dimerosporium mangiferum*).—Intense black velvety patches on both surfaces of the leaves.
Control.—Spray with any good spray mixture.

Matthiola. CLUB-ROOT.—See under *Cabbage.*

Mentha. RUST (*Puccinia menthæ*).—A most destructive rust disease.
Control.—None given.

Mignonette. LEAF-SPOT (*Cercospora resedæ*).—First reddish discoloration of leaves. Later small depressed spots with brownish or yellowish margin.
Control.—Spraying with bordeaux mixture gives good results.

Morus. LEAF-SPOT (*Cercospora moricola*).—Not serious.
LEAF-BLIGHT (*Pseudomonas mori*).—Wilting and death of leaves. Cankers girdle the twigs.
Control.—Prune off diseased parts and burn.

Muscari. SMUT (*Urocystis colchici*).—Long black powdery streaks on leaves.
Control.—Destroy affected plants by burning. Use new soil.

Mushroom. MOLD (*Mycogone perniciosa*).—Mushrooms develop abnormally as monstrous soft growths. These develop into a moldy mass and putrify.
Control.—Affected beds should be thoroughly cleaned and sprayed with copper sulfate, one pound to fifty gallons of water.

Muskmelon. DOWNY MILDEW.—See under *Cucumber.*
WILT.—See under *Cucurbita.*

Narcissus. LEAF-SPOT (*Ramularia narcissi*).—Spots on leaves and stem.
Control.—Burn diseased parts and spray with bordeaux mixture.

Nasturtium. WHITE "RUST." (*Cystopus candidus*).—See under *Horse-Radish.*

Nectarine. YELLOWS, etc.—See under *Peach.*

Nerium. BLACK MOLD (*Capnodium fœdum*).—Black velvety-like growth on leaves.
Control.—Spray with bordeaux mixture.

Nicotiana. ROOT-ROT (*Thielavia basicola*).—Blackening and rotting of the roots of seedling plants.
Control.—Steam sterilization of seed-beds.
MOSAIC or CALICO DISEASE.—Enxymic disease. Mottling of leaf. Spread by touch.

Oak. ANTHRACNOSE (*Gnomonia veneta*).—Brown spotting on under side of leaves, along veins. Brown pustules on spots. Death of leaves and twigs. See under *Arboriculture, Diseases of Trees.*
Control.—Collect and burn all diseased twigs and leaves. Spray with bordeaux mixture frequently from time buds swell.

Œnothera. LEAF-GALLS (*Synchytrium fulgens*).—Yellow swellings on the leaves.
Control.—Destroy affected leaves.

Okra.—See under *Hibiscus.*

Olive. LIMB-GALL, or KNOT (*Pseudomonas oleæ*).—Knots or galls on the twigs and limbs.
Control.—Remove and burn affected limbs.

Onion. MILDEW (*Peronospora schleideniana*).—Causes a wilt or blight of the leaves.
Control.—Spray with bordeaux mixture, 5–5–50, to which has been added one gallon of resin sal-soda sticker. First application when third leaf has developed, repeating every ten days until harvest time.
SMUT (*Urocystis cepulæ*).—Black pustules on leaves and bulbs. Seedlings may be killed outright.
Control.—Grow seed in new soil. Drill in with the seed one hundred pounds of sulfur and fifty pounds of air-slaked lime to the acre.

Opuntia. SPOT (*Diplodia opuntiæ*).—Sometimes a serious pest of cactus.

Orach. GALLS (*Urophlyctis pulposa*).—Glassy swellings on leaves, stems and flowers of Chenopodium and Atriplex.
Control.—Burn affected plants.

Orange. BLACK-MOLD (*Capnodium citri*).—Black mold-like growth on leaves and fruit.
Control.—Spray with any good fungicide.

Orchids. LEAF-BLIGHT (*Glomerella cincta*).—Leaf dies back from the tip, turning brown.
Control.—Burn affected leaves. Spray frequently then with bordeaux mixture.

Ornithogalum. WARTS (*Synchytrium niesii*).—Dirty white warts on leaves, bounded by a dark line.
Control.—Burn diseased leaves.

Pæonia. STEM-ROT and WILT (*Sclerotinia pæoniæ*).—Gradual wilting and dying of leaves caused by decay of stem at or near surface of soil.
Control.—Spray the stems frequently with a strong fungicide. Burn affected plants.

Palms. LEAF-SPOT (*Glœosporium allescheri*).—May cause ultimate death of leaves.
Control.—Frequent spraying with bordeaux mixture and eradication of diseased leaves may prove beneficial.

DISEASES AND INSECTS

CATALOGUE OF DISEASES, continued.

Pandanus. BLACK CANKER (*Nectria pandani*).—Kills branches and entire plants. Black pustules on bark oozing black tendrils.
Control.—Cut out diseased portions as soon as noticed.

Pansy. LEAF-SPOT (*Peronospora violæ*).—Discolored spots with pale violet growth on them.
Control.—Spray with bordeaux mixture.

Papaver. MILDEW (*Peronospora arborescens*).—Downy mildew of wild and cultivated poppies. Especially injurious to seedlings of garden species.
Control.—Spray with bordeaux mixture.

Parsley. LEAF-SCORCH (*Septoria petroselini*).—Small scattered brown patches, which increase in size until whole leaf is covered.
Control.—Spray early with dilute bordeaux. Pick off and burn affected leaves.

Parsnip. LEAF-BLIGHT.—See under *Celery, Early Leaf-Blight.*

Pea. MILDEW (*Erysiphe polygoni*).—A powdery mildew on pods and leaves.
Control.—Dust dry sulfur over the plants.

Peach. BLIGHT (*Coryneum beyerinkii*).—A spotting, gumming and death of the buds and twigs, particularly in the lower parts of the tree. The fruit drops.
Control.—For California conditions, two applications bordeaux mixture, 5–5–50, or lime-sulfur, 1–10, (1) in November or December, and (2) in February or March.
LEAF-CURL (*Exoascus deformans*).—Leaves curl and wrinkle.
Control.—Spray with lime-sulfur, 1–11, before buds swell.
BROWN-ROT (*Sclerotinia fructigena*).—Rot on fruit and cankers on limbs.
Control.—Spray with self-boiled lime-sulfur, 8–8–50, adding two pounds arsenate of lead. Spray (1) about time shucks are shedding from young fruit; (2) two or three weeks later; (3) one month before fruit ripens.
SCAB, or BLACK-SPOT (*Cladosporium carpophilum*).—Black scab-like spots on fruit.
Control.—Self-boiled lime-sulfur applied as under *Brown-Rot.*
YELLOWS.—A fatal disease. Red spots in fruit. Tuft-like growth of new shoots and finally yellow foliage.
Control.—Burn affected trees.

Pear. BLIGHT (*Bacillus amylovorus*).—Flowers, young fruit, twigs, and leaves turn black and die. Limbs die back and sunken cankers form in bark.
Control.—Eradicate all wild hawthorns, pears and apples. Inspect and remove all blighted parts of tree. Paint wounds with coal-tar.
SCAB.—Very similar disease to *Apple Scab*, which see.

Pecan. LEAF-BLOTCH (*Mycosphærella convexula*).—Dark-colored blotches covered with minute black dots on leaves in mid-summer.
Control.—None given.

Pelargonium. DROPSY.—Translucent spotting of leaf. Spots finally die.
Control.—Withhold water until absolutely necessary.

Persimmon. ANTHRACNOSE (*Glomerella rufomaculans*).—Similar if not identical to *Piper Anthracnose*, which see.

Petunia. WILT.—See under *Dahlia.*

Phlox. STEM-CANKER (*Pyrenochæta phloxidis*).—Canker just above the ground on the stem. Plant dies; first turning yellow and then falls over.
Control.—Diseased stems should be removed and burned.

Physalis. WILT (*Bacillus solonacearum*).—Pith of stem turns brown, sap-tubes filled with viscid ooze.
Control.—Get rid of insects such as potato beetle and burn all affected plants.

Picea. LEAF-SPOT and LEAF-CAST (*Phoma sp.*).—Causes discoloration and dropping of needles. Black dots on affected needles.
Control.—Clean up all fallen needles and burn.
DROUGHT INJURY.—Drying up of needles. Water in dry weather.

Pine. ROOT-ROT (*Armillaria mellea*).—Tops turn yellow and die, swelling of trunk at surface of ground. Decay of roots with black threads abundantly present. Toadstools around base of tree.
Control.—Dig up and burn and destroy all toadstools near the affected trees.

Pineapple. HEART-ROT.—Browning of the axis of the fruit, due to excessive moisture at time of ripening.
Control.—Keep down humidity in greenhouses.

Piper. ANTHRACNOSE (*Glœosporium piperatum*).—Spots on leaves of plants. Also apple bitter-rot fungus (*Glomerella rufomaculans*) causes similar spots on the fruits.
Control.—Frequent spraying with bordeaux mixture.

Platanus. ANTHRACNOSE.—See under *Oak.* Same disease.

Plum. BLACK-KNOT (*Plowrightia morbosa*).—Black tumorous swellings from 1 to several inches in lengtb, on limbs and twigs.
Control.—Burn all affected parts in the fall. Burn whole tree if badly affected.
BROWN-ROT.—See under *Peach.*

Polygonum. TAR-SPOT (*Rhytisma bistortæ*).—Black tar-like spots on leaves.
Control.—Burn affected leaves.

Pomegranate. INTERNAL ROT (*Sterigmatocystis castanea*).—Central cavity of fruit occupied by a black sporulating fungus.
Control.—None known.

CATALOGUE OF DISEASES, continued.

Pomelo. WITHER-TIP (*Colletotrichum glœosporioides*).—Anthracnose cankers of stem, spots on leaves and flowers and general wilting of tips of branches.
Control.—Prune off affected parts and spray with bordeaux mixture.

Populus. HEART-ROT (*Polyporus sulphureus*).—Red rot of the wood, which finally breaks up into cubes.
Control.—Surgery methods.

Potato. EARLY BLIGHT (*Alternaria solani*).—Circular spots, usually in July and final blighting of whole leaf.
Control.—Spray with bordeaux mixture, every ten days, beginning when plants are 6 to 8 inches high.
LATE BLIGHT and POTATO-ROT (*Phytophthora infestans*).—Quick-spreading watery appearing spots in leaves. Mildew on under side. Plants appear as scalded by hot water. Tubers rot in soil or soon after digging.
Control.—Spray with bordeaux mixture, 5–5–50, at least three applications and in wet seasons, six or more may be necessary. Use from forty to one hundred gallons per acre.
SCAB (*Oöspora scabies*).—A scabby and pitted roughness of the tubers.
Control.—Keep lime and ashes off the land. Soak uncut seed tubers in a solution of formalin, one pint to thirty gallons of water for two hours. Avoid land that has grown scabby potatoes.

Potentilla. LEAF-SPOT.—See under *Strawberry.*

Primula. ROT (*Botrytis sp.*)—Similar to rot of *Pæonia*, which see.

Prune.—See under *Plum.*

Prunus.—See under *Cherry, Plum* and *Peach.*

Pseudotsuga. BLIGHT (*Sclerotinia fuckeliana*).—Gray mold of seedlings and younger shoots of older trees in moist situations.
Control.—Spray with bordeaux mixture.

Psidium.—See under *Guava.*

Pyrus.—See under *Apple* and *Pear.*

Quince. BLIGHT.—See under *Pear.*
RUST (*Gymnosporangium globosum*).—Orange rust of fruit.
Control.—Destroy red cedars in the neighborhood, also wild apples and hawthorns. Spray as for *Apple Scab.*

Radish. WHITE "RUST" or MILDEW (*Albugo candidus*).—A whitish powdery growth on the leaves and petioles, often causing distortion.
Control.—Steam sterilize the soil before planting.
CLUB-ROOT.—See under *Cabbage.*
BLACK-ROT.—See under *Cabbage.*

Ranunculus. MILDEW (*Plasmopara pygmæa*).—Downy mildew of leaves.
Control.—Spray with bordeaux mixture.

Raspberry. ANTHRACNOSE (*Glœosporium venetum*).—Circular or elliptical, gray scab-like spots on the canes.
Control.—Remove diseased canes as soon as fruit is picked. Avoid taking young plants from diseased plantings.
CROWN-GALL.—See under *Blackberry.*
RED, or ORANGE RUST (*Gymnoconia interstitialis*).—Dense red powdery growth on under side of leaves of black varieties and blackberries.
Control.—Dig up and destroy affected plants.
LEAF-SPOT.—See under *Dewberry.* Same disease.

Retinospora. GALL (*Gymnosporangium sp.*).—Swellings on limbs and twigs with red-brown pustules covering them.
Control.—Prune off affected parts and keep at a distance from species of Pomeæ.

Rhamnus. RUST (*Puccinia coronata*).—Irregular yellow blotches, with yellow pustules on under side of leaf. Also on fruit and flowers.
Control.—Keep at a distance from "rusted" cereals and other grasses.

Rheum. SOFT-ROT.—See under *Carrot.*

Rhododendron. GALLS (*Exobasidium rhododendri*).—Galls of the size of a pea or larger, at first pale green, then red and brownish covered with white bloom.
Control.—Leaves bearing galls should be removed and burned.

Rhubarb. SOFT-ROT.—See under *Carrot.*

Rhus. CANKER and TWIG BLIGHT (*Endothia parasitica*).—See under *Chestnut.* Causes death of twigs.

Ribes.—See under *Currant* and *Gooseberry.*

Richardia. SOFT-ROT (*Bacillus aroideæ*).—Soft rotting of corms (bulbs) and leaves.
Control.—Change soil every three or four years. Reject corms which show the disease.

Robinia. HEART-ROT (*Trametes robiniophila* and *Fomes rimosus*).—Heart-wood converted into punk. Shelf-like bodies grow from wounds.
Control.—Surgery methods.

Rose. MILDEW (*Sphærotheca pannosa*).—A white powdery mildew on new growth.
Control.—In greenhouses, keep steam-pipes painted with a paste of equal parts lime and sulfur mixed in water. Out-of-doors roses should be dusted with sulfur flower or sprayed with potassium sulfid, one ounce to three gallons of water.
STEM-BLIGHT.—Similar to *Raspberry Anthracnose*, which see.

DISEASES AND INSECTS

CATALOGUE OF DISEASES, continued.

Rubus.—See under *Raspberry.*

Salix. RUST.—Numerous species of the rust fungi produce red rust spots on the leaves.
Control.—Keep at a distance from species of conifers.
HEART-ROT (*Trametes suaveolens*).—Enters through wounds.
Control.—Surgery methods.

Salsify. MILDEW (*Albugo tragopogonis*).—Distortion and white blisters on host.
Control.—Eradicate affected plants and grow on new soil apart from wild and cultivated species of the Compositæ.

Sambucus. CANKERS.—See under *Lonicera.*

Sarracenia. BLIGHT.—See under *Orchids.*

Saxifraga. RUST (*Puccinia pazschkei* and *P. saxifrage*).—Dark brown concentric circles of rust pustules on upper surface of the leaves.
Control.—Burn affected leaves.

Scilla. BULB-ROT (*Sclerotinia bulborum*).—Yellow stripes and blotches on leaves in early summer, with olive-brown mold on them. Rots the bulb later.
Control.—Destroy affected plants. Spray with potassium sulfid. Use new soil thereafter.

Sedum. LEAF-SPOT (*Septoria sedi*).—Dark circular blotches appear on the leaves and defoliation occurs.
Control.—Destroy affected parts by burning.

Sempervivum. RUST (*Endophyllum sempervivi*).—Brown rust pustules rupturing epidermis of leaf.
Control.—Destroy affected plants as the fungus lives over from year to year in the same plant.

Senecio. RUST (*Coleosporium senecionis*).—Orange patches on under surface of leaf.
Control.—Keep at a distance from species of Pinus. Burn affected plants to protect neighboring pines.

Sequoia. BLIGHT.—See under *Pseudotsuga.*

Silene. SMUT.—See under *Lychnis.*

Solanum.—See under *Potato, Eggplant,* etc.

Sorbus. BLIGHT.—See under *Pear.*

Spinach. ANTHRACNOSE (*Colletotrichum spinaceæ*).—Spots on leaves, at first minute and watery, gradually increasing in size and becoming gray and dry.
Control.—Gather and destroy all diseased leaves.
MILDEW (*Peronospora effusa*).—Gray, slightly violet, patches of a velvety texture on under side of leaves.
Control.—As for *Anthracnose,* which see.

Spiræa. RUST (*Triphragmium ulmariæ*).—Reddish yellow and dark brown rust pustules on leaves.
Control.—Burn affected parts.

Squash. WILT.—See under *Cucurbita.*

Strawberry. LEAF-SPOT, or LEAF-BLIGHT (*Mycosphærella fragariæ*).—Small purple or red spots appearing on leaves. Leaf appears blotched.
Control.—Spray with bordeaux mixture, 4–4–50, soon after growth begins and make three or four additional sprayings during season.

Sweet Pea. MILDEW.—See under *Pea.*

Sweet Potato. BLACK-ROT (*Ceratocystis fimbriata*).—Black shank and a black rot of tuber.
Control.—Never use sprouts from affected potatoes. Steam sterilize hotbeds.
ROTS.—The sweet potato is susceptible to a large number of rots, soft, dry, hard, white, etc.
Control.—Use soil which has not grown diseased sweet potatoes heretofore.

Syringa. MILDEW (*Microsphæra alni*).—White powdery mildew on upper surface of leaves.
Control.—Dust with sulfur.
TWIG and BUD DISEASE (*Phytophthora syringæ*).—Tips of twigs killed.
Control.—Prune off twigs.

Thalictrum. RED-SPOT (*Synchytrium anemones*).—Red eruptions on stem, leaf and flower. Causing at times swelling and crumpling of the organ.
Control.—Burn affected parts.

Thuja. ROOT-ROT (*Polyporus schweinitzii*).—Diseased wood yellowish, cheesy, brittle when dry.
HEART-ROT (*Fomes carneus*).—Causes pockets in the affected wood.
Control.—Remove all affected wood, using surgery methods.

Tilia. LEAF-SPOT (*Cercospora microsora*).—Causes spotting and defoliation.
Control.—Two sprayings in Massachusetts resulted in longer retention of the leaves.

Tomato. LEAF-SPOT (*Septoria lycopersica*).—At first small spots appear, which spread until the whole leaf is consumed. Fruit may be attacked.
Control.—Spray with bordeaux mixture, 4–4–50, making the first application two weeks after the plants are set out and repeating every two weeks throughout the season.
DOWNY MILDEW.—See under *Potato. Late Blight.*
END-ROT.—Due to lack of sufficient soil moisture.
Control.—Water soil in dry periods.

Toxylon (Maclura). RUST (*Physopella fici*).—Pale cinnamon-brown rust pustules on under side of leaf.
Control.—Destroy by burning the affected leaves.

CATALOGUE OF DISEASES, continued.

Tropæolum.—See under *Horse-Radish.*

Tsuga. HEART-ROT (*Trametes pini*).—Light brown decay pitted with small oblong cavities, which are white-lined.
SAP-ROT (*Fomes pinicola*).—Soft decay of sap-wood.
Control.—Surgery methods.

Tulipa. MOLD (*Sclerotinia parasitica*).—Olive-brown, velvety patches formed on leaves, stem, and flowers; also, later, small black lumps at base of stems.
Control.—Burn affected plants.

Turnip. CLUB-ROOT.—See under *Cabbage.* Same disease.
SOFT-ROT.—See under *Carrot.* Same disease.

Ulmus. TAR-SPOT (*Gnomonia ulmea*).—Black spots on upper surface of leaves.
Control.—Burn old leaves in fall or winter.
HEART-ROT (*Pleurotus ulmarius*).—Soft rotting of wood.
Control.—Surgery methods.

Vaccinium. LEAF-BLISTER (*Exobasidium vaccinii*).—Large blisters on leaves, petioles and stems, of a red or purple color. White bloom beneath.
Control.—Remove and burn diseased parts.

Verbena. MILDEW. (*Erysiphe cichoracearum* and others).—Powdery mildew growths on leaves.
Control.—Spray with any good fungicide or dust with powdered sulfur.

Veronica. LEAF-SPOT (*Septoria veronicæ*).—Well-defined spots on leaves.
Control.—Pick off and burn affected leaves.

Vinca. LEAF-SPOT (*Sphæropsis vincæ*).—Leaves disfigured by spots which occur on the stem at times as well.
Control.—Destroy diseased parts of plants.

Violet. ROOT-ROT (*Thielavia basicola*).—Plants make poor growth; roots rotted off.
Control.—Start in steam-sterilized soil, and transfer to sterilized beds.

Vitis.—See under *Grape.*

Walnut. BLIGHT (*Pseudomonas juglandis*).—Black spotting of fruit and black cankers on the stems. Twigs and fruit-spurs killed.
Control.—None known except such as mentioned under *Pear Blight.* Grow immune varieties.
ANTHRACNOSE, or LEAF-BLIGHT (*Marsonia juglandis*).—See under *Hickory-Nut.* Same disease.

Watermelon. MILDEW.—See under *Cucumber.*
WILT (*Fusarium vasinfecta*).—Wilting of leaves and plant dries up.
Control.—None recommended. Resistant varieties should be grown.

Yucca. LEAF-BLOTCH.—See under *Agave.*

Zea.—See under *Corn.*

Zinnia. WILT.—See under *Dahlia.*

DONALD REDDICK.

Insect enemies of plants.

The animals which constitute the insect world play an important part in most horticultural operations. The busy bee is an indispensable aid in the production of many fruits, but the equally busy jaws of canker-worms or other insects oftentimes seriously interfere with man's plans for profitable crops. Horticulturists should become more intimately acquainted with their little friends and foes in the insect world. Not only from the economic standpoint is this knowledge necessary in the business of growing plants, but the striking peculiarities of form, coloring, structure, habits, and the wonderful transformations of insects afford one of the most interesting fields in nature. The life-stories of many insects, if told in detail, would rival in variety and interest many a famous fairy tale. The science that treats of insects, or entomology, has now reached the stage at which its devotees are no longer looked upon with ridicule in most communities. At the present time more than 350 trained men are officially employed in entomological work in the United States and Canada.

What they are.—An insect is an animal which, in the adult stage, has its body divided into three distinct regions: the head, the thorax and the abdomen (Fig. 1293). The head bears one pair of antennæ, and there are always three pairs of legs and usually either one or two pairs of wings attached to the thorax. By these characteristics one can usually readily distinguish an adult insect from any other animal. Among the near relatives of insects in the animal world are the cray-

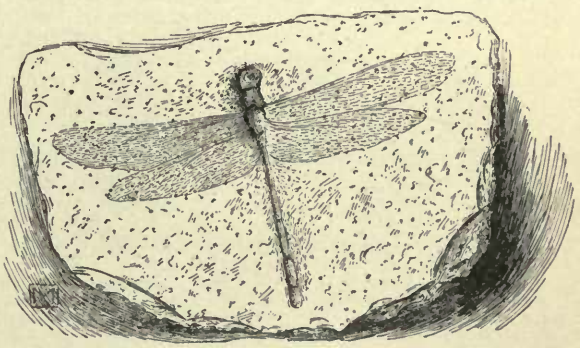
fish, sow-bugs, and crabs, but these are mostly aquatic animals, breathing by true gills; they have two pairs of antennæ, and at least five pairs of legs. Centipedes, or "hundred-legged worms," and millipedes, or "thousand-legged worms," are also nearly related to insects, but they have the thorax and abdomen forming a continuous region, and with six to 200 segments, each bearing one or two pairs of legs; they have one pair of antennæ. The layman usually classes such animals as the spiders, mites and daddy-long-legs among the insects, but they form a distinct class, as they have the head and thorax grown together, no antennæ, and have four pairs of legs.



1293. A beetle, showing the different parts.

How they are constructed.—Insects are constructed on an entirely different plan from the higher animals. Their supporting skeleton is outside, it being simply the skin hardened more or less by a horny substance, known as chitin. This firm outer wall, or skeleton, supports and protects the muscles, blood-vessels, nerves, and other organs within. The mouth-parts, antennæ and eyes of an insect are attached to its head, and all are exceedingly useful organs, as will be shown later in discussing the feeling and the other sensations of an insect. An insect's wings and legs are always borne by the thorax. The wings are primarily organs of flight, but are used as musical organs by some of the grasshoppers and crickets. Female canker-worm moths, bed-bugs, and some other insects have practically no wings, and the house-flies, mosquitos, male bark lice, and similar insects have but one pair of wings. Insects use their legs primarily for locomotion; some have their front legs modified for catching other insects for food; others have hind legs fitted for jumping, while the honey-bee has little "pockets" on its hind legs for carrying pollen to feed its young.

The arrangement of the internal organs in insects is interesting and somewhat peculiar. The alimentary or food canal in larvæ is a nearly straight tube, occupying the central portion of the body; in adult insects it is usually much longer than the body and is more or less folded; from the mouth the food passes through a pharynx, an esophagus, sometimes a crop and a gizzard, a stomach, and a small and large intestine. The nervous system of an insect is similar to that in the higher animals, but it extends along the venter instead of the back. There is a little brain in the upper part of the head, and two nerve cords extend from this around the food-canal to another ganglion or nerve center in the lower part of the head; two nerve cords then extend longitudinally along the venter and connect a series of nerve centers or ganglia, typically one for each segment of the body. From each of these ganglia or little brains nerves arise, which supply the adjacent organs and ramify throughout the body. In insects, all parts of the body cavity that are not occupied by the internal organs are filled with a rich, colorless or slightly greenish blood. There is no system of tubes like our arteries and veins, in which the blood is confined and through which it flows. There is a so-called "heart" above the food-canal, along the middle line of the back; it is a tube consisting of several chambers communicating with each other and with the body cavity by valvular openings. The blood is forced through this heart into the head, where it escapes into the body cavity. It then flows to all parts of the body, even out into the appendages, in regular streams which have definite directions, but which are not confined in tubes. They, like the ocean currents, are definite streams with liquid shores. Insects do not breathe through the mouth, as many suppose, but through a series of holes along the sides of the body. These openings, or spiracles, lead into a system of air-tubes, called tracheæ. These tracheæ branch and finally ramify all through the insect. Insects have no lungs, but the tracheæ sometimes connect with air-sacs or bladders in the body, which help to buoy up the insect when flying. Thus the relation between the circulation of the blood and respiration is not nearly so intimate in insects as in man. In insects the air is carried to all the tissues of the body in the tracheæ and the blood simply bathes these tissues. Just how the blood is purified and how the waste matter is disposed of in insects are not yet clearly understood. Aquatic insects breathe by either carrying down bubbles of air from the surface entangled under their wings, or they may be provided with organs known as tracheal gills; these



1295. Fossil dragon-fly, Petalia longialata. (×⅓)

are usually plate-like expansions of the body that are abundantly supplied with tracheæ, in which the air is brought practically in contact with the air in water, and may thus be purified. More than 4,000 different muscles have been found in a single caterpillar. Notwithstanding their delicate appearance, these muscles are really very strong and their rapidity of action is wonderful; in certain gnats the muscles move or vibrate the wings 15,000 times a second.

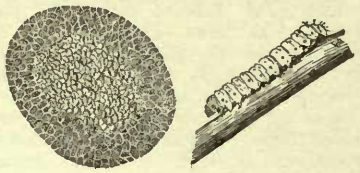


1294. Head of grasshopper. Showing the great eye. A detail of a part of the surface of the compound eye is also shown.

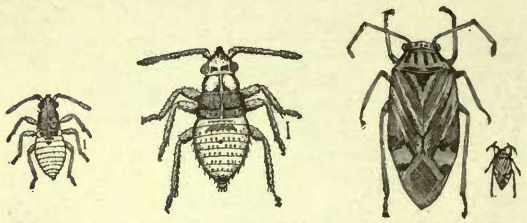
Their sensations.—Insects can see, feel, hear, taste and smell, and they may also possess other senses, as a sense of direction. Many insects have two kinds of eyes. On each side of the head the large compound eye is easily recognized (Fig. 1294); each compound eye is composed of many small eyes, from fifty in some ants to many thousands in a butterfly or dragon-fly. Between these compound eyes, from one to four simple eyes are to be found in many adult insects. Caterpillars and other larvæ possess only simple eyes. It is thought that each facet of the compound eye sees a part of an object; thus the whole eye would form a mosaic picture on the insect's brain. The simple eyes doubtless see as our eyes do, and seem to be best adapted for use in dark places and for near vision. Insects do not see the form of objects distinctly, but their eyes are doubtless superior to ours in distinguishing the smallest movements of an object. It is now supposed that no insects can distinctly see objects at a greater distance than 6 feet. It must be a sixth

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sense, a sense of direction, which enables the bee to find its way for a mile or more back to its home. Insects are doubtless able to distinguish the color of objects, and some insects seem to prefer certain colors. Blue is said to be the favorite color of the honey-bee, and violet that of ants; ants are also apparently sensitive to the ultra-violet rays of light, which man cannot perceive. It is generally supposed that the shape and high colors of flowers attract insects; but recent experiments seem to show that insects are guided to flowers by the sense of smell rather than by sight. The hard outer skin of an insect has no nerves distributed in it, hence it is not sensitive; but it is pierced with holes, in which grow hairs that are in connection with nerves at their base. It is by means of these sensory hairs that insects feel, and are sensitive to touch on most parts of the body. Doubtless insects are not deaf, for we know that many of them make sounds, and it must naturally follow that they have ears to hear, for there is every reason to suppose that they make these sounds as love-songs to attract the



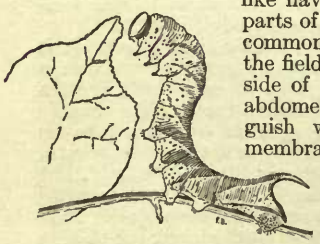
1296. The four stages in an insect's life—egg, larva, pupa, imago.—The codlin-moth. (Egg much enlarged; others ×1½)



1297. Nymphs of the four-lined leaf-bug, and adult of the tarnished plant-bug.

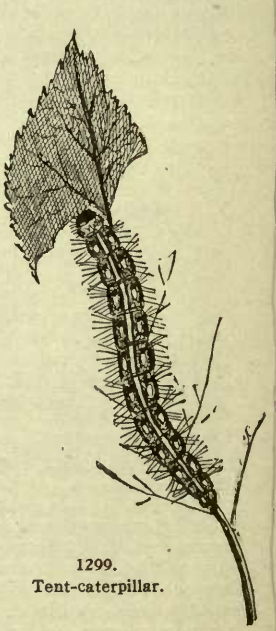
The smaller one at the left is the nymph recently hatched. The next is the nymph after the first moult. The imago is shown at the right. Hair lines at the right of nymphs, and small figure near imago indicate the natural size.

sexes, as a means of communication, or possibly to express their emotions. Some think that bees and ants hear sounds too shrill for our ears. Insects have no true voice, but produce various noises mechanically, either by rapid movements of their wings, which causes the humming of bees and flies, or by friction between roughened surfaces on the body or its appendages, thus producing the rasping sounds or shrill cries of some crickets and grasshoppers. The house-fly hums on F, thus vibrating its wings 335 times in a second, while the wing tone of the honey-bee is A. Usually the males are the musicians of the insect world, but it is the female of the familiar mosquito which does the singing, and the "biting" also. The male mosquito doubtless hears the song of his mate by means of his antennæ, as the song causes the antennal hairs to vibrate rapidly. Organs which are structurally ear-like have been found in various parts of the body of insects. The common brown grasshoppers of the fields have a large ear on each side of the first segment of the abdomen; one can easily distinguish with the naked eye the membrane or tympanum stretched over a cavity. Many of the long-horned green grasshoppers, katydids and crickets have two similar ears on the tibia of each front leg. Some think that mosquitos have the faculty of the perception of the direction of sound more highly developed than in any other class of animals. Insects undoubtedly possess the sense of taste. When morphine or strychnine was mixed with honey, ants perceived the fraud the moment they began to feed. The substitution of alum for sugar was soon detected by wasps. Bees and wasps seem to have a more delicate gustatory sense than flies. Taste organs have been found in many insects, and are usually situated either in the mouth or on the organs immediately surrounding it. Many experiments have shown that the antennæ are the principal organs of smell in insects. Blow-flies and cockroaches which have had their antennæ removed are not attracted by their favorite food, and male insects find their mates with difficulty when deprived of their antennæ. The familiar world which surrounds us may be a totally different place to insects. To them it may be full of music which we cannot hear, of color which we cannot see, of sensations which we cannot perceive. Do insects think or reason? Why not? Their actions are said to be the result of inherited habit or instinct. But some of them have been seen to do things which require the exercise of instinctive powers so acute and so closely akin to reason that one can hardly escape the conclusion that some insects are endowed with reasoning powers.



1298. Larva of a sphinx moth.

Their number, size and age.—Experts guess that there are from 2,000,000 to 10,000,000 different kinds of insects in the world. Only about 400,000 of these have yet been described and named by man. Between 30,000 and 40,000 are now known in North America. Four-fifths of all the kinds of animals are insects; some single families of insects are said to contain more species than one can see stars in a clear sky at night; and there are as many butterflies as birds in North America. The larger part of the land animals are insects, and it is asserted that the larger proportion of the animal matter existing on the lands of the globe is probably locked up in the forms of insects. Insects vary in size from little beetles, of which it would take 100, placed end to end, to measure an inch, up to tropical species 6 or 8 inches in length, or of equal bulk to a mouse. Insects have a very long, but, as yet, very imperfect pedigree extending through the geological ages to Silurian times. Fossil remains of many different kinds of insects have been found in the rocks (Fig. 1295); even such delicate insects as plant-lice left their impress on the rocks ages ago. In the carboniferous or coal age, the insect world was evidently quite different from that of today, for fossils of veritable insect mammoths have been found; dragon-flies with a wing-expanse of 2 to 3 feet then existed. Insect fossils found in the tertiary rocks



1299. Tent-caterpillar.

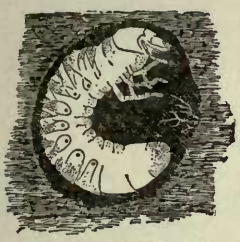
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indicate that there were even more kinds of insects then than now.

Their growth and transformations. Fig. 1296.—Insects begin life as an egg; in some cases the egg stage is passed within the body of the mother, which then gives birth to living young. The eggs of insects exhibit a wonderful variety of forms, sizes, colors and characteristic markings. A single scale insect may lay thousands of eggs, while some plant-lice produce only one. Remarkable instinct is often shown by the mother insect in placing her eggs where her young will find proper food. From their birth the young of some of the lowest or most generalized insects closely resemble their parents, and they undergo no striking change during their life; hence are said to have no metamorphosis. In the case of grasshoppers, stink-bugs, dragon-flies, and many other insects, the young at birth resemble their parents, but have no wings. As they grow, wings gradually develop and often changes in markings occur, until the adult stage is reached. The growth, however, is gradual, and no striking or complete change occurs, and these insects are said to undergo an incomplete metamorphosis. The young insects in all stages are called *nymphs* (Fig. 1297); thus insects with an incomplete metamorphosis pass through three different forms during their life: an *egg*, the young or *nymph* stage, and the *adult*. From the eggs of butterflies, moths, flies, beetles, bees and some other insects, there hatches a worm-like creature, much unlike the parent insect. It is called a *larva* (Fig. 1298); the larvæ of butterflies and moths are often called *caterpillars* (Fig. 1299); *maggots* are the larvæ of flies (Fig. 1300); and the term *grub* is applied to the larvæ of beetles and bees (Fig. 1301). When these larvæ get their full growth, some of them go into the ground where they form an earthen cell, while others proceed to spin around themselves a silken home or *cocoon* (Figs. 1302–1304). In these retreats the larvæ change to a quiescent or lifeless-appearing creature which has little resemblance to either the larva or the parent insect. It is call a *pupa* (Fig. 1305). The pupæ of butterflies are often called *chrysalids*. Flies change to pupæ in the hardened skin of the maggot. Some pupæ, like those of mosquitos, are very active. Wonderful changes take place within the skin of the pupa. Nearly all the larval tissues break down and the insect is practically made over, from a crawling larva to a beautiful, flying adult insect. When the adult is fully formed, it breaks its pupal shroud and emerges to spend a comparatively brief existence as a winged creature. Such insects are said to undergo a complete metamorphosis, and pass through four strikingly different stages during their life: the egg, the worm-like larva, the quiescent pupa, and the adult insect. Such remarkable changes or transformations make the story of an insect's life one of intense interest to one who reads it from nature's book. Various kinds of adult insects, or imagoes, are shown in Figs. 1306–1311. No two kinds of insects have the same life-story to tell. Some pass their whole life on a single host; some partake of only a certain kind of food, while others thrive on many kinds of plants; some are cannibals at times, and others, like the parasites, are boarders within their host, while many prey openly on their brethren in the insect world. Usually the life of the adult insect is brief, but ants have been kept for thirteen years, and the periodical cicada has to spend seventeen years as a nymph underground before it is fitted to become a denizen of the air. The winter months may be passed in any of the different stages of the insect's life. Two very closely allied insects may have very different life habits.



1300. A maggot. Larva of a dipterous insect.

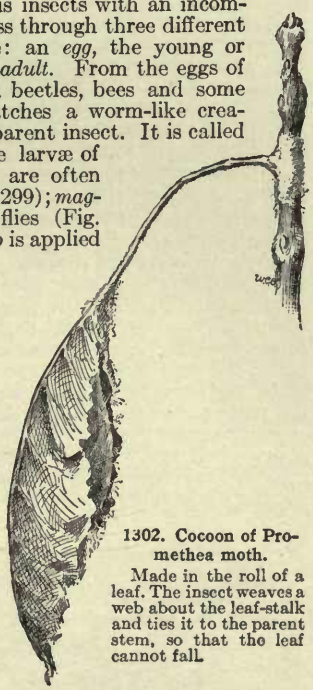


1301. A grub. Larva of a beetle.



1303. Lengthwise section of the Promethea cocoon.

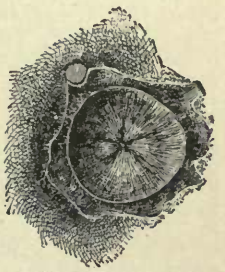
Showing at apex the valve-like opening through which the moth escaped.



1302. Cocoon of Promethea moth.

Made in the roll of a leaf. The insect weaves a web about the leaf-stalk and ties it to the parent stem, so that the leaf cannot fall.

How they grow.—Many persons think that the small house-flies grow to be the large ones. While most insects feed after they become adults, they get little or none of their growth during their adult life. Insects grow mostly while they are larvæ, or nymphs. The maggots from which the little house-flies develop doubtless do not have as luxuriant or favorable feeding-grounds as do those of the larger flies. In thirty days some leaf-feeding caterpillars will increase in size 10,000 times; and a certain flesh-feeding maggot will in twenty-four hours consume two hundred times its own weight, which would be paralleled in the human race if a one-day-old baby ate 1,500 pounds the first day of its existence! The skin of insects is so hard and inelastic that it cannot stretch to accommodate such rapid growth. But nature obviates this difficulty by teaching these creatures how to grow a new suit of clothes or a new skin underneath the old one, and then to shed or molt the latter. The old skin is shed in its entirety, even from all the appendages, and sometimes remains in such a natural position where the insect left it as to easily deceive one into thinking that he is looking at the insect rather than at its cast-off clothes. Some insects are so neat and economical that they devour their old suits or skins soon after molting them. Larvæ, or nymphs, may molt from two or three to ten or more times; the larvæ do not often change strikingly in appear-



1304. End of cocoon of Cecropia moth.

Inside view, showing where the moth gets out.



1305. Pupa of tomato worm.



1306. The cabbage butterfly.

ance, but the nymphs gradually acquire the characters and structures of the adult.

How they eat.—To the horticulturist, the mouth-parts of an insect are its most important organs or appendages. The mouth-parts are built on two very different plans. Grasshoppers, beetles, caterpillars and grubs have two pairs of horny jaws, working from side to side, with which they bite or chew off pieces of their food, that then pass into the food-canal for digestion (Fig. 1312). The scale insects (Fig. 1313), plant-lice, true bugs (Fig. 1314), mosquitos and others have these jaws drawn out into thread-like organs, which are worked along a groove in a stiff beak or extended under-lip. Such insects can eat only liquid food, which they suck with their beak-like mouth-parts. The insect places its beak on the surface of the plant, forces the thread-like jaws into the tissues, and then begins a sucking operation, which draws the juices of the plant up along the jaws, and the groove in the beak into the food-canal of the insect. Thus a sucking insect could not partake of particles of poison sprayed on the surface of a plant. Its mouth-parts are not built for such feeding, and as it is impracticable to poison the juice of the plant, one is forced to fight such insects with a deadly gas, or each individual insect must be actually hit with some insecticide. A knowledge of these fundamental facts about the eating habits of insects would have saved much time and money that have been wasted in trying to check the ravages of sucking insects with paris green and similar poisons. Some insects, like the fruit flies, have mouth-parts fitted for lapping up liquids.



1307. Imago of a tent-caterpillar.



1308. A beetle. The adult of a borer larva.

Beneficial insects.

The horticulturist has many staunch and true friends among the insects. The honey-bee, the many wild bees, and other insects, as they visit the blossoms to get food for themselves, for their young, and honey for man, leave an insurance policy in the shape of tiny grains of pollen, which often insures a crop of fruit that otherwise might be extremely uncertain. The honey-bee is often accused of biting into ripe fruits, especially grapes. They have not yet been proved guilty, and careful, exhaustive experiments have shown that they will not do it under the most favorable circumstances. Wasps and other strong-jawed insects are responsible for most of this injury, the bees only sipping the juice from the wound. See *Bees*, Vol. I.

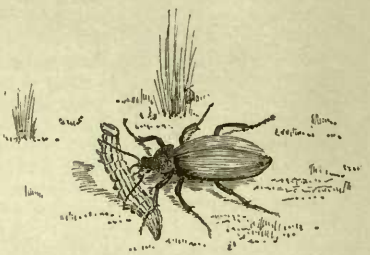


1309. One of the weevil beetles. With a long and strong proboscis.

Most of the pretty little beetles known to every child as "lady-bugs" eat nothing but injurious insects; many other beetles are also predaceous. Man is also often deeply indebted to many of the two-winged insects or true flies whose larvæ live as parasites inside the body of insect pests or feed upon them predaceously. Were it not for the ravenous larvæ of the "lady-bugs" and of the syrphus flies, plant-lice of all kinds would soon get beyond control. While man must recognize these little friends as valuable aids in his warfare against the hordes of insect pests, it will rarely be safe to wait for the pests to be controlled by their enemies. Fig. 1315 shows a tomato worm bearing the cocoons of a parasite. Fig. 1310 shows one of the predaceous beetles destroying a cutworm.

Injurious insects.

There are now several thousand different kinds of insects that may be classed as injurious in the United States and Canada. Over 600 kinds were exhibited at the Columbian Exposition in 1893. All of these may not be injurious every year, as most insect pests have periods of subsidence, when certain factors, possibly their enemies or perhaps climate conditions, hold them in check. The outlook for American horticulturists, so far as injurious insects are concerned, is not encouraging. Nowhere else in the world are insects being fought as intelligently, successfully and scientifically as in America, yet we never have exterminated, and it is very doubtful if we ever will, a single insect pest. This means that American horticulturists will never have any fewer kinds of insects to fight. On the contrary, there are many more insect pests now than in our grandfather's early days, and new pests are appearing every year. This alarming state of affairs is largely due to two causes, for both of which man is responsible. Man is continually encroaching upon and thereby disturbing nature's primitive domain and the equilibrium which has there become established between animals and plants. In consequence, insects like the Colorado potato beetle, the apple-tree or the peach-tree borers have been attracted from their original wild food-plants to man's cultivated crops, which often offer practically unlimited feeding-grounds. Most of the new insect pests, however, are now coming to America from foreign shores. American horticulturists are continually importing plants from the ends of the earth, and oftentimes the plants are accompanied by one or more of their insect pests. Some comparatively recent introductions of this kind are the sinuate pear-borer, the pear midge, the gypsy moth, the brown-tail moth, the horn-fly and the elm leaf-beetle; such standard pests as the Hessian fly, the cabbage butterfly, the currant-worm, the codlin-moth (Fig. 1296) came in many years ago. Of the seventy-three insects which rank as first-class pests, each of them almost annually causing a loss of hundreds of thousands of dollars, over



1310. Ground beetle. One of the commonest predaceous insects.



1311. Moths of the peach-tree borer. The lowest one is male.

one-half have been introduced from foreign countries, mostly from Europe. It is a significant fact that usually these imported insects become much more serious pests here than in their native home; this is doubtless largely due to the absence of their native enemies, to more favorable climatic conditions here, and to a less intense system of agriculture in this country. Most of our worst insect pests of the fruits, of the garden crops, of the granary, of the household, of the greenhouse, and practically all of our most dangerous scale insects, are of foreign origin. Man will continue to encroach on and disturb nature's primitive domain, and commercial operations will never cease, nor is there much hope of ever effectually quarantining our shores against these little foes; hence there seems to be no practicable way to stop this increase of the insect enemies of the horticulturist. The one who is the best fitted by nature, and who best fits himself with a knowledge of these pests and how to fight them, will usually be the one to survive and reap the reward of profitable crops. No part of a plant, from its roots to the fruit it produces, escapes the tiny jaws or the sucking beaks of insects.

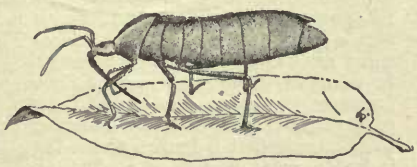


1312. Mouth-parts of a biting insect.



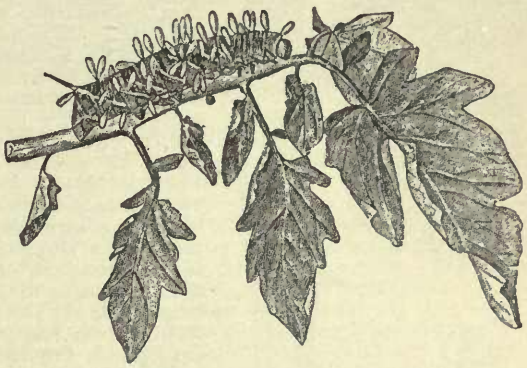
1313. San José Scale.
Showing the mature winter scale; also the insect itself, with its thread-like feeding organs.

Root-feeding insects.—Many of the small fruits and vegetables are often seriously injured by insects feeding on the roots. The grape-vine fidia (the grub of a small beetle) and the grape phylloxera plant-louse live on grape roots. Strawberries often succumb to the attacks of the grubs of several small beetles known as strawberry-root worms, and to the large white grubs of the May beetles. The roots of cabbages, radishes and other cruciferous plants are often devoured by hordes of hungry maggots. These underground root-feeding insects are difficult pests to control, like any other unseen foe. Sometimes they can be reached successfully by injecting a little carbon bisulfide into the soil around the base of the plant. The cabbage maggots can be prevented largely by the use of tarred paper pads placed around the plants, or by pouring a carbolic acid emulsion at the base of the infested plants. The strawberry root-feeders are best controlled by frequent cultivation and a short rotation of crops.



1314. Hemipterous insect. Known to entomologists as a true bug.

Borers.—These are the larvæ of several different kinds of insects, which burrow into and feed upon the inner bark, the solid wood, or the interior pith of the larger roots, trunks, branches, and stems or stalks of many horticultural plants. Nearly every kind of fruit trees is attacked by its special kind of borer, as are also many of the smaller vine and bush-fruits and garden crops. Borers are often the most destructive of insect pests. The two apple-tree borers, the round-headed (Fig. 1316) and the flat-headed species, and the peach-tree borer (Fig. 1311) doubtless cause the death of as many apple and peach trees in America as all other enemies combined. The fruit-bark beetles, or "shot-hole" borers, usually attack only unthrifty or sickly fruit trees, and a tree once infested by them is usually doomed. Two borers, one the grub of a beetle and the other the caterpillar of a moth, sometimes tunnel down the stems of currants and gooseberries. Raspberries and blackberries (Fig. 1317) also suffer from two or thee kinds of borers, one working in the root, one in the stem, and a maggot bores down and kills the new shoots. A caterpillar closely allied to the peach-tree borer lives in squash vines, often ruining the crop. The potato-stalk weevil sometimes does much damage in potato fields. Sometimes one can prevent borers from getting into a fruit tree with a paper bandage closely wrapped around the part liable to be attacked, or by the application of some "wash." Most of the washes recommended will prove ineffectual or dangerous to use. Gas-tar has given good results, but some report injury to peach trees from its use; hence one should first experiment with it on a few trees. No way has been found to keep borers out of the small fruits or garden crops; usually if infested canes, stems or plants are cut out and burned early in the fall or whenever noticed, most of the borers will be killed. When borers once get into fruit trees, the "digging-out" process is usually the only resort, although some report that they readily kill the depredator by simply injecting a little carbon bisulfide into the entrance of his burrow and quickly closing it with putty.



1315. Tomato worm attacked by parasitic insects.



1316. Burrows of an apple-tree borer.
The holes at *a* show where the imago or beetle emerged.

Bud- and leaf-feeding insects.—The buds and leaves of horticultural crops often swarm with legions of biting and sucking insects. A mere enumeration of the different kinds of these pests would weary the reader. Some insects, like the rose chafer, work on several different kinds of plants, while many others attack only one or two kinds. In apple orchards, the opening buds are seized upon by the the hungry bud-moth and case-bearing caterpillars, by

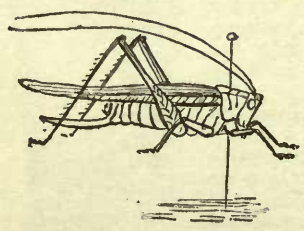
DISEASES AND INSECTS

the newly hatched canker-worms, and by tent-caterpillars, whose tents or "sign-boards" are familiar objects in many orchards. These pests continue their destructive work on the leaves. The pear slug often needs to be checked in its work of skeletonizing the leaves of the pear and cherry. The pear psylla, one of the jumping plant-lice, is a very serious menace to pear-growing in many localities; the fruit is either dwarfed or drops from badly infested trees, and sometimes so many little pumps sucking out its life finally cause the death of the tree. The little blue grape-vine flea-beetle often literally nips the prospective crop of fruit in the bud, or the rose-chafer may swarm over the vines and eat the foliage or blossoms. Currant and gooseberry growers realize that eternal vigilance against the familiar green currant worms is the price of a crop of fruit. The asparagus beetles would soon appropriate every asparagus shoot that appears in many localities. It is a continual struggle against insect pests to get a paying crop of almost any vegetable. The several kinds of cabbage caterpillars would soon riddle the leaves. The hungry striped cucumber beetles can hardly wait for the melon, squash, or cucumber vines to come up. Two sucking insects, the harlequin cabbage bug and the squash stink-bug, are equally as destructive as their biting relatives. The bud- and leaf-feeding insects are usually readily controlled by spraying some poison on their food, or by hitting them with some oil or soap spray. As the female moths of canker-worms are wingless, a wire trap or sticky bandage placed around the trunk of the tree in the late fall and early spring, to capture the moths as they crawl up the tree to lay their eggs, will greatly help to check these serious pests. The collection and burning of the conspicuous egg-rings of the tent-caterpillars at any time between August and the following April will greatly reduce the vast numbers of tents or signboards of shiftlessness in apple orchards. Hand-picking or collecting is the most successful method of controlling the rose-chafer, harlequin cabbage bug, and the squash stink-bug in many cases. Prompt action, guided by a knowledge of the insect's habits and life-history, and any intelligent use of materials and apparatus, are essential in any successful effort to control these bud- and leaf-feeding pests of the horticulturist.



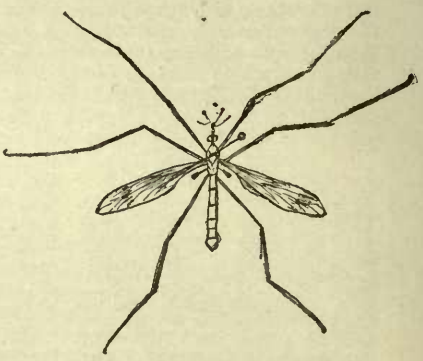
1317. A beetle borer and its work.

The larva bores in the young wood of raspberry and blackberry canes, causing the swellings seen in the picture.



1318. Grasshopper. (Mounted)

Fruit-eating insects.—"Wormy" apples, pears, quinces, plums, peaches, cherries, apricots, grapes, currants and nuts are often the rule rather than the exception. The codlin-moth or apple-worm often ruins from one-third to one-half of the crop each year in many localities; it also infests pears seriously. The apple maggot tunnels its way through and through the flesh of a large percentage of the apples in the northern sections of the country. Most of the wormy plums, peaches, cherries and apricots are the work of the grub of that worst insect enemy of the stone fruits—the plum curculio; the plum gouger, a similar insect, whose grub works in the pit of plums, is equally destructive to this fruit in some states. "Knotty" quinces are largely the work of the adults of the quince curculio, while its grub often ruins the fruit with its disgusting worm-hole. There is also a grape curculio that, with the aid of the caterpillar of a little moth, works havoc in grapes. Currants and gooseberries are often wormy from the work of two or three different kinds of maggots and caterpillars. Two kinds of fruit flies attack the cherry; infested cherries may show no external signs of the presence of the maggot reveling in the juices within. Various small beetles known as weevils, are responsible for most wormy nuts. Most of the fruit-eating insects are out of the reach of the ordinary insecticides. The codlin-moth is a noted exception, however, for the peculiar habit that the little caterpillar has of usually entering the blossom end of the fruit and feeding therein for a few days, gives the man with a poison spray a very vulnerable point of attack. It is only necessary to spray a bit of poison into the open calyx cup within a few days after the petals fall, and let nature soon close the calices and keep the poison therein until the newly-hatched caterpillar includes it in its first menu. Often 95 per cent of the apples that would otherwise be ruined by the worms are saved by an application of paris green at this critical time.



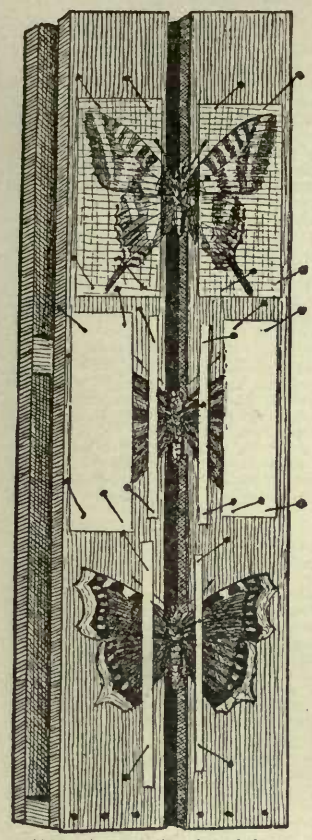
1319. A crane fly. (Mounted)

Plant-lice.—Scarcely a plant escapes the little suction pump or beak of some kind of a plant-louse or aphis. More than 300 different kinds of plant-lice have been identified in the United States, and nearly every kind of fruit, flower, farm or garden crop has its special plant-louse enemy, which is often a serious factor in the production of a crop. These little creatures are so small, so variable, so hard to perceive, present so many different forms in the same species, and have such varied and interesting life-stories to tell, that what is known about them is but a mere beginning as compared to what is yet to be learned. It would take a large volume to include the interesting stories which might be told of the lives and of the relations with ants of some of the commonest of these plant-lice. No other group of insects presents so many curious, varied, interesting, and wonderful problems of life as do the aphids. In the aggregate, the damage done by plant-lice is very great.



1320. A snapping beetle. (Mounted)

At times hundreds of acres of peas have been ruined by an aphid. Nursery stock often suffers severely and bearing fruit trees are often seriously injured by them. About forty different kinds of aphides live in greenhouses where a perpetual warfare has to be waged against them. In four years nearly 100 generations of a common aphis have been reared in greenhouses, and there were no indications of any egg-stage or of male forms during this time, so that they may thus breed indefinitely in houses, their young being born alive and no males appearing. The standard remedies for plant-lice are whale-oil soap, kerosene emulsion, and tobacco in various ways (as a decoction, dry as a dust, or in the form of similar extracts), and these are successfully used to kill the aphides in all situations.



1321. A spreading board for drying soft-winged insects.

Scale insects.—Since the advent of San José scale into the eastern United States, scale insects of all kinds have attracted world-wide attention. They are all small insects, and derive their name from the fact that their tender bodies are protected by hard, scale-like coverings secreted by the insects. Thus protected, they are difficult insects to kill, and as they are easily transported on nursery stock, buds or cions, and also multiply rapidly, the scale insects are justly to be considered as among the most dangerous and destructive of injurious insects. A single female San José scale may rear a brood of from 100 to 600 young, and there may be four or five generations a year; and more than 2,000 eggs have been laid by a single Lecanium scale. The scale insects, the dreaded San José species included, can be controlled successfully by judicious, intelligent and timely work with sprays of lime-sulfur, crude petroleum, or hydrocyanic acid gas, which should be used in the case of nursery stock. Since 1889 fumigation with hydrocyanic acid gas has been extensively practised in the citrus orchards of California, and now Florida and South African fruit-growers are also using it in their orchards. Large gas-tight tents or boxes are placed over the trees and the gas then generated within. Much nursery stock is now treated with the gas in tight boxes or houses; this is required by law in many states, and it should be practised in other regions. Recently greenhouses, railway coaches, rooms in private houses, and whole flouring mills have been effectively fumigated with this gas.

Insects are preserved in collections by securing them in tight cases by means of a pin inserted through the thorax, or through the right wing if the subject is a beetle. Moths and butterflies are pinned in position on a spreading-board until thoroughly dried. See Figs. 1318–1322. Every horticulturist should make a collection of injurious insects.

Insect literature for horticulturists.—Horticulturists should keep in close touch with the experiment stations and state entomologists of their own and of other states, and also with the Department of Agriculture at Washington; for it is from these sources that the best and latest advice regarding injurious insects is now being disseminated free, either by personal correspondence or by means of bulletins. Among the books, one or more of which may well find a place in a horticulturist's library are the following: Weed's "Insects and Insecticides," Lodeman's "The Spraying of Plants," Saunders' "Insects Injurious to Fruits," Sanderson's "Insect Pests of Orchard, Farm and Garden," and Slingerland and Crosby's "Fruit Insects."

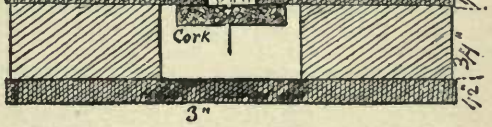
M. V. Slingerland.
C. R. Crosby†

Other invertebrate animals.

Mites.—Mites belong to the class of animals known as Arachnida, which are closely related to insects. Spiders and scorpions also belong in this group. Mites are small creatures, usually possessing four pairs of legs when mature, and the body is not divided into three divisions as in the case of insects. The greenhouse red-spider (*Tetranychus bimaculatus*) is one of the most common and injurious species. It occurs on a wide variety of plants grown under glass and also out-of-doors on the foliage of many wild and cultivated plants. It is about $\frac{1}{50}$in. long and varies in color from yellow through orange to brown and dark green, often with a darker spot on each side of the body. It spins a very delicate silken web-like nest over its breeding-ground. It can be killed on the foliage of plants grown in the open with soap solution, dusting with sulfur, and hydrated lime, or by using a flour-paste spray. In greenhouses, it is best controlled by repeated spraying with water, using much force and little water to avoid drenching the beds.

The clover mite (*Bryobia pratensis*) is a minute, spider-like, oval, reddish brown mite about $\frac{3}{100}$inch in length with long front legs. It attacks the foliage of many fruit and forest trees as well as clover and grasses. The tiny, round, reddish eggs often occur in great numbers on the bark of trees in winter giving the branches a reddish color. It may be controlled by the same treatment as for red-spider. In addition, the eggs may be killed with a lime-sulfur solution while the trees are dormant.

The pear-leaf blister-mite (*Eriophyes pyri*) differs from most other mites in having only two pairs of legs and in its elongate body. The mite is only $\frac{1}{125}$inch in length; it burrows in the tissue of the leaf, causing blister-like galls. The eggs are laid within the gall,



1322. A cross-section of spreading board in front of the cleat "*d*," in Fig. 1321.

and some of the mites when mature leave through a small opening and migrate to new leaves. The mature mites hibernate under the bud-scales. This pest is controlled by applications of lime-sulfur or miscible oils while the trees are dormant.

Nematodes.—A species of nematode worm (*Heterodera radicicola*) lives parasitically in the roots of a wide variety of wild and cultivated plants producing enlarged knots or swellings. This disease is known as

root-knot and is more prevalent in light soils. It is especially troublesome in greenhouses. The adult female worm is flask-shaped, .5 to 1 mm. in length, pearly white in color, and is found within the knots on the roots. Each female lays several hundred eggs. The young worms may continue within the same root or migrate through the soil to others. Nematode root-galls have been found on nearly 500 different species of plants. It is especially destructive to okra, hollyhock, *Amarantus tricolor*, peach, snapdragon, celery, heart-leaved basil, wax gourd, beet, rape, red pepper, balloon vine, melon papaw, catalpa, endive, watermelon, coffee, muskmelon, cucumber, squash, pumpkin, carrot, deutzia, California poppy, fig, soybean, pecan, morning-glory, lettuce, gourd, sweet pea, flax, tomato, tobacco, peony, ginseng, passiflora, petunia, tuberose, cherry, pomegranate, eggplant, potato, salsify, clovers, violet, Old World grape. See page 1023.

This pest may be controlled in greenhouses by the use of live steam to sterilize the soil or by a weak solution of formaldehyde, one part, 36 to 40 per cent formaldehyde, to one hundred parts water, applied at the rate of one to one and one-half gallons to every square yard of soil surface of shallow beds. After the application, the soil should be thoroughly stirred and planting should not be done till at least ten days later. Under field conditions, the problem is more difficult. The most feasible method is a system of crop-rotation in which an immune crop is grown for at least two years between susceptible crops. One of the most resistant crops is the Iron variety of cowpea. Clean cultivation should be practised so as to destroy all susceptible plants.

Insecticides.

Insecticides are substances used to kill insects, as poisons, washes and gases. Insects are subject to many natural checks, such as wind, rains, sudden changes of temperature, the attacks of parasites and predaceous enemies, and are often destroyed in great numbers by bacterial and fungous diseases. In spite of these natural checks it is, however, usually necessary to resort to a spray or some other artificial insecticide for the protection of our crops.

The essential requirements for a satisfactory insecticide are: efficient killing power, safety to the foliage, cheapness and ease of application. The choice of an insecticide for any particular case will depend upon a number of factors: upon the structure, habits, and life-history of the insect to be killed; and upon the susceptibility of the host plant to injury, its mode of growth and the conditions under which it is cultivated. Some insects, as the plant-lice, are soft-bodied and provided with a thin and delicate integument; others, like the beetles and wireworms, have hard, horny shells impervious to ordinary spray liquids; some insects bite off and swallow portions of the plant, while others merely suck out the sap by means of a slender tube; some are injurious in the larval stage, others as adults; some attack the roots, some the foliage and fruit, while others burrow in the trunk and branches. Plants vary greatly in their susceptibility to injury from the use of insecticides; the peach and Japan plum have especially tender foliage, while the apple is not so easily injured. All these points and many more must be considered in selecting an insecticide which will be adapted to the control of any injurious insect. Our methods of fighting insects are constantly changing as new facts are discovered, new methods devised and new insecticides invented. Our present methods are the results of a more or less unconscious coöperation extending over many years between the practical grower, the student of insect life and the progressive manufacturers of spraying materials and spray machinery.

Insecticides may be classed into those which are eaten with the food and kill by poisoning; those that kill by contact with the insect's body; and fumes of gases used for fumigation. The poisons are effective against the biting or chewing and lapping (fruit flies) insects; the contact insecticides are used as a rule against sucking insects; and fumes and gases are employed principally in greenhouses and for the fumigation of nursery stock, stored seeds, and citrus trees.

Poisoning insecticides.

The most widely used substance for the poisoning of insects is arsenic in its various compounds. For this purpose only compounds insoluble in water can be used, as soluble arsenic is very injurious to foliage.

White arsenic.—This is the cheapest form in which arsenic can be obtained. It is a white powder, soluble in water and very injurious to foliage. A cheap and efficient insecticide may be prepared from it as follows:

For use with bordeaux mixture only. Sal-soda, two pounds; water, one gallon; arsenic, one pound. Mix the white arsenic into a paste and then add the sal-soda and water, and boil until dissolved. Add water to replace any that has boiled away, so that one gallon of stock solution is the result. Use one quart of this stock solution to fifty gallons of bordeaux mixture for fruit trees. Make sure that there is enough lime in the mixture to prevent the caustic action of the arsenic.

For use without bordeaux mixture. Sal-soda, one pound; water, one gallon; white arsenic, one pound; quicklime, two pounds. Dissolve the white arsenic with the water and sal-soda as above, and use this solution while hot to slake the two pounds of lime. Add enough water to make two gallons. Use two quarts of this stock solution in fifty gallons of water.

As there is always some danger of foliage injury from the use of these home-made arsenic compounds, and as they cannot be safely combined with the dilute lime-sulfur when used as a summer spray, they are now rarely employed in commercial orchard spraying.

Paris green.—Paris green is composed of copper oxid, acetic acid and arsenious oxid chemically combined as copper-aceto-arsenite. By the National Insecticide Law of 1910, paris green must contain at least 50 per cent arsenious oxid and must not contain arsenic in water-soluble form equivalent to more than 3½ per cent arsenious oxid. For many years paris green has been the standard insecticide for orchard use, but is now largely replaced by the safer and more adhesive arsenate of lead. In spraying apples, paris green is used at the rate of one-half pound to one hundred gallons of water or bordeaux mixture. When used with water, lime twice the bulk of the paris green should be added to lessen the danger of foliage injury. Paris green cannot safely be used with either the dilute lime-sulfur as used for summer spraying or with the self-boiled lime-sulfur.

London purple.—London purple is an arsenite of lime and is a by-product in the manufacture of aniline dyes. Its composition is variable, the arsenic content varying from 30 to 50 per cent. Owing to the presence of much soluble arsenic it is likely to cause foliage injury, and it is now little used in commercial spraying.

Arsenate of lead.—Arsenate of lead was first used as an insecticide in 1893, in Massachusetts. It has now almost entirely replaced paris green for orchard work throughout the country. It adheres better to the leaves, may be used at considerably greater strength without injuring the foliage and may be combined with a dilute lime-sulfur solution or with the self-boiled lime-sulfur. Chemically, arsenate of lead may be either triplumbic arsenate or plumbic-hydrogen arsenate. The commercial product usually consists of a mixture of these two forms, the proportion depending on the method of manufacture employed. It is usually sold in the form of a thick paste, but for some purposes the powdered form is preferred. Under the National Insecticide Law of 1910, arsenate of lead paste must not contain more than 50 per cent water and must contain the arsenic equivalent of at least 12½ per cent arsenious oxid. The water-soluble arsenic must not exceed an equivalent of three-fourths of 1 per cent of arsenic oxid. In the best grades of arsenate of lead paste the chemical is in a finely divided condition, and thus when diluted for use remains in suspension for a considerable time. Arsenate of lead is used at various strengths, depending upon the insect to be killed and on the susceptibility of the foliage to injury. Four pounds in one hundred gallons can be used on the peach if combined with the self-boiled lime-sulfur; on apple, four or five pounds in one hundred gallons is usually sufficient; on grapes for killing the grape root-worm beetles and the rose-chafer, eight to ten pounds in one hundred gallons have been found necessary. The poison is more readily eaten by these beetles if sweetened by two gallons of molasses in one hundred gallons, but, unfortunately, the addition of molasses greatly decreases the adhesiveness of the poison. Some species of fruit flies may be controlled by the use of sweetened arsenate of lead sprayed on the foliage of the plants at the first appearance of the flies. They lap up the poison with their fleshy tongue-like mouth-parts and succumb before ovipositing.

Arsenite of zinc.—Arsenite of zinc is a light fluffy powder and contains the equivalent of about 40 per cent arsenious oxid. It has been used extensively on the Pacific slope as a substitute for arsenate of lead. It kills somewhat more quickly and is fairly safe on apple foliage when used with bordeaux mixture or with lime. When sweetened with molasses, it is injurious to foliage. One pound of zinc arsenate is equivalent to about three pounds of arsenate of lead. In orchard experiments, as a rule, it has not shown that it is superior to the latter.

Hellebore.—Hellebore is a light brown powder made from the roots of the white hellebore plant (*Veratrum album*), one of the lily family. It is applied both dry and in water. In the dry state, it is usually applied without dilution, although the addition of a little flour will render it more adhesive. In water, four ounces of the poison is mixed with two or three gallons, and an ounce of glue, or thin flour paste, is sometimes added to make it adhere. A decoction is made by using boiling water in the same proportions. Hellebore soon loses its strength, and a fresh article should always be demanded. It is much less poisonous than the arsenicals, and should be used in mixed with two or three gallons, and an ounce of glue, or thin flour paste, is sometimes added to make it adhere. A decoction is made by using boiling water in the same proportions. Hellebore soon loses its strength, and a fresh article should always be demanded. It is much less poisonous than the arsenicals, and should be used in place of them upon ripening fruit. It is used for various leaf-eating insects, particularly for the currant-worm and rose-slug.

Contact insecticides.

The most important contact insecticides are soaps, sulfur, sulfur compound, and oily or resinous emulsions.

Soaps.—The most commonly used soap solution is that prepared from fish-oil soap. The commercial brands of this soap are usually by-products and contain many impurities; further, many of them contain an excess of free or uncombined alkali and are thus likely to injure young and tender foliage. A good fish-oil soap may be prepared by the following formula: Caustic soda, six pounds; water, one-half gallon; fish-oil, twenty-two pounds. Dissolve the caustic soda in the water and then add the fish-oil gradually under constant and vigorous stirring. The combination occurs readily at ordinary summer temperatures, and boiling is unnecessary. Stir briskly for about twenty minutes after the last of the oil has been added. There is now on the market a good brand of insecticide soap prepared from cotton-seed oil soap stock or from an impure grade known as pancoline.

Sulfur.—Sulfur may be obtained in two forms,—flowers of sulfur and flour of sulfur. In the form of a powder or dust, sulfur is especially valuable against red-spider. In California, flowers of sulfur mixed with equal parts of hydrated lime is blown on the trees for the control of red-spider and mite. It may also be used for the same purpose mixed with water at the rate of one pound in three gallons of water, to which has been added a little soap to keep the sulfur in suspension. The mixture should be agitated constantly during spraying. The sulfur remains longer in suspension if it is first made into a paste with water containing one-half of 1 per cent of glue. Page 1028.

Lime-sulfur solution.—A solution of lime-sulfur was first used as an insecticide in California in 1886. It is now the standard remedy for blister mite, San José scale and similar scales, as well as an efficient fungicide. The lime-sulfur solution may be purchased in the concentrated form or may be prepared as follows: Lump lime (95 per cent calcium oxid), thirty-eight pounds; lump lime (90 per cent calcium oxid), forty pounds; sulfur, eighty pounds; water, fifty gallons. Make a paste of the sulfur with about ten gallons of hot water. Add the lime. As the lime slakes, add hot water as necessary to prevent caking. When the lime has slaked, add hot water to make fifty gallons and boil one hour, stirring constantly. Water should be added from time to time to keep the liquid up to fifty gallons. Store in air-tight hardwood barrels. Test the strength of the solution with a Baumé hydrometer and dilute for use according to the following table (see also p. 1029):

DILUTIONS FOR DORMANT AND SUMMER SPRAYING WITH LIME-SULFUR MIXTURES

Reading on hydrometer	Amount of dilution. Number of gallons of water to one gallon of lime-sulfur solution.		
	For San José scale	For blister mite	For summer spraying of apples
Degrees Baumé			
35	9	12½	45
34	8¾	12	43¼
33	8¼	11½	41½
32	8	11	40
31	7½	10½	37¾
30	7¼	10	36¼
29	6¾	9½	34¼
28	6½	9	32¼
27	6	8½	31
26	5¾	8	29½
25	5¼	7½	27¾
24	5	7	26
23	4½	6½	24¼
22	4¼	6	22¾
21	3¾	5½	21¼
20	3½	5	19¾
19	3¼	4¾	18¾
18	3	4¼	17
17	2¾	4	16
16	2½	3¾	15
15	2¼	3½	14
14	2	3	12¾

Emulsions.—Emulsions are oily or resinous sprays in which these substances are suspended in water in the form of minute globules, a condition brought about by the addition of soap. They form an important class of contact insecticides, useful particularly against scale insects and plant-lice.

Kerosene emulsion.—Kerosene emulsion is the oldest of our contact insecticides. It is especially valuable for use against plant-lice and other small, soft-bodied insects. It is prepared by the following formula: Soap, one-half pound; water, one gallon; kerosene, two gallons. Dissolve the soap in hot water; remove from the fire and, while still hot, add the kerosene. Pump the liquid back into itself for five or ten minutes or until it becomes a creamy mass. If properly made, the oil will not separate on cooling. For use on dormant trees, dilute with five to seven parts of water. For killing plant-lice on foliage, dilute with ten to fifteen parts of water.—Crude-oil emulsion is made in the same way by substituting crude oil in place of kerosene. The strength of oil emulsions is frequently indicated by the percentage of oil in the diluted liquid: for a 10 per cent emulsion, add seventeen gallons of water to three gallons of stock emulsion; for a 15 per cent emulsion, add ten and one-half gallons of water to three gallons of stock emulsion; for a 20 per cent emulsion, add seven gallons of water to three gallons of stock emulsion; for a 25 per cent emulsion, add five gallons of water to three gallons of stock emulsion.

Distillate emulsion.—Distillate emulsion is widely used in California. Distillate (28° Baumé), twenty gallons; whale-oil soap, thirty pounds; water, twelve gallons. Dissolve the whale-oil soap in the water which should be heated to the boiling point, add the distillate and agitate thoroughly while the solution is hot. For use, add twenty gallons of water to each gallon of the stock solution.

Carbolic acid emulsion.—This spray is used in California for mealy-bugs, plant-lice, and the soft brown scale: Whale-oil soap, forty pounds; crude carbolic acid, five gallons; water, forty gallons. Dissolve the soap completely in hot water, add the carbolic acid, and heat to the boiling point for twenty minutes. For use, add twenty gallons of water to each gallon of stock solution.

Miscible oils.—There are now on the market a number of concentrated oil emulsions, known as soluble or miscible oils, intended primarily for use against the San José scale. For this purpose they are fairly effective when diluted with not more than fifteen parts of water. To lessen danger of injury to the trees, applications should not be made when the temperature is below freezing, nor when the trees are wet with snow or rain. Methods have been devised for preparing these concentrated emulsions at home, but as there is considerable danger attending the process, it is better to buy them ready-made.

Tobacco.—Tobacco is one of our most useful insecticides. The poisonous principle in tobacco is an alkaloid nicotine, which in the pure state is a colorless fluid; slightly heavier than water, of little smell when cold and with an exceedingly acrid burning taste even when largely diluted. It is soluble in water and entirely volatile. It is one of the most virulent poisons known; a single drop is sufficient to kill a dog. Commercial tobacco preparations have been on the market for many years. The most important of these are black leaf, "black leaf 40," and nicofume.

Black Leaf.—Black leaf was formerly the most widely used tobacco extract. It contains only 2.7 per cent nicotine and has now been replaced by the more concentrated extracts. It is used for plant-lice at the rate of one gallon to sixty-five gallons of water.

"Black leaf 40."—"Black leaf 40" is a concentrated tobacco extract containing 40 per cent nicotine sulfate. Its specific gravity is about 1.25. In this preparation the nicotine is in a non-volatile form, it having been treated with sulfuric acid to form the sulfate. "Black leaf 40" is used at strengths varying from one part in 800 parts of water to one part in 1,600 parts. It can be satisfactorily combined with other sprays, as for example, lime-sulfur solution, arsenate of lead, and the various soap solutions. When used with water, about four pounds of soap should be added to make the mixture spread and stick better.

Nicofume is a tobacco extract containing 40 per cent of nicotine in the volatile form. It is intended primarily for use in greenhouses. Strips of paper soaked in this preparation are smudged in greenhouses to destroy aphids.

Tobacco is also used in the form of dust for the same purpose. It is especially valuable against root-lice on asters and other plants. Tobacco extracts can be made at home by steeping tobacco stems in water, but as they vary greatly in nicotine content and are sometimes likely to injure tender foliage, it is better to buy the standardized extracts.

Pyrethrum.—A very fine, light brown powder, made from the flower-heads of species of pyrethrum. It is scarcely injurious to man. Three brands are on the market:

Persian insect-powder, made from the heads of *Pyrethrum roseum*, a species also cultivated as an ornamental plant. The plant is native to the Caucasus region.

Dalmation insect-powder, made from *Pyrethrum cinerariæfolium.*

Buhach, made in California from cultivated plants of *Pyrethrum cinerariæfolium.*

When fresh and pure, all these brands appear to be equally valuable, but the home-grown product is usually considered most reliable. Pyrethrum soon loses its value when exposed to the air. It is used in various ways:

(1) In solution in water, one ounce to three gallons. Should be mixed up twenty-four hours before using.

(2) Dry, without dilution. In this form it is excellent for thrips and lice on roses and other bushes. Apply when the bush is wet. Useful for aphis on house plants.

(3) Dry, diluted with flour or any light and fine powder. The poison may be used in the proportion of one part to from six to thirty of the dilutent.

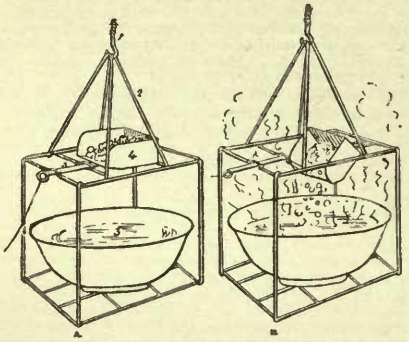
(4) In fumigation. It may be scattered directly upon coals, or made into small balls by wetting and molding with the hands and

then set upon coals. This is a desirable way of dealing with mosquitos and flies.

(5) In alcohol. (*a*) Put a part of pyrethrum (buhach) and four parts alcohol, by weight, in any tight vessel. Shake occasionally, and after eight days filter. Apply with an atomizer. Excellent for greenhouse pests. For some plants it needs to be diluted a little. (*b*) Dissolve about four ounces of powder in one gill of alcohol, and add twelve gallons of water.

(6) Decoction. Whole flower-heads are treated to boiling water, and the liquid is covered to prevent evaporation. Boiling the liquid destroys its value.

Good insect-powder can be made from *Pyrethrum roseum*, and probably also from *P. cinerariæfolium*, grown in the home garden.



1323. Device for discharging the cyanide into the acid.

Bait, vegetable bait.—Spray a patch of clover or some other plant that the insects will eat with paris green or some other arsenical; mow it close to the ground, and while fresh place it in small piles round the infested plants. To avoid wilting of the bait, cover the heaps with a shingle or piece of board.

Bran-arsenic mash.—White arsenic, one-half pound, or paris green, one pound; bran, fifty pounds. Mix thoroughly and then add enough water to make a wet mash. Sugar or molasses may be added, but is unnecessary. Poisoned baits are used against cutworms and grasshoppers.

Kansas grasshopper bait.—This bait is the most efficient means of controlling grasshoppers yet devised. It is prepared as follows: Bran, twenty pounds; paris green, one pound; syrup, two quarts; oranges or lemons, three fruits; water, three and one-half gallons. Mix the bran and paris green thoroughly in a wash-tub while dry. Squeeze the juice of the oranges or lemons into the water; chop the pulp and peel fine and add them also. Dissolve the syrup in the water and wet the bran and poison with the mixture, stirring at the same time so as to dampen the mash thoroughly. Sow the bait broadcast in the infested area early in the morning.

Criddle mixture.—Mix one pound of paris green with one-half barrel of horse droppings, and add one pound of salt if the material is not fresh. For use against grasshoppers.

Gas tar is used extensively for painting wounds to keep out the moisture and prevent the entrance of insects. It is also sometimes used on peach trees to keep out the borers. In this case it should be applied in the spring only, as there is danger of injuring the trees in the fall.

Asphalt.—Certain grades of asphalt have been used successfully on peach in California to keep out the Pacific peach tree-borer. Experiments in the eastern states indicate that it may be used to advantage against the common peach tree-borer.

Hot-water.—Submerge affected plants or branches in water at a temperature of about 125°. For aphis. It will also kill rose-bugs at a temperature of 125° to 135°.

Gasolene torch.—The gasolene torch has been successfully used for the control of scale insects on date palms in Arizona. The trees are first pruned closely, drenched with gasolene and fired. They are then scorched with a gasolene blast torch.

Flour paste.—Mix a cheap grade of wheat flour with cold water, making a thin batter, without lumps; or wash the flour through a wire screen with a stream of cold water. Dilute until there is one pound of flour in each gallon of mixture. Cook until a paste is formed, stirring constantly to prevent caking or burning. Add sufficient water to make up for evaporation. For use, add eight gallons of this stock solution to one hundred gallons of water. Used for red spider in California.

General practices.

Cleanliness.—Much can be done to check the ravages of insects by destroying their breeding-places and hiding-places. Weeds, rubbish, and refuse should be eliminated.

Hand-picking is often still the best means of destroying insects despite all the perfection of machinery and of materials. This is, particularly true about the home grounds and in the garden. The cultivator should not scorn this method.

Promoting growth.—Any course that tends to promote vigor will be helpful in enabling plants to withstand the attacks of plant-lice and other insects.

Burning.—Larvæ which live or feed in webs, like the tent-caterpillar and fall web-worm may be burned with a torch. The lamp or torch used in campaign parades finds its most efficient use here.

Banding.—To prevent the ascent of canker-worm moths and gypsy-moth caterpillars, various forms of sticky bands are in use. For this purpose there is no better substance than "tree tanglefoot." It may be applied directly to the tree-trunk, but when so used leaves an unsightly mark and requires more material than when the following method is used: First place a strip of cotton batting 3 inches wide around the trunk; cover this with a strip of tarred paper 5 inches wide; draw the paper tight and fasten at the lap only with three or four tacks. Spread the tanglefoot on the upper two-thirds of the paper, and comb it from time to time to keep the surface sticky. Burlap bands are made by tying or tacking a strip of burlap around the trunk and letting the edges hang down. The larvæ will hide under the loose edge, where they may be killed. Banding is now little used for codlin-moth, since spraying with poison has been found so much more effective.

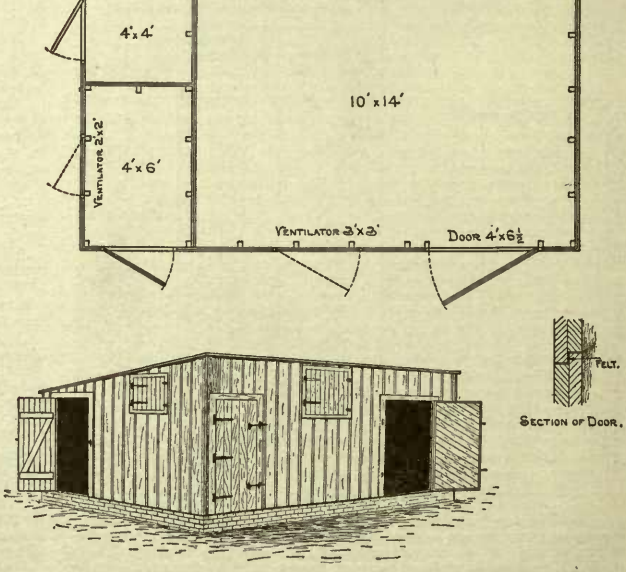
Fumigation.

Poisonous gases are widely used in killing insects under certain conditions. Hydrocyanic acid gas is employed in the fumigation of greenhouses and citrus trees. It is a most deadly and effective material. In Europe, fumigation with this gas is known as cyaniding and cyanization. Nicotine preparations are used extensively in greenhouse fumigation. Carbon bisulfid is employed almost exclusively for the treatment of stored grains and seeds.

Hydrocyanic acid gas.—This gas is generated by adding potassium or sodium cyanide to dilute sulfuric acid. The gas is a deadly poison, and great care should be taken not to inhale it. One breath is fatal!

Potassium cyanide is a white amorphous salt that readily absorbs moisture when exposed to the air. Pure potassium cyanide contains 40 per cent of cyanogen (CN) by weight. When potassium cyanide (KCN) is placed in dilute sulfuric acid the cyanogen (CN) unites with the hydrogen (H) of the acid (H_2SO_4) to form hydrocyanic acid gas (HCN). In the preparation of this gas for fumigation purposes use a potassium cyanide which is at least 98 per cent pure. The chemicals should always be combined in the following proportions: Potassium cyanide, one ounce; sulfuric acid, one fluid ounce; water, three fluid ounces.

Always use an earthen dish, *pour in the water first*, and add the sulfuric acid. When all is ready, drop in the proper quantity of potassium cyanide and retire



1324. Shed for the fumigation of nursery stock.

immediately, before the gas arises. Fig. 1323 shows a device used abroad (from the "Gardening World") for dumping the cyanide (at 4) into the acid by means of a cord that extends outside the house.

White-fly.—The quantity of chemicals used for a given space will depend on the nature of the insects to be killed and the susceptibility of the plants to injury. This quantity is usually indicated by amount of potassium cyanide required for each 100 cubic feet of space. For treating white-fly on tomatoes in greenhouses, use one ounce to 3,000 cubic feet, letting the fumigation continue all night. The same treatment applies for cucumber. Fumigate on dry, dark nights when there is no wind. The house should be as dry as practicable and the temperature not above 60° F.

Greenhouses.—No one formula can be given for fumigating with hydrocyanic acid gas the different kinds of plants grown in greenhouses, as the species and varieties differ greatly in their ability to withstand the effects of the gas. For the general run of greenhouse subjects, the practice is to use one ounce of potassium cyanide, one ounce of sulfuric acid, two ounces water, to each 2,000 cubic feet of space. The cyanide should be 98 per cent pure. Fumigate at night when there is no wind and when the plants are dry and the house cool; leave the house closed till morning, and open it up and let it air out before entering it. This applies to chrysanthemums, cinerarias, azaleas, bulbs, carnations and other common plants.

Ferns and roses are very susceptible to injury, and fumigation, if attempted at all, should be performed with great care. In cases of doubt, or when there is reason to suspect that the plants are particularly susceptible, and when one does not have definite instructions, it is well to fumigate with the weakest strength in use, and increase it in subsequent fumigations if the insects are not killed and if the plants are not injured.

Violets are very susceptible to injury from tobacco fumigation, and commercial growers therefore regularly use hydrocyanic acid gas for the control of "green-fly" and "black-fly," two species of plant-lice. The latter is much more difficult to kill. For over-night fumigation from one-fourth to one-half ounce potassium cyanide to each 1,000 cubic feet is generally used. Sometimes one ounce potassium cyanide to each 1,000 cubic feet is used, the fumigation continuing only from twenty-five to thirty-five minutes This treatment is more likely to injure the plants. Violets may be injured severely by the gas without the leaves being burned. This injury consists in a weakening of the plants which defers blooming for several weeks.

Dormant nursery stock may be fumigated with hydrocyanic acid gas in a tight box or fumigating-house made especially for the purpose. Fumigating-houses are built of two thicknesses of matched boards with building-paper between, and are provided with a tight-fitting door and ventilators. The stock should be reasonably dry to avoid injury, and should be piled loosely in the house to permit a free circulation of the gas. Use one ounce of potassium cyanide for each 100 cubic feet of space, and let the fumigation continue forty minutes to one hour.

A fumigating-house is shown in Fig. 1324 (from a bulletin on "The San José Scale," by A. E. Stene, of the Rhode Island State Board of Agriculture and College of Agriculture). It is a house or box as nearly air-tight as possible. The floor should have a movable slat grating on which the plants may be laid, some distance from the ground, to allow of circulation of the gas. The house shown in the cut is 8 feet high in front and 6 feet in rear, and the larger room contains 980 cubic feet, requiring approximately ten ounces of cyanide. The other rooms allow of smaller quantities to be fumigated. The doors opening from the outside provide quick discharge of the air when fumigation is completed.

Fumigation of citrus trees.—In this case, the tree to be fumigated with the hydrocyanic acid gas is covered with an octagonal sheet tent (Fig. 1325) made of six and one-half ounce special drill or eight-ounce special army duck, and the gas is generated in the ordinary way beneath it. The tent is so marked that when in position it is an easy matter to determine the distance over the tent and the circumference at the ground. When these figures are known, the proper dosage may be obtained from the following chart, which has been prepared for a strength of one ounce of cyanide for each 100 cubic feet of space:

DISTANCE AROUND, IN FEET.

DISTANCE OVER, IN FEET.	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	
10	2	2	2	2	2																							10
12	2	2	3	3	3	3																						12
14	3	3	3	3	3	3	4	4	4	4	4	5																14
16	3	3	3	3	4	4	4	4	4	5	5	5	5	5														16
18	3	3	3	4	4	4	5	5	5	5	5	5	5	6														18
			20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	
20			3	4	4	5	5	5	5	5	5	6	6	6	7	7	8	8										20
22					5	5	5	5	5	5	6	6	7	7	8	8	8	8										22
24						5	5	5	6	6	6	7	8	8	8	8	9	9										24
26							5	6	6	7	7	8	8	8	8	9	10	10	10	11	11	11						26
28								6	7	8	8	8	8	9	9	10	11	11	11	11	12	12						28
								30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	
30								7	8	8	8	9	9	10	10	11	11	11	11	12	13	14	14	14	15	16	16	30
32											9	10	10	11	11	12	12	12	13	13	14	14	14	15	16	16	17	32
34												10	11	11	12	13	13	14	14	14	14	15	16	16	17	17	17	34
36												11	11	12	13	13	14	14	15	15	16	17	17	17	17	18	19	36
38													12	12	13	14	14	15	16	16	17	17	17	18	18	19	20	38
													40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	
40													12	13	14	14	15	15	16	17	17	18	18	19	20	20	20	40
41														14	14	15	15	16	17	17	18	18	19	20	20	20	21	41
42															15	15	16	17	17	18	19	19	20	20	20	21	21	42
43																16	17	17	18	19	19	20	20	20	20	21	22	43
44																		17	18	19	19	20	20	20	21	22	22	44
																		50	52	54	56	58	60	62	64	66	68	
45																		17	18	19	20	20	20	21	22	23	23	45
46																		18	19	20	20	20	21	22	22	23	23	46
47																		18	19	20	20	21	22	22	23	23	24	47
48																		19	20	20	21	22	22	23	23	24	24	48
49																		19	20	21	21	22	23	23	23	24	25	49

Dosage chart for fumigating citrus trees with high-grade sodium cyanide (Bureau of Entomology, United States Department of Agriculture).

The top line of numbers, beginning at 16 and continuing to 68, represents the distance in feet around the bottom of the tent. The outer vertical columns of larger numbers running from 10 to 49 represent the distance in feet over the top of the tent. The number of ounces of cyanide to use for a tree of known dimensions is found in that square where the vertical column

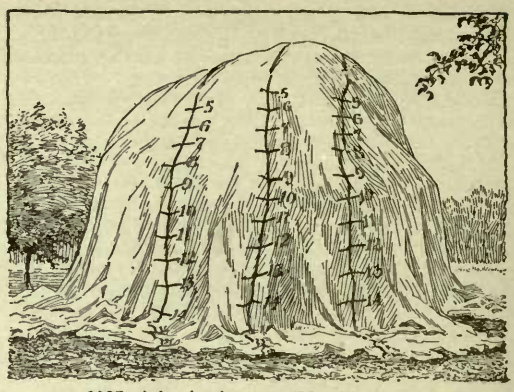
DISEASES AND INSECTS

headed by the distance around the tree intersects the horizontal line of figures corresponding to the distance over. For certain insects it is not advisable to use the full dosage schedule.

Sodium cyanide (NaCN) is coming into use as a substitute for potassium cyanide. When pure, this compound contains 53 per cent of cyanogen; that is, about 33 per cent more of cyanogen than is present in potassium cyanide. It is customary to indicate the strength of sodium cyanide in terms of potassium cyanide; that is, pure sodium cyanide is said to be 133 per cent pure. This means that 100 pounds of sodium cyanide will yield as much cyanogen as 133 pounds of potassium cyanide. For fumigation purposes, sodium cyanide should be at least 124 per cent pure and should not contain more than 1 per cent of common salt.

Because of the greater content of cyanogen of sodium cyanide, a smaller quantity is required. The chemicals should be combined in the following proportions: Sodium cyanide, one ounce; sulfuric acid, one and one-half fluid ounces; water, two ounces.

The following dosage schedule corresponds to the one given above for potassium cyanide:



1325. A fumigating tent (Morrill system).

	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	
10	1	1	1	1½	1½																												10
12	1½	1½	1½	1½	2	2	2½																										12
14	1½	2	2	2½	2½	2½	3	3	3½	4	4½	5																					14
16	2	2½	2½	3	3	3	3½	3½	4	4½	5	5½	6	7																			16
18			3	3	3½	3½	4	4½	4½	5	5½	6	7	7½	8																		18
			20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	
20			3	4	4½	5	5½	5½	6	6½	7	7	8	8½	9	9½																	20
22				4½	5	5½	6	6½	7	7½	7½	8	8½	8½	9½	10	10½																22
24					5½	6½	7	7½	8	8½	9½	9½	9½	10	10½	11	11½	12															24
26							7	8	8½	9	9½	10	10½	10½	11	11	11½	12	13	14	14½	15											26
28								8½	9½	10	10½	11	11½	11½	12½	12½	13	13½	14	14½	15½	16											28
								30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	
30									10	11	11½	12	12½	13	13½	14	14½	14½	15	15½	16½	17½	18	19	20	20½	21½						30
32											12	12½	13	14	15	15½	16	16½	17	17½	18	18½	19	19½	20½	21½	22½						32
34												13	14	15	16	17	17½	18	18½	19	19½	20	20½	21	21½	22½	23						34
36												14	15	16	17	17½	18	19½	20	20½	21½	21½	22	22½	23	23½	25½						36
38													16	16½	17½	18½	19	20½	21	21½	22	23	23½	24	24½	25	25½						38
													40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	
40														17	18	19	20	21	22	22½	23	24	24½	25	25½	26	26½	27	27½	28				40
41														18	19	20	21	22	22½	23½	24	24½	25	25½	26	26½	27	27½	28	28½	29			41
42															20	20½	22	22½	23	24½	25	25½	26	26½	27	27½	28	28½	29	29	30	30½		42
43																21½	22½	23	23½	25	25½	26	26½	27	27½	28	28½	29	29½	30	30½	31		43
44																	23	23½	24	25	26	26½	27	27½	28	28½	29	29½	30	31	31½	32		44
																		50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	
45																		24	25	26	26½	27	27½	28	29	29½	30	30½	31	31½	32	33		45
46																		24½	25½	26½	27½	27½	28	28½	29½	30	30½	31	31½	32½	33	34		46
47																		25	26	27	27½	28	28½	29	30	30½	31½	32	32½	33	34	35		47
48																		25½	26½	27½	28	28½	29	29½	30½	31	32	32½	33	34	35	36		48
49																		26½	27	28	28½	29	29½	30	31	31½	32½	33	34	35	36	37		49
																		50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	
50																							30	31	31½	32½	33	33½	35	36	37	38	50
51																							31	31½	32	33	33½	34	36	37	38	39	51
52																							31½	32	33	33½	34	35	37	38	39	41	52
53																							32	32½	33½	34	35	36	38	39	40	41	53
54																							32½	33	34	35	36	37	39	40	41	42	54
																							60	62	64	66	68	70	72	74	76	78	
55																							33	34	35	36	37	37½	40	41	42	43	55
56																							34	35	36	37	37½	38	40½	42	43	44	56
57																							34½	35½	36½	37½	38½	39	41	42½	43½	45	57
58																							35	36	37	38	39	40	42	43	44	46	58
59																							36	36½	38	39	40	40½	42½	43½	45	47	59

Dosage chart for fumigating citrus trees with potassium cyanide (Bureau of Entomology, United States Department of Agriculture).

Nicotine preparations.—Tobacco is used in various ways in fumigating greenhouses. For smoking or smudging greenhouses, tobacco-stems are burned slowly. Best results are secured when a sheet-iron vessel made for the purpose is used, having holes in the bottom to supply draft. A quart of live coals is placed in the bottom of the vessel, and about a pailful of tobacco-stems is laid on them. The stems should not blaze, but burn with a slow smudge. If they are slightly damp, better results are obtained. Some plants are injured by a very heavy smoke, and in order to avoid this injury, and also more effectually to destroy the insects, it is better to smoke rather lightly and often. It is always well to smoke through two consecutive days, for the insects which persist through the first treatment, being weak, will be killed by the second. If the plants are wet, the smoke is more likely to scorch them. The smudge often injures flowers, as those of roses and chrysanthemums. In order to avoid this injury, the flowers should be covered with paper bags. Violet plants are very liable to injury.

Tobacco fumes can be more conveniently generated by burning strips of prepared nicotine paper, or by vaporizing a concentrated aqueous solution of nicotine over alcohol or special kerosene lamps.

Bisulfid of carbon is a thin liquid that volatilizes at a very low temperature, the vapor being very destructive to animal life. It is exceedingly inflammable, and should never be used near a lamp or fire. It is sometimes used for the control of certain root insects. It is poured into holes made around the infested plants, and these are then immediately closed up causing the fumes to permeate the soil in all directions.

Against weevils infesting stored grain and seeds, carbon bisulfid is effective at the rate of five to eight pounds for each 1,000 cubic feet, provided the application is made while the temperature is not below 65° F. Make the bins as tight as possible. If bins are only single sheathed with common flooring use twenty to twenty-five pounds carbon bisulfid. Let the fumigation continue for at least twenty-four hours. Care should be taken not to apply carbon bisulfied when there is indication of heating in the grain.

C. R. Crosby.
Robert Matheson.

Catalogue of insects.

Abutilon. Abutilon Moth (*Cosmophila erosa*).—A pale pea-green caterpillar striped with lemon-yellow often defoliates the plants in the southern states.

Treatment.—The young caterpillar may be killed by spraying with "Black Leaf 40" tobacco extract, one part in 650 parts water, adding soap to make the liquid spread and stick better.

Acacia. Cottony Cushion Scale.—See *Citrus.*

Oleander Scale.—See *Hedera.*

Red Scale.—See *Citrus.*

Acer. Box-Elder Bug (*Leptocoris trivittatus*) is about ½ inch in length, dark gray in color marked with red. They congregate about box elder in great numbers, on the sap of which they feed. The young nymphs may be killed by spraying with ordinary contact insecticides.

Cottony Maple Scale (*Pulvinaria vitis*) is a brown, soft-bodied, scale insect, ⅛ inch in length. The eggs are laid beneath a conspicuous cottony mass which protrudes from under the scale. The eggs hatch during June and July, and the fertilized females hibernate on the smaller branches. There is one generation annually.

Treatment.—A stiff stream of water will dislodge many of the mature scales in June or July. The young scales may be killed with tobacco extract. The most effective treatment on maples is 15 per cent kerosene emulsion applied during the dormant season to kill the hibernating females.

Green-striped Maple Worm (*Anisota rubicunda*) is a large, pale yellowish green caterpillar, striped with dark green, that occasionally defoliates the maple.

Treatment.—The young caterpillars may be controlled by spraying with arsenate of lead, four to eight pounds to one hundred gallons of water.

Pigeon Tremex (*Tremex columba*) is a large four-winged fly having a wing expanse of 2½ inches. The abdomen ends in a prominent ovipositor. The larva, over 2 inches long when full-grown, burrows in the wood, seriously injuring the tree when abundant. Vigorous trees usually overcome the attack.

Plant-Lice.—Several species are occasionally injurious.

Treatment.—"Black Leaf 40" tobacco extract, three-fourths of a pint to one hundred gallons of water, adding four pounds of soap, is an efficient remedy.

Sugar-Maple Borer (*Plagionotus speciosus*) is very destructive to hard maples. The parent beetle is about an inch long, black, brilliantly marked and banded with yellow. The larva is a large borer about 2 inches in length when mature. They burrow mostly in the sapwood, several often girdling and killing a tree. It is a difficult matter to prevent this injury.

Treatment.—Digging out the borers is the only remedy known.

Woolly Maple-Leaf Scale (*Phenacoccus acericola*) is a soft-bodied woolly-covered insect about ¼ inch long, found on the under side of the leaves. There are two or three generations a year. They hibernate as young on the bark of the trunk and branches.

Treatment.—Winter applications of whale-oil soap, one pound in one gallon of water, have given the best results.

Æsculus. Tussock-Moth.—See *Apple.*

Agave. Oleander Scale.—See *Hedera.*

Red Scale.—See *Citrus.*

Alder. Alder Blight Aphis (*Pemphigus tessellata*) occurs in colonies on the branches and appears as conspicuous white, woolly masses.

Treatment.—They may be dislodged by a stiff stream of water or may be killed by spraying with kerosene emulsion.

Saw-Fly Leaf-Miner (*Kaliosysphinga dohrnii*) feeds between the upper and lower layers of the leaves, causing large blotch mines.

No remedy known.

Allamanda. Citrus White Fly.—See *Citrus.*

Almond. Black Scale.—See *Citrus.*

Clover Mite.—See *Peach.*

Cottony Cushion Scale.—See *Citrus.*

Pear Thrips.—See *Pear.*

San José Scale.—See *Apple.*

Aloe. Oleander Scale.—See *Hedera.*

Amaryllis. Narcissus Bulb-Fly.—See *Narcissus.*

Ampelopsis. Myron Sphinx (*Ampelophaga myron*).—Large, green or brown, smooth caterpillars occasionally defoliate the vines.

Treatment.—Hand-picking.

Annona. Florida Wax Scale.—See *Citrus.*

Anthurium. Florida Wax Scale.—See *Citrus.*

Apple. Aphids or Plant-Lice.—There are three species which commonly attack the opening buds and leaves of apple,—the leaf aphis (*Aphis pomi*), rosy aphis (*Aphis sorbi*) and bud aphis (*Siphocoryne avenæ*).

Treatment.—These small, soft-bodied insects may be controlled by thorough spraying with "Black Leaf 40" tobacco extract, three-fourths of a pint, in one-hundred gallons of water, adding four pounds of soap. Make the application before the leaves curl.

Apple-Curculio (*Anthonomus quadrigibbus*).—A soft, white grub, about ½ inch long, living in the fruit.

Treatment.—Clean cultivation. Rake the small apples that drop early out into the sun where they will dry up.

Catalogue of Insects, continued.

Apple Flea-Beetle (*Graptodera foliacea*).—Brassy, green beetle, ⅛ inch or less long, feeding upon leaves.

Treatment.—Arsenicals. Lime-sulfur or bordeaux mixture as a repellent.

Apple Leaf-Hopper (*Empoasca mali*).—A slender pale yellowish green bug; the nymphs are pale greenish and usually found on the under side of the leaves. The winter eggs are laid in blisters under the bark of the smaller branches; summer eggs, in the leaf veins and petioles. Four generations annually. The insect feeds by extracting the juices from the leaves, causing them to turn pale and curl. It is most injurious to nursery stock.

Treatment.—The young nymphs may be killed by spraying with "Black Leaf 40" tobacco extract, three-fourths of a pint in one hundred gallons of water, adding three to four pounds of soap. Nurserymen often catch the adults by the use of sticky shields.

Apple Leaf-Roller (*Archips argyrospila*).—A green caterpillar with a black head, 1 inch or less in length when mature, attacks the opening buds rolling and webbing together the leaves, flowers and young fruit into a nest. Holes are eaten in the young apples, deforming them. Eggs are laid in June in small, flat masses on the bark and are covered with a smooth varnish-like coating. They do not hatch till the following spring.

Treatment.—To kill eggs spray with miscible oil, one gallon in fifteen gallons of water, making the application as late as possible before the buds open. If the eggs have been neglected, recourse must be had to arsenate of lead, six pounds in one hundred gallons water. Apply before the blossoms open.

Apple Maggot (*Rhagoletis promnella*).—A white maggot that tunnels apples through and through, causing decay and falling of the fruit. The parent flies appear the latter part of June and early July and insert the eggs under the skin of the fruit. Hibernation takes place in small puparia just below the surface of the soil. Sweet and subacid varieties are most susceptible, but others are sometimes attacked.

Treatment.—Clean cultivation. Spray when flies appear with arsenate of lead, four pounds in one hundred gallons of water. The addition of two or three gallons of molasses is supposed to render the poison more attractive to the flies.

Brown-tail Moth (*Euproctis chrysorrhœa*).—This highly destructive European insect was introduced near Boston a number of years ago, and is now rapidly spreading over New England. The snow-white moths, with a large tuft of brown hairs at the tip of the abdomen, appear in July and deposit eggs on the leaves in elongate masses covered with brown hairs from the body of the female. The caterpillars become only partly grown the first season, and hibernate in conspicuous nests, 3 or 4 inches long, at the tips of the branches. The black-bodied caterpillars, clothed with rather long, brownish, stinging hairs, complete their growth the next spring, feeding ravenously on the tender foliage and causing great damage in orchards, parks, and forests.

Treatment.—Cut out and burn all winter nests before the buds start. In the spring, spray with arsenate of lead, as recommended for the gipsy-moth. Prevent the ascent of caterpillars from other trees by banding the trunks with tanglefoot. Keep the bands fresh by combing the surface every few days.

Bud-Moth (*Tmetocera ocellana*).—The small brown caterpillars with black heads burrow into the buds, feeding on the opening leaves and flowers and web them together.

Treatment.—Spray with arsenate of lead, four pounds in one hundred gallons of water, just as the blossoms show pink, and again as the last of the petals are falling.

Canker-Worm, Fall (*Alsophila pometaria*).—Wingless female moths usually emerge from the ground in late autumn, crawl up the trees and deposit their eggs on the smaller branches. The eggs hatch in April or May and the blackish yellow-striped, looping caterpillars defoliate the trees.

Treatment.—Band tree trunks in the fall with tanglefoot or cotton batting to prevent ascent of moths. The young canker-worms may be killed by spraying with arsenate of lead, six pounds to one hundred gallons of water.

Canker-Worm, Spring (*Paleacrita vernata*).—Habits similar to the fall canker-worm, but the moths emerge in March and April. Caterpillars are distinguished by having only two pairs of prolegs.

Treatment.—Same as for fall canker-worm except the bands should be applied in early spring.

Case-Bearers.—The pistol-case-bearer (*Coleophora malivorella*) and the cigar-case-bearer (*C. fletcherella*).—The small caterpillars live in pistol or cigar-shaped cases, about ¼ inch long, that they carry around with them. They appear in spring on the opening buds at the same time as the bud-moth, and may be controlled by the same means.

Codlin-Moth (*Carpocapsa pomonella*).—This is the pinkish caterpillar which causes a large proportion of wormy apples. The eggs are laid by a small moth on the leaves and the skin of the fruit. Most of the caterpillars enter the apple at the blossom end. When the petals fall, the calyx is open, and this is the time to spray. The calyx soon closes, and keeps the poison inside ready for the young caterpillars' first meal. After the calyx has closed, it is too late to spray effectively. The caterpillars become full-grown in July and August, leave the fruit, crawl down on the trunk, and there most of them spin cocoons under the loose bark. In most parts of the country there are two broods annually.

DISEASES AND INSECTS

CATALOGUE OF INSECTS, continued.

Treatment.—As the last of the petals are falling, spray with four pounds arsenate of lead in one hundred gallons of water, using a stiff spray to force it into the blossom end of the apple. Repeat the application three weeks later.

FALL WEB-WORM (*Hyphantria cunea*).—Hairy larva, about an inch long, varying from gray to pale yellow or bluish black, feeding upon the leaves of many trees, in tents or webs.

Treatment.—Destroy by burning the webs, or removing them and crushing the larvæ. Spray with arsenicals.

FLAT-HEADED BORER (*Chrysobothris femorata*).—Larva about an inch long, flesh-colored, the second segment ("head") greatly enlarged; boring under the bark and sometimes into the wood. They are readily located in late summer or fall by the dead and sunken patches of bark.

Preventive.—Soap and carbolic acid washes applied from May to July. Keep trees vigorous.

GREEN FRUIT-WORMS (*Xylina sp.*).—Yellowish or apple-green caterpillars, striped with cream-color, 1 to 1½ inches in length when mature, attack the opening leaves and blossoms and eat holes in the developing fruit. The parent moths emerge from hibernation in early spring and lay their eggs on the smaller branches. One brood annually.

Treatment.—Thorough and repeated spraying with arsenate of lead, six pounds in one hundred gallons of water, will kill many of the young caterpillars. Make the application when blossom clusters appear.

GYPSY MOTH (*Porthetria dispar*).—The full-grown caterpillar is about 2 inches long, dark gray in ground-color with eleven pairs of prominent tubercles on the back, the first five pairs blue, the last six dark red. They become full-grown about the first of July. They pupate in slight cocoons. The moths emerge in seven to seventeen days. The male has a light brown body, wings yellowish brown, and each front wing is crossed by four wavy dark brown lines. In the female the body is light buff and the wings grayish white. The dark markings on the front wings are similar to those of the male. The females do not fly, but each lays its eggs in a mass about an inch in length covered with hairs from its body. Hibernation takes place in the egg stage. The eggs hatch just as the buds are bursting.

Treatment.—Kill the eggs by saturating the masses with crude coal-tar creosote, to which a little lamp-black has been added as a marker. When the young caterpillars hatch, spray the trees with arsenate of lead, ten pounds in one-hundred gallons of water. When the caterpillars are half-grown, use thirteen to fifteen pounds of lead arsenate. Full-grown caterpillars are very resistant to poisons. Band the tree trunks with tanglefoot to prevent the ascent of wandering caterpillars.

LEAF-BLISTER MITE.—See *Pear.*

LEAF-CRUMPLER (*Mineola indigenella*).—Reddish brown caterpillars that live in slender, horn-shaped cases and feed on the tender leaves. They hibernate as partly grown larvæ and attack the opening buds the following spring. They usually live in a nest of several leaves fastened together with silk.

Treatment.—Gather the nests and burn them. Arsenicals when the buds open.

LESSER APPLE-WORM (*Enarmonia prunivora*).—Similar to the codlin-moth, but larvæ often feed just under the skin of the fruit, causing blotched areas.

Treatment.—As for codlin-moth.

OYSTER-SHELL SCALE (*Lepidosaphes ulmi*).—This is an elongate scale (sometimes called bark-louse), ⅛ inch in length, resembling an oyster-shell in shape and often incrusting the bark. It hibernates as minute white eggs under the old scales. The eggs hatch during the latter part of May or in June, the date depending on the season. After they hatch, the young may be seen as tiny whitish lice crawling about on the bark. When these young appear, spray with kerosene emulsion, diluted with six parts of water, or whale-oil, or any good soap, one pound in four or five gallons of water. Where trees are regularly sprayed with lime-sulfur, as for the San José scale or blister mite, the oyster-shell scale is usually controlled.

PALMER WORM (*Ypsolophus pometellus*).—The brownish green, white-striped caterpillars, ½ inch in length when mature, skeletonize the tender foliage in June and eat holes in the young apples. There is only one brood a year.

Treatment.—Spray with arsenate of lead, four pounds in one hundred gallons of water when the caterpillars first appear.

PLUM-CURCULIO (*Conotrachelus nenuphar*).—A snout-beetle that deforms the fruit by its characteristic feeding and egg-laying punctures. The grubs develop in the fruit and cause it to fall.

Treatment.—Spraying with arsenate of lead, as for codlin-moth, whenever it can be applied with a fungicide so as not to increase expense, will help to control the trouble. Thorough superficial tillage of the surface of soil during July and August will kill many of the pupæ, and is recommended. For treatment on plum, see under *Plum.*

RED BUGS (*Heterocordylus malinus* and *Lygidea mendax*).—The winter is passed as eggs inserted in the smaller branches. The brilliant red nymphs appear as the buds open and feed on the foliage for a time. Then they puncture the newly set apples causing one of three things: some drop, some dry up and remain on trees till next spring, and others mature as knotty, misshapen, worthless fruit. One generation a year.

Treatment.—The young nymphs may be killed by thorough spraying with "Black Leaf 40" tobacco extract, one pint in one hundred gallons water, adding four pounds of soap, (1) when blossoms show pink, (2) when the last of the petals are falling.

CATALOGUE OF INSECTS, continued.

RED-HUMPED APPLE CATERPILLAR (*Schizeura concinna*).—These red-headed, black-and-yellow-striped caterpillars with a red hump on the fourth segment often attract attention in August and September by feeding in colonies on the ends of the branches.

Treatment.—Spray for the young caterpillars with arsenate of lead, four pounds in one hundred gallons of water. As they are most troublesome on newly planted trees the older caterpillars may be shaken to the ground and crushed under foot.

RIBBED COCOON-MAKER (*Bucculatrix pomifoliella.*—A minute yellow or green larva feeding upon the upper surface of the leaves, causing the lower surface to turn brown. The cocoons are white and slender, and are laid side by side upon the under side of twigs, where they are conspicuous in winter.

Treatment.—Lime-sulfur while tree is dormant. Arsenicals for the larvæ in summer.

ROSE-CHAFER.—See *Grape.*

ROUND-HEADED BORER (*Saperda candida*).—A yellowish white grub with dark brown head, about 1 inch long when mature. It is said to remain in the larval state three years. The parent beetle is silvery white on the head and beneath; the thorax and wing-covers are light brown: two silvery white stripes extend from the head to the tip of the wing-covers. The eggs are laid in slits in the bark, mostly in June.

Preventive.—Keep the beetles from laying eggs by spraying the trunks several times during the spring and summer with kerosene emulsion or by coating them with an alkaline wash made from soap, caustic potash, and carbolic acid. Tarred paper tree-protectors well tied at the top, or wire mosquito-netting protectors closed at the top and encircling the trunk so loosely that the beetles cannot reach the bark, are effective in preventing egg-laying. Practise clean cultivation, and do not let water sprouts or other rank vegetation encircle the base of the tree.

Remedial.—Dig out the borers whenever they can be located by discolored bark or by the sawdust thrown out of the burrow.

SAN JOSÉ SCALE (*Aspidiotus perniciosus*).—This scale is nearly circular in outline and about the size of a pinhead. When abundant it forms a crust on the branches, and causes small red spots on the fruit. It multiplies with marvelous rapidity, there being three or four broods annually, and each mother scale may give birth to several hundred young. The young are born alive, and breeding continues until late autumn, when all stages are killed by the cold weather, except the tiny, half-grown, black scales, many of which hibernate safely.

Treatment.—Spray thoroughly in the fall after the leaves drop, or early in the spring before growth begins, with lime-sulfur wash, one gallon in eight gallons of water, or miscible oil, one gallon in fifteen gallons of water. When badly infested, make two applications, one in the fall and another in the spring. In case of large, old trees, 25 per cent crude-oil emulsion should be applied just as the buds are swelling.

SCURFY SCALE (*Chionaspis furfurus*).—This whitish, pear-shaped scale, about ⅛ inch in length, often incrusts the bark, giving it a scurfy appearance. It hibernates as purplish eggs under the old scales.

Treatment.—Spray as recommended for oyster-shell scale.

TENT-CATERPILLARS (*Malacosoma americana* and *M. disstria*).—Larvæ nearly 2 inches long, spotted and striped with yellow, white, and black; feeding upon the leaves. They congregate in tents or in clusters on the bark at night and in cool weather, and forage out upon the branches during the day.

Treatment.—Arsenicals, as for codlin-moth. Burn out nests with torch, or cut them out and crush the larvæ. Pick off egg masses from twigs during winter and spring.

TUSSOCK-MOTH (*Hemerocampa leucostigma*).—A handsome, red-headed, yellow and black tufted caterpillar, about an inch long, which devours the leaves and sometimes eats into the fruit.

Remedial.—Collect the frothy egg-masses in fall and winter and band the trees to prevent a reinfestation by migrating caterpillars. Spray with arsenicals as for codlin-moth, taking care to cover the under side of the leaves.

TWIG-BORER (*Schistoceros hamatus*).—Beetle, ⅜ inch long, cylindrical and dark brown, boring into twigs of apple, pear, and other trees. The beetle enters just above a bud.

Treatment.—Burn the twigs. The early stages are passed in dying wood, such as prunings, diseased canes, and in upturned roots. Burn such rubbish, and thus destroy their breeding-places. This is also a grape pest.

TWIG-GIRDLER (*Oncideres cingulatus*).—Small branches are often girdled by a handsome ash-sprinkled reddish brown beetle, about ½ inch in length. The girdled twigs soon fall and the grubs develop in the fallen branches.

Treatment.—Collect and burn all fallen branches.

WOOLLY APHIS (*Schizoneura lanigera*).—Small reddish brown plant-lice covered with a conspicuous mass of white, waxy fibers, found on the branches, sprouts, trunks and roots.

Treatment.—For the form above ground drench the infested parts with 15 per cent kerosene emulsion; for the underground form remove the earth beneath the tree to a depth of 3 inches, and apply 10 per cent kerosene emulsion liberally, and replace the earth. In the case of nursery stock the emulsion may be applied in a shallow furrow close to the row. Do not set infested trees.

YELLOW-NECKED APPLE CATERPILLARS (*Datana ministra*).—Apple branches are often defoliated in late summer by colonies of black- and yellow-striped caterpillars about 2 inches in length when mature.

Treatment.—Same as for *Red-humped Caterpillar*, which see.

CATALOGUE OF INSECTS, continued.

Apricot. BARK BEETLE.—See *Peach.*
BLACK SCALE—See *Citrus.*
CANKER-WORMS.—See *Apple.*
CLOVER MITE.—See *Peach.*
COTTONY CUSHION SCALE.—See *Citrus.*
EUROPEAN FRUIT LECANIUM.—See *Plum.*
FROSTED SCALE (*Eulecanium pruinosum*).—A large soft-bodied scale, ½ inch in length, hemispherical in shape with a frost-like covering of wax.
Treatment.—Kerosene or distillate emulsion while the trees are dormant.
PEACH TREE-BORERS.—See *Peach.*
PEAR THRIPS.—See *Pear.*
PLUM-CURCULIO.—See *Plum.*

Aquilegia. COLUMBINE BORER (*Papaipema purpurifascia*).—The full-grown caterpillar measures 1⅜ inches in length, salmon-pink in color with three narrow stripes visible from above, the two lateral ones broadly interrupted in the middle. It bores in the stems near the base.
Treatment—Dig out and destroy caterpillars.

Artichoke. STEM MAGGOT (*Straussia longipennis*).—A small yellowish maggot boring in the pith of the stems. The adult are two-winged yellowish flies with banded wings.
Treatment.—Encourage growth; vigorous plants outlive injury.

Asparagus. COMMON ASPARAGUS-BEETLE (*Crioceris asparagi*).—Beetle, less than ¼ inch in length, yellow, red, and shining black, with conspicuous ornamentation, feeding upon the tender shoots. Larva feeds upon the leaves and tender bark.
Treatment.—Freshly slaked lime dusted on before the dew has disappeared in the morning. Poultry. Cut down all plants in early spring to force the beetles to deposit their eggs upon the new shoots, which are then cut every few days before the eggs hatch; or leave a row or so around the field as a lure for the beetles where they may be killed with arsenicals.
TWELVE-SPOTTED ASPARAGUS-BEETLE (*Crioceris 12-punctata*).—Similar to the last, but with twelve spots on the wing-covers.
Treatment.—Similar to that used above, except that the grubs cannot be destroyed by lime, since they live within the berry.
ASPARAGUS MINER (*Agromyza simplex*).—A maggot mining under the skin near the base of the plant.
Treatment.—Leave a few volunteer plants as a trap in which the fly will deposit her eggs. Pull and burn these plants in late June and early July. The flies may be killed before ovipositing with sweetened arsenate of lead.

Aspidistra. FLORIDA RED SCALE.—See *Citrus.*

Aster. BLISTER BEETLES.—Large, black, grayish or striped beetles that feed on the flowers. The larvæ in general feed on grasshopper eggs.
Treatment.—Hand-picking.
TARNISHED PLANT-BUG (*Lygus pratensis*).—An active bronzy brown sucking bug ⅛ inch long, mottled with various shades of yellowish, that stunts the terminal buds by its feeding punctures and also injures the flower-buds so that they either do not open or produce imperfect flowers. Injured plants are dwarfed and stunted.
Treatment.—No satisfactory control measures are known. Plants grown in shade are less liable to injury.
ROOT-LOUSE (*Aphis maidiradicis*).—Small bluish green plant-lice infesting the roots, causing the plants to turn yellow and sickly.
Treatment.—Mix tobacco dust into the soil around the plants when transplanting.
WHITE GRUBS.—See *Corn.*

Aucuba. THE YELLOW SCALE.—See *Citrus.*

Avocado. LEAF-ROLLER (*Amorbia emigratella*).—A yellowish green caterpillar striped with pinkish brown, about 1 inch long when mature, rolls the leaves and eats small holes in the fruit, rendering it unfit for sale.
Treatment.—Arsenate of lead when the caterpillars appear.
MEALY-BUG (*Dactylopius nipæ*).—A small unarmored scale with white mealy covering.
Treatment.—Kerosene emulsion, one part to ten parts water.

Bamboo. COTTONY BAMBOO SCALE (*Antonina crawi*).—Small purplish red scales ⅛ to ¼ inch in length, covered with a dense cottony coating; often ½ inch in diameter. They collect in large numbers in the crotches and leaf-axils.
Treatment.—Repeated applications of kerosene emulsion.
PLANT LOUSE (*Myzocallis arundicolens*).—Small yellowish lice which collect in large numbers on the under surface of the leaves.
Treatment.—Contact sprays.

Banana. BANANA WEEVIL (*Sphenophorus sordidus*).—A small grub boring in the stems.
FLORIDA RED SCALE.—See *Citrus.*
MEALY-BUG (*Ceroputo yuccæ*).—Soft scales closely resembling the common mealy-bug (Pseudococcus).
Treatment.—Kerosene emulsion.

Bean. BEAN LADY-BIRD (*Epilachua corrupta*).—A light yellowish brown lady-bird beetle, with four black spots on each wing-cover, attacks and devours all parts of the bean plant. The larva, which is yellow and covered with stout branched spines, also feeds on the bean.
Treatment.—Arsenate of lead or kerosene emulsion.

CATALOGUE OF INSECTS, continued.

BEAN LEAF-BEETLE (*Cerotoma trifurcata*).—A pale yellow beetle ¼ inch in length, with black markings on the wing-covers, often eats round holes in the leaves. The larvæ feed on the roots and main stems of the plants.
Treatment.—Arsenate of lead as soon as the beetles appear.
BEAN-WEEVIL (*Bruchus obtectus*).—Closely resembles the pea-weevil, which see for description and remedies. Holding over the seed will be of no value with this insect.
CORN-EAR WORM.—See *Corn.*
CUTWORM.—See *Corn.*
PEA APHIS.—See *Pea.*
SEED-CORN MAGGOT (*Pegomya fusciceps*).—A maggot attacking germinating seeds and roots of young plants.
Treatment.—Avoid stable manure; practise crop-rotation. In the garden, use sand moistened with kerosene around the plants to keep the flies from laying the eggs.

Beet. BEET APHIS (*Pemphigus betæ*).—A root-infesting plant-louse locally abundant in certain western states.
Treatment.—Rotation of crops.
BEET LEAF-HOPPER (*Eutettix tenella*).—A small, pale yellowish green leaf-hopper punctures the leaves, causing the disease, curly top. Present in the western states.
Treatment.—No satisfactory treatment known.
BLISTER BEETLES.—See *Aster.*
CUTWORMS.—See *Corn.*
FALSE CHINCH BUG (*Nysius angustatus* var. *minutus*).—Small grayish brown bugs, 1/16 inch in length. Destructive to sugar beets grown for seed.
Control.—Contact insecticides; clean cultivation.
GRASSHOPPERS.—See *Corn.*
LEAF-MINER.—See *Spinach.*
LARGER BEET LEAF-BEETLE (*Monoxia puncticollis*).—A dull brown beetle with striped wing-covers. Both larvæ and adults feed on the sugar beet, often in immense numbers.
Treatment.—Same as for *Flea-Beetles.* See *Potato.*
FLEA-BEETLE.—See *Potato.*
WESTERN BEET BEETLE (*Monoxia consputa*).—A beetle closely allied to the larger beet leaf-beetle, feeding on the leaves, leaving only the veins.
Treatment.—Same as for *Flea-Beetles.* See *Potato.*
BEET ARMY WORM (*Laphygma exigua*).—A large caterpillar about 1¼ inches long when mature, olivaceous to greenish in color, broadly striped with lighter green; defoliates the plants.
Treatment.—See *Army Worm, Corn.*
BEET WEB-WORM (*Loxostege sticticalis*).—Pale yellowish green caterpillars striped with lighter green, about ¾ inch long, frequently defoliate the plants in certain regions.
Treatment.—Destroy all weeds. Spray with arsenate of lead.

Begonia. GREENHOUSE THRIPS.—See *Citrus.*
GREENHOUSE WHITE-FLY.—See *Tomato.*
MEALY-BUGS.—See *Citrus.*
WHITE-FLY.—See *Citrus.*

Berberis. BARBERRY PLANT-LOUSE (*Rhopalosiphium berberidis*).—Small, greenish yellow lice attacking the leaves and young growth.
Treatment.—Tobacco extract or kerosene emulsion.

Betula. BIRCH APHIS (*Callipterus betulæcoleus*).—A small, yellowish plant-louse occasionally abundant on the under side of birch foliage (cut-leaf varieties).
Treatment.—"Black Leaf 40" tobacco extract three-fourths of a pint to one hundred gallons of water.
BIRCH LEAF BUCCULATRIX (*Bucculatrix canadensisella*).—Small, whitish larvæ skeletonizing the leaves.
Treatment.—Arsenate of lead, six pounds in one hundred gallons water.
BRONZE BIRCH BORER (*Agrilus anxius*).—Slender, flattened yellowish white grubs, ¾ inch long when full-grown, burrow under the bark on all parts of the tree. The top branch usually dies first and is the first indication that the tree is infested.
Treatment.—Cut down and burn all infested trees immediately to prevent spread to other trees.
FROSTED SCALE.—See *Apricot.* Occurs in California on birch.
OYSTER-SHELL SCALE.—See *Apple.*

Bignonia. HEMISPHERICAL SCALE.—See *Citrus.*
MEALY-BUGS.—See *Citrus.*

Billbergia. PINEAPPLE SCALE.—See *Pineapple.*

Blackberry.—See *Bramble Fruits.*

Bramble Fruits. BLACKBERRY LEAF-MINER (*Metellus rubi*).—A greenish white larva with brown markings, ⅛ inch in length when full-grown, causing blotch mines in the leaves.
Treatment.—No satisfactory treatment known.
CANE-BORER (*Oberea bimaculata*).—Beetle, black, small, and slim; making two girdles about an inch apart near the tip of the cane, in June, and laying an egg just above the lower girdle; the larva, attaining the length of nearly an inch, bores down the cane. Also in blackberry.
Remedy.—As soon as the tip of the cane wilts, cut it off below the lower girdle and burn it.
RASPBERRY BEETLE (*Byturus unicolor*).—A light brown beetle one-seventh inch long feeds on the opening leaves and blossoms. The small white grub feeds between the berry and receptacle of red raspberries.
RASPBERRY CANE MAGGOT (*Phorbia rubivora*).—Small, white maggot which burrows in the new canes and girdles the shoot. The eggs are laid by a fly in April or May.

DISEASES AND INSECTS

CATALOGUE OF INSECTS, continued.

Treatment.—Pull up or cut off canes several inches below the girdle and burn them.

RASPBERRY HORNTAIL (*Hartigia abdominalis*).—A whitish larva, about 1 inch in length when mature; when young it burrows under the bark, girdling the tip. It then tunnels out the pith.

Treatment.—Cut off infested canes when wilting is observed.

RASPBERRY ROOT-BORER (*Bembecia marginata*).—Larva about 1 inch long, boring in the roots and the lower parts of the cane, remaining in the root over winter.

Remedy.—Dig out the borers. Destroy wild berry bushes.

RASPBERRY SAW-FLY (*Monophadnus rubi*).—Larva about ¾ inch long, green, feeding upon the leaves.

Remedies.—Hellebore; arsenicals, after fruiting.

RED-NECKED CANE-BORER (*Agrilus ruficollis*).—A yellowish white flattened grub, ¾ inch in length when mature, burrows in the canes causing swellings or galls characterized by the splitting of the bark. The parent beetle is ½ inch in length, black, with thorax or "neck" reddish.

Treatment.—Cut out and burn all infested canes.

RED-SPIDER.—See *Peach.* Do not use lime-sulfur on raspberry foliage.

TREE-CRICKET (*Ecanthus nigricornis*).—Small and whitish cricket-like insect, puncturing canes for 2 or 3 inches, and depositing eggs in the punctures.

Remedy.—Burn all infested canes in winter or very early spring.

Brassica.—See *Cabbage.*

Brussels Sprouts.—See *Cabbage.*

Buxus. OLEANDER SCALE.—See *Hedera.*

Cabbage. CABBAGE APHIS (*Aphis brassicæ*).—These small, mealy plant-lice are especially troublesome during cool, dry seasons, when their natural enemies are less active.

Treatment.—Thorough spraying with "Black Leaf 40" tobacco extract, three-fourths of a pint in one hundred gallons water, adding four or five pounds of soap.

CABBAGE-LOOPER (*Autographa brassicæ*).—A pale green looping caterpillar, striped with lighter lines, over 1 inch in length when mature. Especially destructive to late cauliflower.

Treatment.—Very difficult to poison. Some growers dust the plants with pure paris green, using a blower.

CABBAGE MAGGOT (*Pegomya brassicæ*).—A small white maggot, the larva of a small fly, eating into the crown and roots of young cabbage, cauliflower, radish, and turnip plants.

Treatment.—Carbolic acid emulsion diluted with thirty parts of water, applied the day following the transplanting of the cabbage plants, and repeated once a week for several applications. Remove a little earth from about the plants, and spray on the emulsion forcibly. Better results may be secured by using tightly fitting cards cut from tarred paper. In seed-beds, protect the plants by surrounding the bed with boards 1 foot wide placed on edge, across which a tight cover of cheese cloth is stretched.

CABBAGE-WORM or CABBAGE-BUTTERFLY (*Pontia rapæ*).—The green caterpillars hatch from eggs laid by the common white butterfly. There are several broods every season.

Treatment.—If plants are not heading, spray with kerosene emulsion or with paris green to which the sticker has been added. If heading, apply hellebore.

CUTWORMS.—See *Corn.*

DIAMOND-BACK MOTH (*Plutella maculipennis*).—A pale green, active caterpillar, about ½ inch in length when mature, feeds on the under sides of the leaves. Pupates in an open-work silken cocoon on the leaves. Destructive to late cauliflower.

Treatment.—Same as for cabbage looper.

FLEA-BEETLES.—See *Potato.*

HARLEQUIN CABBAGE-BUG (*Murgantia histrionica*).—Bug about ½ inch long, gaudily colored with orange dots and stripes over a blue-black ground, feeding upon cabbage; two to six broods.

Treatment.—Hand-picking. Place blocks about the patch, and the bugs will collect under them. In the fall make small piles of the rubbish in the patch, and burn them at the approach of winter. Practise clean culture. Destroy all cabbage stalks and other cruciferous plants in fall. Early in the spring, plant a trap crop of mustard, radish, rape, or kale. When the over-wintering bugs congregate on these plants, destroy them with pure kerosene or by hand.

Cactus. MEALY-BUGS.—See *Citrus.*

Cactus. *Chelinidea vittigera.*—A yellowish bug resembling the common squash stink bug (*Anasa tristis*), feeding on the joints of opuntia, causing small circular discolored areas and destruction of the plants.

Treatment.—Destroy young with gasolene torch. In winter, burn trash in which adults are hibernating.

COTTONY COCHINEAL INSECT (*Dactylopius confusus*).—A scale insect covered with large flocculent masses of pure white wax.

Control.—Usually kept in check by its predaceous enemies.

Melitara junctolinella.—Large indigo-blue (young), or conspicuously banded (last stage) larvæ living within the joints of opuntia, causing tumor-like swellings.

Control.—Burn injured joints with gasolene torch.

Mimorista flavidissimalis.—Yellowish caterpillars burrowing in the young joints, thus destroying new growth. Their presence is indicated by exuding sap.

Treatment.—Powdered arsenate of lead dusted on the young growth early in the season.

Narnia pallidicorins.—Brownish yellow bugs about ¾ inch in length injuring the fruit.

CATALOGUE OF INSECTS, continued.

Control.—Destroy the gregarious bugs with the gasolene torch.

Opuntia longicorns (*Moneilema sp.*).—Shining, black, wingless beetles ¾ to 1 inch in length. The larvæ burrow in the main stems and older joints of the prickly pear.

Control.—Hand-picking the beetles; burning infested stems; spraying with arsenate of lead.

Carnation. CARNATION MITE (*Pediculopsis graminum*).—A minute mite found in the buds and instrumental in transmitting the bud-rot disease.

Treatment.—Gather and burn all infested buds.

GREEN PLANT-LOUSE (*Myzus persicæ*).—Small greenish plant-lice infesting the terminal branches.

Treatment.—Fumigation with hydrocyanic acid gas or tobacco.

Carrot. CARROT BEETLE (*Ligyrus gibbosus*).—A reddish brown beetle ½ inch or more long, which attacks the young plants. The larva lives in the ground, where it feeds on humus.

Preventive.—Crop-rotation and other remedies for white grub. See under *Corn.*

CARROT RUST FLY.—See *Celery.*

PARSNIP LEAF-MINER.—See *Parsnip.*

PARSNIP PLANT-LOUSE.—See *Parsnip.*

PARSNIP WEB-WORM.—See *Parsnip.*

Carya.—See *Hickory.*

Castanea.—See *Chestnut.*

Catalpa. CATALPA-MIDGE (*Cecidonyia catalpæ*).—Small yellowish-maggots, scarcely ⅛ inch in length when mature, attacking the seeds, terminal buds, ends of branches and leaves, deforming them.

Treatment.—Plow in early fall or late spring to destroy pupæ in nurseries.

CATALPA SPHINX (*Sphinx catalpæ*).—A sulfur-yellow caterpillar with black head and a broad black stripe down the back, about 2½ inches in length when mature, defoliates the trees. Several broods a season.

Treatment.—Arsenate of lead when the caterpillars are small. Hand-picking later.

Cauliflower.—See *Cabbage.*

Ceanothus. CITRUS MEALY-BUG.—See *Citrus.*

MEALY-BUG.—See *Banana.*

OYSTER-SHELL SCALE.—See *Apple.*

Celery. CARROT RUST-FLY (*Psila rosæ*).—Minute whitish yellow maggots infesting the roots and stunting the plants.

Preventive.—Late sowing and rotation of crops. Celery or carrots should not follow each other.

CELERY CATERPILLAR (*Papilio polyzenes*).—A large green caterpillar, ringed with black and spotted with yellow, which feeds on the leaves.

Treatment.—Hand-picking as soon as observed.

CELERY LEAF-TYER (*Phlyctænia ferrugalis*).—A greenish caterpillar, feeding on the under side of the leaves.

Treatment.—Spray with arsenicals while the larvæ are still young.

CELERY LOOPER (*Autographa falcigera*).—A greenish looping caterpillar with white stripes, about 1½ inches long when mature; feeds on the tender leaves.

Treatment.—No satisfactory treatment known.

LITTLE NEGRO BUG (*Corimelæna pulcaria*).—Glossy black bugs, ⅛ inch in length, that collect in clusters in the axils of the leaflets and cause the plants to wilt.

Treatment.—Kerosene emulsion or tobacco extract.

PARSNIP PLANT-LOUSE.—See *Parsnip.*

Chard.—See *Beet.*

Cherry. APHIS (*Myzus cerasi*).—Blackish plant-lice infesting the leaves and tips of new growth.

Treatment.—Spray as soon as the first lice appear with whale-oil soap or tobacco extract.

CANKER WORM.—See *Apple.*

CHERRY FRUIT FLIES (*Rhagoletis cingulata* and *R. fausta*).—Small maggots infesting ripening fruit. Adults are flies with banded wings and insert their eggs under the skin of the fruit.

Treatment.—Spray with arsenate of lead, five pounds in one hundred gallons sweetened with three gallons molasses to kill flies before egg-laying. Should be done when flies first appear,—last of June in New York.

CHERRY SCALE (*Aspidiotus forbesi*).—Resembles the San José scale.

Treatment.—Same as for *San José Scale.* See *Apple.*

PLUM-CURCULIO.—See *Plum.*

ROSE-CHAFER.—See *Grape.*

SLUG (*Eriocampoides limacina*).—Larva, ½ inch long, blackish and slimy, feeding upon the leaves; two broods.

Treatment.—Arsenicals, hellebore, tobacco extract.

CHERRY TREE TORTRIX (*Archips cerasivorana*).—Tips of branches are frequently webbed into nests by colonies of lemon-yellow caterpillars.

Treatment.—Wipe out nests and destroy the caterpillars.

PEACH TREE BORER.—See *Peach.*

FRUIT TREE BARK BEETLE.—See *Peach.*

Chestnut. CHESTNUT WEEVILS (*Balaninus proboscideus* and *B. rectus*).—Brownish beetles with extremely long, slender snouts with which they bore holes into the nuts for deposition of eggs. The grubs feed on the kernel, producing wormy nuts.

Treatment.—No satisfactory control measures known.

CATALOGUE OF INSECTS, continued.

TWO-LINED CHESTNUT BORER (*Agrilus bilineatus*).—Slender, flattened grubs, ¾ inch long when mature, burrowing under the bark and girdling the trees.

Treatment.—Cut and burn infested trees to prevent spread.

EUROPEAN FRUIT LECANIUM.—See *Plum.*

Chrysanthemum. GREEN APHIS (*Aphis rufomaculata*).—Small, green lice attacking the terminal shoots.

Treatment.—Fumigation.

BLACK APHIS (*Macrosiphum sanborni*).—Small, black lice attacking the terminal shoots.

Treatment.—Fumigation.

TARNISHED PLANT-BUG.—See *Aster.*

CHRYSANTHEMUM LEAF-MINER (*Oscinis sp.*).—Works in the leaves.

Treatment.—Hand-picking.

Cineraria. LEAF-TYER.—See *Celery.*

Citrus. BARNACLE SCALE (*Ceroplastes cirripediformis*).—A large, dark brown scale covered with a waxy secretion ½ inch in length. Surface of scale sculptured like a miniature barnacle.

Control.—Resin wash or kerosene emulsion before the waxy covering is secreted.

BLACK CITRUS LOUSE (*Toxoptera aurantiæ*).—Small, dull black lice, curling the leaves and killing the new growth.

Control.—Contact sprays before the leaves curl.

BLACK SCALE (*Saissetia oleæ*).—A black, oval scale ¼ inch in diameter with an "H"-shaped mark on the back of the female. The young are light yellow to brown, unmarked. The scales secrete honey dew in which a fungus grows smutting the fruit.

Treatment.—Fumigation. On citrus, use a half to three-fourths of regular dosage between September and January. On deciduous fruits and olive, water distillate, caustic soda mechanical mixtures or distillate emulsion may be used to kill scales less than one-half grown.

CITRUS RED-SPIDER (*Tetranychus mytilaspidis*).—Bright red, minute mite, frequently abundant on fruit and foliage.

Treatment.—Dusting with sulphur or commercial lime-sulfur solution diluted 1-35 or 50 of water.

CITRUS THRIPS (*Euthrips citri*).—Slender, minute, orange-yellow insects, less than one-thirtieth inch in length, scarring the fruit and injuring the foliage.

Treatment.—Lime-sulfur solution one part in eighty parts water (likely to cause slight injury to foliage) or "Black Leaf 40" tobacco extract, one part in 1,800 parts water. Make four applications: (1) As the last of petals are falling; (2) ten to fifteen days later; (3) three to four weeks after the second; (4) during the months of August or September (for California). In greenhouses, fumigate with hydrocyanic acid gas.

COTTONY CUSHION SCALE (*Icerya purchasi*).—Red or yellowish scale insects with large, white, fluted, cottony masses which cover the eggs from ¼ to ½ inch in length.

Control.—Natural enemies, principally by the common Vedalia.

FLORIDA RED SCALE (*Chrysomphalus aonidum*).—Circular flat, brown scales, ⅛ to ⅛ inch in diameter.

Treatment.—Fumigation with full dosage schedule.

FLORIDA WAX SCALE (*Ceroplastes floridensis*).—Oval convex, white or pinkish, waxy scales with the upper surface evenly lobed, 1-12 to ¼ inch in diameter.

Control.—Resin wash or kerosene emulsion applied to the young scales before the waxy covering is formed.

FULLER'S ROSE BEETLE.—See *Strawberry.*

GLOVER'S SCALE (*Lepidosaphes gloverii*).—Closely resembles the purple scale, but is longer and narrower.

Control.—Same as for *Purple Scale*, which see.

GREENHOUSE THRIPS (*Heliothrips hæmorrhoidalis*).—A slender, minute, yellowish brown insect destroying the blossoms and russeting the fruit.

Treatment.—Same as for *Citrus Thrips*, which see.

HEMISPHERICAL SCALE (*Saissetia hemispharica*).—A smooth, oval, convex soft scale without markings. Common in greenhouses.

Treatment.—Same as for *Black Scale*, which see.

MEALY-BUG (*Pseudococcus citri*).—Small, soft-bodied scale insects, ¼ to ⅜ inch long, covered with a white waxy secretion.

Control.—A thorough application of carbolic acid emulsion; spray under heavy pressure.

MELON APHIS.—See *Muskmelon.*

MEDITERRANEAN FRUIT FLY (*Ceratitis capitata*).—Small white maggots burrowing in a great variety of soft, juicy fruits. The parent fly is about the size of the house fly, yellowish marked with black, and with faintly banded wings. Widely distributed in the tropical and subtropical regions of the world and a most serious horticultural pest wherever it occurs. Rigid quarantine regulations have prevented its introduction into the United States.

Treatment.—Sweetened arsenate of lead to kill the flies before oviposition.

ORANGE CHIONASPIS (*Chionaspis citri*).—Elongate, blackish brown scale with a gray margin and dark yellow exuviæ.

Treatment.—Fumigation; kerosene emulsion, one part in five parts of water; three applications at three-week intervals.

ORANGE MAGGOT (*Trypeta ludens*).—Dirty white maggots, about ½ inch in length when mature, burrowing in the pulp. From four to twenty maggots may occur in a single orange. The adult two-winged fly is straw-yellow in color with brownish markings and bands on the wings. A serious pest to oranges in Mexico.

Control.—Pick up and destroy all infested fruit.

CATALOGUE OF INSECTS, continued.

ORANGE TORTRIX (*Tortrix citrana*).—Greenish white to dark, irregularly striped caterpillars, ½ inch long when mature, that burrow into the rind and induce decay.

Control.—Destroy all infested fruit.

PURPLE SCALE (*Lepidosaphes beckii*).—Reddish brown to rich purple oyster-shell-shaped scales ⅛ to ⅛ inch in length.

Control.—Fumigate with full dosage schedule.

RED SCALE (*Chrysomphalus aurantii*).—Circular, flat, reddish scales, ⅛ to ⅛ inch in diameter.

Control.—Fumigation with full dosage schedule. On deciduous trees lime-sulfur solution, one part in nine parts of water; or distillate emulsion.

SILVER MITE (*Eriophyes oleivorus*).—A minute, elongate four-legged yellow mite causing russeting of the orange and silvering of the lemon.

Control.—Same as for *Citrus Red Spider*, which see.

SOFT BROWN SCALE (*Coccus hesperidum*).—Oval, yellowish brown, flat, soft scale, sometimes with darker markings, ¼ inch in length.

Control.—Same as for *Black Scale*, which see.

WHITE-FLY (*Aleyrodes citri* and *A. nubifera*).—The immature stages are found on the under side of the leaves and are scale-like in form. The adults are minute white-winged flies.

Treatment.—Fumigation. Fungous parasites.

YELLOW SCALE (*Chrysomphalus citrinus*).—Similar to the red scale but yellowish in color.

Control.—Same as for *Red Scale*, which see.

Clematis. RED SPIDER.—See *Peach.*

SOFT BROWN SCALE.—See *Citrus.*

Coconut. COCONUT SCALE (*Aspidiotus destructor*).—Whitish to creamy transparent scales often abundant on under side of leaves and fruit.

Treatment.—When occurring on young trees spray with whale-oil soap; on older trees it is advisable to remove and burn badly infested leaves.

COCONUT BEETLE (*Strategus anachoreta*).—Large black beetles attacking young trees near the "collar." One beetle will destroy a tree if not removed in time.

Treatment.—Dig out and destroy.

COCONUT WHITE-FLY (*Aleyrodes cocois*).—Similar to the citrus white fly.

Control.—Contact insecticides. Destroy wild food plants.

FLORIDA RED SCALE.—See *Citrus.*

PALM WEEVIL (*Rhynchophorus palmarum*).—Shining black snout beetles, the larvæ of which live in young palm trees reducing the interior tissues to a mass of pulp.

Treatment.—Dress all wounds with tar or similar preparations. Avoid all unnecessary pruning. Destroy all felled trees and stumps not used as traps. The beetles may be attracted by the use of injured palm cabbages and trapped under rubbish.

RHINOCEROS BEETLE (*Oryctes rhinoceros*).—A large beetle about 1½ inches long, attacking and burrowing through the crown and stem.

Treatment.—Destroy all breeding-places, such as old coconut trees, stump, and cocao pods.

Cocos.—See *Coconut.*

Codiæum. GREENHOUSE THRIPS.—See *Citrus.*

MEALY-BUGS.—See *Citrus.*

PURPLE SCALE.—See *Citrus.*

Coffee. BLACK CITRUS LOUSE.—See *Citrus.*

COFFEE LEAF-MINER (*Cemiostoma coffeella*).—A small caterpillar about ⅛ inch long, mines in the leaves producing small brownish areas. Badly infested leaves drop.

Treatment.—No satisfactory treatment known.

HEMISPHERICAL SCALE.—See *Citrus.*

MEALY-BUG.—See *Citrus.*

Coleus. MEALY-BUG.—See *Citrus.*

Orthezia insignis.—Ocherous to dark green scale insect covered with a white waxy secretion extending posteriorly into a broad plate.

Treatment.—Contact insecticides.

WHITE-FLY.—See *Tomato.*

Corn. ARMY-WORM (*Leucania unipuncta*).—A cut-worm-like caterpillar, which normally feeds on grass. When this food-supply is exhausted, they migrate in numbers to other fields and attack corn, wheat, and similar crops.

Preventive.—To stop the advance of the "army," plow deep furrows so the dirt is thrown toward the colony; in the bottom of the furrows dig post-holes into which the caterpillars will fall and where they may be killed with kerosene.

CHINCH-BUG (*Blissus leucopterus*).—A red or white and black sucking bug, three-twentieths of an inch long. Attacks wheat and corn in great numbers.

Preventives.—Clean farming to destroy suitable hibernating shelter. Stop the migration of the bugs from the wheat-fields into corn by maintaining along the field a dust strip 10 feet wide in which a furrow and post-hole barrier has been constructed. This may be supplemented by a coal-tar barrier.

ANGOUMOIS GRAIN MOTH (*Sitotroga cerealella*).—A small caterpillar living in the grains. The adult is a small grayish brown moth. Most destructive in storage.

Treatment.—Fumigate with carbon bisulfid, five pounds to 1,000 cubic feet. Make bins perfectly tight and sprinkle over grain, covering with gas-proof tarpaulin. Fumigate at least twenty-four hours. This should be done when temperature is not below 65° F. In steam-heated mills, the most practicable method of destroying grain-infesting insects is by holding temperature from 118° to 122° for several hours.

DISEASES AND INSECTS

CATALOGUE OF INSECTS, continued.

CORN EAR-WORM (*Heliothis armiger*).—A green or brownish striped caterpillar feeding on the corn beneath the husk. Three to six generations yearly.

Preventives.—Plant as early as possible, and still avoid a "set-back" to the crop.

CORN-ROOT APHIS (*Aphis maidiradicis*).—A bluish green aphis infesting the roots.

Preventives.—A short rotation period in corn, especially in dry years. Deep and thorough and repeated stirring of old corn ground in fall and spring as a preparation for corn-planting. Maintenance and increase of the fertility of the soil.

CUTWORMS (*Agrotis, Hadena*, etc.).—Soft-bodied caterpillars eating and cutting off the young plants.

Preventives.—Early fall plowing of grass lands intended for corn; pasturing by pigs of grass or clover land intended for corn; distributing a line of poisoned bran by means of a seed-drill. To prevent the caterpillars entering from a neighboring grass field, destroy them with a line of poisoned vegetable bait.

GRASSHOPPERS (*Acrididæ*).—Poison them with the following mixture: Bran, twenty pounds; paris green, one pound; syrup, two quarts; oranges or lemons, three fruits; water, three and one-half gallons. Mix the bran and paris green thoroughly in a wash-tub while dry. Squeeze the juice of oranges or lemons into the water and add pulp and peel cut into small pieces. Dissolve the syrup in the water and moisten the bran mixture with it, mixing thoroughly. Sow broadcast in infested areas early in the morning.

NORTHERN CORN ROOT-WORM (*Diabrotica longicornis*).—A whitish grub ⅔ inch long, which burrows in the roots.

Preventive.—Crop-rotation; corn should not follow corn.

SOD WEB-WORMS (*Crambus sp.*).—Gray or brownish caterpillars about ½ inch long, living in silk-lined burrows in the soil at base of plant. They thrive in grass land.

Preventive.—Early fall plowing of grass land intended for corn, or else plow as late as possible the next spring.

WHITE GRUBS (*Lachnosterna sp.*).—The large white curved larvæ of the common June beetle.

Preventives.—Rotation of crops; do not let corn follow sod, but let a crop of clover or clover and oats intervene. To help clear sod land of grubs, pasture to hogs any time between April and October. To prevent laying of eggs in corn-field, keep the ground free from weeds during May and June. Thorough cultivation and heavy fertilization.

WIRE-WORMS (*Elateridæ*).—Hard, yellowish, or reddish, cylindrical larvæ feeding on the roots.

Preventives.—Crop-rotation; let clover intervene between sod and corn, planting the corn late the second or third year. Early fall plowing.

Cornus. OYSTER-SHELL SCALE.—See *Apple.*
SAN JOSE SCALE.—See *Apple.*

Corylus. HAZELNUT WEEVIL (*Balaninus obtusus*).—Small whitish grubs living in the kernels. The adult is a yellowish brown beetle with a long, slender snout.

Control.—No efficient treatment known.

Cosmos. ROOT APHIS (*Aphis middletoni*).—Small bluish lice on the roots.

Treatment.—Tobacco dust mixed in the soil.

Cotoneaster. PEAR LEAF-BLISTER MITE.—See *Pear.*

Cranberry. CRANBERRY FULGORID (*Phylloscelis atra*).—Small, broad-bodied, black jumping insect punctures the vines, causing the leaves to turn brown and the fruit to shrivel.

Treatment.—"Black Leaf 40" tobacco extract, one pint to one hundred gallons of water, adding four to five pounds soap to kill young nymphs.

CRANBERRY-GIRDLER (*Crambus hortuellus*).—Small caterpillars, feeding on the stems just beneath the surface of the sand.

Preventive.—Reflow just after picking, for a week or ten days, or reflow for a day or two about June 10.

FALSE ARMY-WORM (*Calocampa nupera*).—Green to blackish caterpillars devouring the leaves and buds.

Treatment.—Reflow for from twenty-four to thirty-six hours soon after the middle of May. It may be necessary to reflow a second time. Destroy all caterpillars washed ashore while the water is on. In dry bogs, spray early in May with arsenate of lead.

FIRE-WORM, CRANBERRY WORM, or BLACK-HEADED CRANBERRY WORM (*Eudemis vacciniana*).—Small larva, green, black-headed, feeding upon the shoots and young leaves, drawing them together by silken threads; two broods.

Treatment.—Flooding for two or three days when the worms come down to pupate. Arsenicals.

FRUIT-WORM (*Mineola vaccinii*).—Small caterpillar working in the fruits, eating out the insides.

Preventives.—For bogs with abundant water, reflow for ten days immediately after picking. Let the foliage ripen, and then turn on water for winter. Draw off water early in April, and every third or fourth year hold it on until the middle of May. For dry bogs spray three times with arsenate of lead during July. Bury all screenings.

YELLOW-HEADED CRANBERRY-WORM (*Acleris minuta*).—Stout, yellowish green, small caterpillar, with a yellow head, webbing up the leaves as it works.

Treatment.—Hold the water late on the bog in spring to prevent egg-laying. Arsenicals from the middle of May till July 1.

CATALOGUE OF INSECTS, continued.

Cratægus. PLANT-LICE.—See *Apple.*
OYSTER-SHELL SCALE.—See *Apple.*
RED-HUMPED CATERPILLAR.—See *Apple.*
SAN JOSÉ SCALE.—See *Apple.*
SCURFY SCALE.—See *Apple.*
WOOLLY APHIS.—See *Apple.*

Cucumber. FLEA-BEETLES.—See *Potato.*
MELON-WORM.—See *Muskmelon.*
PICKLE-WORM (*Diaphania nitidalis*).—Larva, about an inch long, yellowish white, tinged with green, boring into cucumbers; two broods.

Preventives.—Clean farming, fall plowing, and rotation of crops.

Remedies.—Kill the caterpillars before they enter the fruit by spraying with arsenate of lead about the time the buds begin to form, and repeat in two weeks.

RED-SPIDER.—See *Peach.*

SPOTTED CUCUMBER BEETLE (*Diabrotica 12-punctata*).—Beetle, yellowish and black spotted, about ¼ inch long, feeding upon the leaves and fruit. Sometimes attacks fruit trees, and the larva may injure roots of corn.

Treatment.—Same as for *Striped Cucumber Beetle*, which see.

STEM-BORER.—See *Squash.*

STRIPED CUCUMBER BEETLE (*Diabrotica vittata*).—Beetle, ¼ inch long, yellow with black stripes, feeding on leaves. Larva ½ inch long and size of a pin, feeding on roots; two broods.

Preventive.—Cheap boxes covered with thin muslin or screens of mosquito netting, placed over young plants.

Remedies.—Arsenicals in flour; arsenate of lead; ashes, lime, plaster, or fine road dust sprinkled on the plants every two or three days when they are wet; air-slaked lime; plaster and kerosene; tobacco powder, applied liberally. Apply remedies when dew is on, and see that it strikes the under side of the leaves.

WHITE-FLY.—See *Tomato.*

Cucurbita.—See *Squash.*

Currant. BORER (*Sesia tipuliformis*).—A whitish larva, boring in the canes of currants, and sometimes of gooseberries. The larva remains in the cane over winter.

Treatment.—In fall and early spring cut and burn all affected canes. These canes may be distinguished by a lack of vigor and by limberness.

CURRANT APHIS (*Myzus ribis*).—Small yellowish green lice attacking the under side of the leaves, distorting the leaves and causing them to turn red.

Treatment.—Contact insecticides when leaves first appear.

CURRANT MEASURING- or SPAN-WORM (*Cymatophora ribearia*).—Larva somewhat over an inch long, with stripes and dotted with yellow or black, feeding upon the leaves.

Treatment.—Hellebore, applied stronger than for currant-worm. Arsenicals; hand-picking.

CURRANT-WORM, or CURRANT and GOOSEBERRY SAW-FLY (*Pteronus ribesii*).—Larva, about ¾ inch long, yellowish green, feeding on leaves of red and white varieties; two to four broods.

Treatment.—Hellebore, applied early; arsenicals for the early brood. Treatment should begin while the larvæ are on the lowermost leaves of the bushes. Before the leaves are fully grown, the holes made by the worms may be seen. The second brood is best destroyed by killing the first brood.

FOUR-STRIPED PLANT-BUG (*Pœcilocapsus lineatus*).—A bright yellow, black-striped bug about ¼ inch long, puncturing the young leaves and shoots of many plants.

Treatment.—Jarring into a dish of kerosene. Kerosene emulsion when the nymphs are young. Cut off the tips of the shoots in early spring to destroy the eggs.

OYSTER-SHELL SCALE.—See *Apple.*
SAN JOSÉ SCALE.—See *Apple.*

Cycas. HEMISPHERICAL SCALE.—See *Citrus.*
MEALY-BUG.—See *Citrus.*
OLEANDER SCALE.—See *Hedera.*
RED SCALE.—See *Citrus.*
SOFT BROWN SCALE.—See *Citrus.*
WHITE PEACH SCALE.—See *Peach.*

Dahlia. GREENHOUSE THRIPS.—See *Citrus.*
TARNISHED PLANT-BUG.—See *Aster.*

Date. DATE PALM SCALE (*Parlatoria blanchardii*).—Small elongate gray or black scales with white edges. Male scales are white.

Treatment.—Crop close, burn over trunks, after saturating with gasolene and use blast torch.

MARLATT SCALE (*Phœnicococcus marlatti*).—A soft-bodied, oval, wine-red insect, one twenty-fifth inch in length, partially covered with white wax, found in large colonies at base of leaves.

Treatment.—Carbolic acid emulsion poured in large quantities at base of leaves.

OLEANDER SCALE.—See *Hedera.*
RED SCALE.—See *Citrus.*
RHINOCEROS BEETLE.—See *Coconut.*

Dewberry.—See *Bramble Fruits.*

Diospyros. WHITE FLY.—See *Citrus.*
WHITE PEACH SCALE.—See *Peach.*

Dracæna. LONG-TAILED MEALY-BUG (*Pseudococcus longispinus*).—Similar to the common mealy-bug, but has two long white anal appendages.

Treatment.—Same as for mealy-bug.

CATALOGUE OF INSECTS, continued.

Echinocactus.—See *Cactus.*

Echinocereus.—See *Cactus.*

Echinopsis.—See *Cactus.*

Eggplant.—See article on *Eggplant.*

Elm.—See *Ulmus.*

Eucalyptus. BLACK SCALE.—See *Citrus.*
OLEANDER SCALE.—See *Hedera.*
RED SCALE.—See *Citrus.*

Eupatorium. BARNACLE SCALE.—See *Citrus.*

Evonymous. EVONYMOUS SCALE (*Chionaspis evonymi*).—Dark brown, convex scales, about one-twelfth inch in diameter with yellow exuviæ. Male scales pure white parallel sides and strongly tricarinated.
Treatment.—Spray with kerosene emulsion every two weeks during the hatching periods until the scale has disappeared.
RED SCALE.—See *Citrus.*

Ferns. FLORIDA WAX SCALE.—See *Citrus.*
GREENHOUSE THRIPS.—See *Citrus.*
HEMISPHERICAL SCALE.—See *Citrus.*
MEALY-BUGS.—See *Citrus.*
OLEANDER SCALE.—See *Hedera.*
SOUTHERN FERN-CUTWORM (*Callopistria floridensis*).—Velvety black or apple-green caterpillars, 1⅜ inches in length when mature, feeding on the fronds.
Treatment.—Try poisoned baits.

Ficus. COTTONY CUSHION SCALE; GREENHOUSE THRIPS; MEALY-BUG; PURPLE SCALE; RED SCALE; SOFT BROWN SCALE.—See *Citrus.*

Fuchsia. GREENHOUSE THRIPS.—See *Citrus.*
MEALY-BUGS.—See *Citrus.*
RED-SPIDER.—See *Peach.*
WHITE FLY.—See *Tomato.*

Gardenia. CITRUS WHITE FLY.—See *Citrus.*
JAPANESE WAX SCALE (*Ceroplastes ceriferus*).—White to creamy waxy masses, ¼ to ¾ inch in diameter.
Control.—Young scales may be killed with kerosene emulsion before the waxy covering is formed.
ORTHEZIA.—See *Coleus.*

Genista. GENISTA CATERPILLAR (*Mecyna reversalis*).—Pale yellowish brown caterpillars marked with numerous black spots and setæ, feeding on the foliage.
Treatment.—Arsenicals.

Geranium. MEALY-BUGS.—See *Citrus.*
RED-SPIDER.—See *Peach.*
WHITE-FLY.—See *Tomato.*

Gooseberry. CURRANT-BORER; CURRANT MEASURING- or SPAN-WORM; FOUR-STRIPED PLANT-BUG; GOOSEBERRY- or CURRANT-WORM.—See *Currant.*
GOOSEBERRY FRUIT-WORM (*Dakruma convolutella*).—Larva about ¾ inch long, greenish or yellowish, feeding in the berry, causing it to ripen prematurely.
Treatment.—Destroy affected berries. Clean cultivation. Poultry.

Grape. GRAPE-CURCULIO (*Craponius inæqualis*).—Larva small, white, with a brownish head. Infests the grape in June and July, causing a little black hole in the skin and a discoloration of the berry immediately around it. The adult is a grayish brown snout-beetle, about one-tenth inch long.
Treatment.—Spray with arsenate of lead while the beetles are feeding on the leaves. The beetles may be jarred down on sheets, as with the plum-curculio. Bag the clusters.
GRAPE ROOT-WORM (*Fidia viticida*).—The small white grubs feed upon the roots, often killing the vines in a few years. The adults are small grayish brown beetles that eat peculiar chain-like holes in the leaves during July and August.
Treatment.—Cultivate thoroughly in June, especially close around the vines to kill the pupæ in the soil. At the first appearance of the beetles, spray the planta with arsenate of lead at the rate of eight or ten pounds in one hundred gallons of water, to which should be added one gallon of molasses.
GRAPE-SLUG or SAW-FLY (*Selandria vitis*).—Larva, about ½ inch long, yellowish green with black points, feeding upon the leaves; two broods.
Remedies.—Arsenicals; hellebore.
GRAPEBERRY-WORM (*Polychrosis viteana*).—Larva, about ¼ inch long, feeding on the berry, often securing three or four together by a web; two broods.
Remedy.—Spray with arsenate of lead before blossoms open. Repeat after blooming and again in early July. Destroy wormy berries in August.
GRASSHOPPERS.—See *Corn.*
GRAPE-VINE FLEA-BEETLE (*Graptodera chalybea*).—Beetle, of a blue metallic color, about ¼ inch long, feeding upon the buds and tender shoots in early spring.
Treatment.—Arsenicals to kill the grubs on leaves during May and June. The beetle can be caught by jarring on bright days.
GRAPE-VINE ROOT-BORER (*Memythrus polistiformis*).—Larva 1½ inches or less long, working in the roots.
Preventive.—Thorough cultivation during June and July.
Treatment.—Dig out the borers.
GRAPE-VINE SPHINX (*Ampelophaga myron*).—A large larva, 2 inches long when mature, green with yellow spots and stripes, bearing a horn at the posterior extremity, feeding upon the leaves, and nipping off the young clusters of grapes; two broods.

CATALOGUE OF INSECTS, continued.

Treatment—Hand-picking. Arsenicals early in the season. There are other large sphinx caterpillars which feed upon the foliage of the vine and which are readily kept in check by hand-picking and spraying.
LEAF-HOPPER (*Typhlocyba comes*).—These small yellowish leaf-hoppers, erroneously called "thrips," suck the sap from the under side of the leaves, causing them to turn brown and dry up.
Treatment.—Spray the under side of the leaves very thoroughly with one gallon "Black Leaf 40" in 1,000 gallons of water about July 1, to kill the young leaf-hoppers. When using tobacco extract, add about two pounds soap to each fifty gallons to make it spread and stick better. Repeat the application in a week or ten days. In houses, tobacco smoke, pyrethrum poured upon coals held under the vines, syringing with tobacco-water or soapsuds.
PHYLLOXERA (*Phylloxera vastatrix*).—A minute insect preying upon the roots, and in one form causing galls upon the leaves.
Preventive.—As a rule, this insect is not destructive to American species of vines. Grafting upon resistant stocks is the most reliable method of dealing with the insect yet known. This precaution is taken to a large extent in European countries and in California, as the European vine is particularly subject to attack.
Remedies.—There is no reliable and widely practicable remedy known.
ROSE-CHAFER (*Macrodactylus subspinosus*).—The ungainly, long-legged grayish beetles occur in sandy regions, and often swarm into vineyards and destroy the blossoms and foliage.
Treatment.—At the first appearance of the beetles, spray with arsenate of lead at the rate of eight or ten pounds in one hundred gallons of water, to which should be added one gallon of molasses.
TREE CRICKET.—See *Bramble Fruits.*

Grapefruit.—See *Citrus.*

Guava. BLACK SCALE.—See *Citrus.*
GUAVA MEALY-BUG (*Pseudococcus nipæ*).—Closely resembles the ordinary mealy-bug.
Treatment.—Carbolic acid emulsion.
HEMISPHERICAL SCALE.—See *Citrus.*
MEDITERRANEAN FRUIT FLY.—See *Citrus.*

Hedera. BLACK SCALE; FLORIDA RED SCALE; HEMISPHERICAL SCALE; MEALY-BUGS.—See *Citrus.*
OLEANDER APHIS (*Aphis nerii*).—Deep yellowish plant-lice, marked with black, cluster on the young shoots and buds.
Treatment.—Contact insecticides.
OLEANDER SCALE (*Aspidiotus hederæ*).—Flat, circular, gray scales, ⅛ inch in diameter.
Treatment.—Same as for *San José Scale* (apple), which see.
SOFT BROWN SCALE.—See *Citrus.*

Helianthus. STEM MAGGOT.—See *Artichoke.*

Heliotropium. RED-SPIDER.—See *Peach.*

Hibiscus. MELON APHIS.—See *Muskmelon.*

Hickory. GALL APHIS (*Phylloxera sp.*).—Yellowish green plant-lice causing hollow galls on the leaves, petioles and small twigs.
Treatment.—Spray with contact insecticides just as the buds are opening.
HICKORY BARK BEETLE (*Eccoptogaster quadrispinosa*).—Small brown beetle burrowing into twigs, buds and green nuts in June and July. Early in August the females penetrate the bark of living trees forming longitudinal burrows along the sides of which eggs are deposited. The grubs burrow transversely in the sap-wood, soon killing the trees.
Treatment.—Cut and burn all infested trees before May of each year.
NUT WEEVIL.—See *Pecan.*
TWIG-GIRDLER.—See *Apple.*

Hollyhock. HOLLYHOCK BUG (*Orthotylus delicatus*).—A small green bug attacking the hollyhock with much damage.
Treatment.—Kerosene emulsion; tobacco extracts.
MELON APHIS.—See *Muskmelon.*

Horse-Radish. CABBAGE-WORM.—See *Cabbage.*
FLEA BEETLES.—See *Potato.*
HARLEQUIN CABBAGE-BUG.—See *Cabbage.*

Ipomœa. SOFT BROWN SCALE.—See *Citrus.*

Iris. WHITE-FLY.—See *Citrus.*

Jasminum. CITRUS WHITE-FLY.—See *Citrus.*
SOFT BROWN SCALE.—See *Citrus.*

Juglans.—See *Hickory.*

Juniper. BAGWORM (*Thyridopteryx ephemeræformis*).—Small caterpillars in curious bag-like shelters defoliating the trees in early summer.
Treatment.—Arsenate of lead, two pounds to one hundred gallons of water.
JUNIPER SCALE (*Diaspis carueli*).—Snow-white, circular scales with yellow central exuviæ.
Treatment.—Nothing known.
JUNIPER WEB-WORM (*Phalonia rutilana*).—Small flesh-colored caterpillar that webs the leaves together.
Treatment.—Arsenicals.

Kale.—See *Cabbage.*

Kohlrabi.—See *Cabbage.*

Kumquat.—See *Citrus.*

DISEASES AND INSECTS

CATALOGUE OF INSECTS, continued.

Lantana. GREENHOUSE WHITE-FLY.—See *Tomato.*
MEALY-BUGS.—See *Citrus.*
ORTHEZIA.—See *Coleus.*

Larix. CASE-BEARER (*Coleophora laricella*).—A small reddish brown caterpillar mining the leaves when young. In September it constructs a case and feeds on the surrounding leaves for a time, migrates to the branches and there hibernates.
Treatment.—Spray with lime-sulfur before the buds open to destroy the hibernating caterpillars.
LARCH SAW-FLY (*Lygæonematus erichsonii*).—Grayish green larvæ with black heads feeding on the foliage.
Treatment.—Spray with arsenicals.

Laurus. BLACK SCALE.—See *Citrus.*
FROSTED SCALE.—See *Apricot.*
SOFT BROWN SCALE, and THRIPS.—See *Citrus.*
WHITE PEACH SCALE.—See *Peach.*

Lemon.—See *Citrus.*

Lespedeza. SMOKY CRANE-FLY (*Tipula infuscata*).—Dirty yellowish maggots, ½ inch long, feeding on the roots, often in great abundance.
Treatment.—Short crop-rotation.

Lettuce. APHIS, or GREEN-FLY (*Macrosiphum lactucæ*).—A plant-louse on forced lettuce.
Preventive.—Tobacco-dust applied on the soil and plants as soon as the aphis makes its appearance, or even before. Renew every two or three weeks if necessary. Fumigating with tobacco is the surest remedy.
CABBAGE-LOOPER (*Autographa brassiæ*).—Larva somewhat over an inch long, pale green, with stripes of a lighter color, feeding on leaves of many plants, as cabbage, celery, and endive.
Remedies.—Pyrethrum diluted with not more than three times its bulk with flour; kerosene emulsion; hot water.
GREENHOUSE WHITE-FLY.—See *Tomato.*
ROOT-LOUSE (*Rhizobius lactucæ*).—Small dull-whitish lice, about one-tenth inch in length, feeding on the roots.
Treatment.—Crop-rotation and tobacco dust placed in the soil about the plants.

Liriodendron. TULIP TREE SCALE (*Toumeyella liriodendri*).—Large, nearly hemispherical scales clustered in masses on the under side of branches.
Treatment.—Scrape badly infested branches. Spray with kerosene emulsion or soap solution.

Lupine. LUPINE APHID (*Macrosiphum albifrons*).—Large, green lice covered with fine white powder, infesting the plants.
Treatment.—Contact insecticides.

Lycopersicum.—See *Tomato.*

Magnolia. BLACK SCALE; CITRUS WHITE FLY; GLOVERS' SCALE.—See *Citrus.*
MAGNOLIA SCALE (*Neolecanium cornuparvum*).—Large, convex scales, pinkish in color, and covered with fine powdered wax.
Treatment.—Kerosene emulsion or tobacco extract to kill the young scales.

Maclura. Treated under Toxylon.

Mangifera. CITRUS MEALY-BUG.—See *Citrus.*
FRUIT FLY (*Anastrepha acidusa*).—Small yellowish maggots infesting the ripening fruit.
Treatment.—Try sweetened arsenate of lead to kill the flies.
GREENHOUSE WHITE-FLY.—See *Citrus.*
MANGO WEEVIL (*Cryptorhynchus mangiferæ*).—Brown weevils about ¼ inch long, the grubs living within the seeds.
Treatment.—Gather and destroy all fallen fruit.

Mimulus. *Ceroputo yuccæ.*—Closely resembles the common mealy-bug.
Treatment.—As for mealy-bugs.

Monstera. SCALE (*Hemichionaspis aspidistra*).—Brownish, oyster-shell-shaped scales, attacking the foliage.
Treatment.—Wash the leaves with soapsuds and tobacco extract.

Mushroom. MAGGOTS (*Sciara sp.*).—Small whitish or yellowish white maggots with black heads.
Treatment.—Exclude flies from house or cellar with fine screens. Sterilize manure by heating to 150° F. Fumigate with tobacco.
MUSHROOM MITE (*Tyroglyphus lintneri*).—A minute mite preventing growth of spawn by eating the mycelium.
Control.—In infested houses remove all compost and disinfect by drenching cellar with boiling water. Use sterilized manure.
SPRINGTAILS (*Achoreutes sp.*).—Small black or brown jumping insects which sometimes swarm in on the beds.
Treatment.—Fumigate with potassium cyanide, three to six ounces to each 1,000 cubic foot of air-space. Sterilize all manure with heat before using.
SOWBUGS (*Armadillidium sp.* and *Porcellio sp.*).—Oval, grayish or slate-colored creatures bearing seven pairs of legs; frequently injure mushrooms. These are commonly known as sowbugs and pillbugs.
Treatment.—Mix one quart of cornmeal with sufficient brown sugar to sweeten, then add two tablespoonfuls of paris green. Moisten with water and scatter in places frequented by these sowbugs.

Muskmelon. MELON APHIS (*Aphis gossypii*).—Small, dark green, sluggish lice found abundantly on melon vines, causing curling of the leaves and death of the plant.

CATALOGUE OF INSECTS, continued.

Treatment.—Fumigate with tobacco preparations under cloth-covered frames placed over the plants. Cloth should be treated with linseed oil before using, to make gas-proof. In large fields, spray with "Black Leaf 40" tobacco extract, three-fourths pint to one hundred gallons of water, adding four pounds of soap.
MELON CATERPILLAR (*Diaphania hyalinata*).—Pale, greenish yellow caterpillar about ½ inch in length when mature, feeding on the foliage early in the season; later boring in the fruits.
Treatment.—Use arsenicals early in the season.
PICKLE-WORM.—See *Cucumber.*
STEM-BORER.—See *Squash.*

Narcissus. GREEN APHIS.—Tobacco extract, soap solution or fumigation.
NARCISSUS BULB FLY (*Merodon equestris*).—Grayish maggots, ½ to ¾ inch in length when mature, feeding in the bulb. The adult is a large hairy fly.
Control.—Examine bulbs and discard infested ones, burning them. If bulbs are placed in water for from two to eight days the maggots will usually leave them.

Nasturtium. APHIS. A dark-colored plant-louse.
Treatment.—Spray the plants with tobacco extract or soap solution.

Nectarine.—See *Peach.*

Nelumbo. PLANT-LICE.—Use tobacco preparations for controlling these pests.

Nepenthes. MEALY-BUGS.—See *Citrus.*

Nerium. OLEANDER SCALE.—See *Hedera.*

Oak. BROWN-TAIL MOTH.—See *Apple.*
GIPSY MOTH.—See *Apple.*
PIT-MAKING OAK-SCALE (*Asterolecanium variolosum*).—Circular greenish yellow scales with a glassy appearance. Especially destructive to golden oak.
Treatment.—Kerosene emulsion or soap solution.
TENT CATERPILLARS; TUSSOCK MOTH; TWIG-PRUNER.—See *Apple.*

Okra. MELON APHIS.—See *Muskmelon.*

Olive. BLACK SCALE.—See *Citrus.*
BLACK CITRUS LOUSE.—See *Citrus.*
Chrysomphalus rossi.—Circular or oblong, reddish to dark brown scale with a central black spot.
Treatment.—Same as for *Red Scale.*—See *Citrus.*
OLEANDER SCALE.—See *Hedera.*
PINEAPPLE SCALE.—See *Pineapple.*
PURPLE SCALE; RED SCALE; THRIPS.—See *Citrus.*

Onion. BLACK ONION FLY (*Tritoxa flexa*).—Whitish maggots attacking the bulbs of onions.
Treatment.—Same as for cabbage maggot.
ONION MAGGOT (*Phorbia cepetorum*).—Small maggot feeding on the bulb and roots; several generations.
Treatment.—Use lime, tobacco dust or hellebore as repellents to prevent oviposition. Some of the maggots may be killed by applying carbolic acid emulsion or hellebore decoction to the soil about the plants.
CUTWORMS.—See *Corn.*
ONION THRIPS (*Thrips tabaci*).—Minute, elongate, pale yellow insects attack the leaves, causing them to wilt.
Treatment.—Tobacco sprays. Spray with paris green one pound in one hundred gallons water sweetened with twenty pounds brown sugar when thrips first appear.

Orange.—See *Citrus.*

Orchids. HEMISPHERICAL SCALE.—See *Citrus.*
ORCHIDS ISOSOMA (*Isosoma orchidearum*).—Small, white larvæ infesting the buds causing them to become unduly enlarged.
Treatment.—Cut off and destroy infested buds.
SCALE INSECTS.—Several species.
Treatment.—Wash plants with nicotine solutions and soapsuds.

Papaver. PLANT-LOUSE (*Aphis rumicis*).—Shining black plant-louse that clusters on leaves and stems.
Treatment.—Contact insecticides.

Parsnip. PARSLEY-WORM (*Papilio asterias*).—Larva, 1½ inches long, light yellow or greenish yellow with lines and spots; feeds upon leaves of parsley, celery, carrot, and related plants. When the worm is disturbed it ejects from the anterior end two yellow horns, with an offensive odor.
Remedies.—Hand-picking. Poultry are said to eat them sometimes. Upon parsnips, arsenicals.
PARSNIP-LOUSE (*Hyadaphis pastinacæ*).—Greenish plant-lice.
Treatment.—Contact insecticides.
PARSNIP WEB-WORM (*Depressaria heracliana*).—Larva, about ½ inch long, feeding in the flower-cluster and causing it to become contorted.
Treatment.—Arsenicals, applied as soon as the young worms appear, and before the cluster becomes distorted. Burn the distorted umbels. Destroy all wild carrots.
PARSNIP LEAF-MINER (*Acidia fratria*).—Small, whitish maggots mining the leaves.
Treatment.—Hand-pick infested leaves.

Passiflora. MEALY-BUGS.—See *Citrus.*

Pea. CUT-WORMS.—See *Corn.*
PEA-WEEVIL, or PEA-BUG (*Bruchus pisi*).—A small brown-black beetle, living in peas over winter. The beetle escapes in fall and spring, and lays its eggs in young pea-pods, and the grubs live in the growing peas.

DISEASES AND INSECTS

CATALOGUE OF INSECTS, continued.

Treatment.—Hold over infested seed one year before planting. Late planting in some localities. Fumigation with carbon bisulfid.

PEA APHIS (*Macrosiphum pisi*).—A rather large green plant-louse, often attacking peas in great numbers and causing enormous losses.

Treatment.—Rotation of crops, early planting. When peas are grown in rows, the brush-and-cultivator method may be used. The plant-lice are brushed from the plants with pine boughs, and a cultivator follows stirring the soil. This operation should be performed while the sun is hot and the ground dry. Most of the lice will be killed before they can crawl back to the plants. Repeat every three to seven days.

Peach. BLACK APHIS (*Aphis persicæ-niger*).—A small black or brown plant-louse, which attacks the tops and roots of peach trees. When upon the roots it is a very serious enemy, stunting the tree and perhaps killing it. Thrives in sandy lands.

Treatment. Kerosene emulsion; tobacco decoction and extracts.

CLOVER MITE (*Bryobia pratensis*).—Small reddish mites attacking the leaves, causing them to turn yellow.

Treatment.—Lime-sulfur while trees are dormant. In summer, use self-boiled lime-sulfur, as a dust, or sulfur paste.

FLAT-HEADED BORER.—See *Apple.*

FRUIT TREE BLACK BEETLE (*Scolytus rugulosus*).—A small beetle similar to the peach tree bark-beetle.

Treatment.—Same as for *Peach Tree Bark-Beetle*, which see.

KATYDID.—This insect is often troublesome to the peach in the southern states in the early spring, eating the leaves and girdling young stems.

Remedy.—Poisoned baits placed about the tree.

GREEN PEACH-LOUSE OR APHIS (*Myzus persicæ*).—A small insect feeding upon the young leaves, causing them to curl and die.

Treatment.—Lime-sulfur, kerosene emulsion, or tobacco extract. After the buds open, either of the last two.

PEACH TREE BARK-BEETLE (*Phlœotribus liminaris*).—A dark brown beetle one-tenth inch in length burrowing under the bark.

Treatment.—Burn all brush and worthless trees as soon as the infestation is observed. Keep the trees in healthy condition by thorough cultivation and the use of fertilizers. Apply a thick whitewash to the trunk and branches three times a season: (1) the last week of March, (2) second week in July, (3) first week in October.

PEACH TREE-BORER (*Sanninoidea exitiosa*).—A whitish larva, about ¾ inch long when mature, boring into the crown and upper roots of the peach, causing gum to exude.

Remedies.—Dig out the borers in June and mound up the trees. At the same time apply gas-tar or coal-tar to the trunk from the roots up to a foot or more above the surface of the ground.

PEACH TWIG-MOTH (*Anarsia lineatella*).—The larva of a moth, ¼ inch long, boring in the ends of the shoots, and later in the season attacking the fruit. Several broods.

Remedy.—Spray with lime-sulfur just after the buds swell. Spray trunks and larger branches in late spring to kill first brood pupæ in the curls of bark.

PLUM-CURCULIO (*Conotrachelus nenuphar*).—This insect may be successfully controlled on peach by spraying with arsenate of lead, four pounds to one hundred gallons of self-boiled lime-sulfur. Spray, first, when the "husks" drop from the fruit; second, ten days or two weeks later. It is unsafe to spray peaches more than twice with arsenate of lead.

RED-SPIDER, or MITE (*Tetranychus bimaculatus*).—A small mite infesting many plants, both in the greenhouse and out-of-doors. It flourishes in dry atmospheres, occurring on the under sides of the leaves. In some forms it is reddish, but usually light-colored and two-spotted. Common.

Remedies.—Persistent syringing with water will generally destroy them, if the spray is applied to the under surface. Use lots of force and little water to avoid drenching the beds. Sulfur and water. Dry sulfur. On orchard trees, flour paste.

ROUND-HEADED APPLE TREE BORER.—See *Apple.*

WHITE PEACH SCALE (*Diaspis pentagona*).—Circular gray scales with the exuviæ, at one side of the center.

Remedy.—Same as for *San José Scale.* See *Apple.*

Pear. APPLE TREE-BORER; BUD-MOTH; CODLIN-MOTH; FLAT-HEADED BORER.—See *Apple.*

MIDGE (*Diplosis pyrivora*).—A minute mosquito-like fly; lays eggs in flower-buds when they begin to show white. These hatch into minute grubs which distort and discolor the fruit. New York and eastward. Prefers the Lawrence. Introduced in 1877 from France.

Remedies—Destroy the infested pears. Cultivate and plow in late summer and fall to destroy the pupæ then in the ground.

PEAR-LEAF BLISTER-MITE (*Eriophyes pyri*).—A minute mite which causes black blisters to appear upon the leaves. The mites collect under the bud-scales in winter.

Remedy.—Lime-sulfur or miscible oil as a dormant spray.

PEAR PSYLLA (*Psylla pyricola*).—These minute, yellowish, flat-bodied, sucking insects are often found working in the axils of the leaves and fruit early in the season. They develop into minute, cicada-like jumping-lice. The young psyllas secrete a large quantity of honey-dew, in which a peculiar black fungus grows, giving the bark a characteristic sooty appearance. There may be four broods annually, and the trees are often seriously injured.

CATALOGUE OF INSECTS, continued.

Treatment.—Clean culture; remove rough bark from trunks and larger branches to discourage adults from hibernating; spray with "Black Leaf 40" tobacco extract, one pint in one hundred gallons of water, adding four pounds soap, on warm days in November or April to kill hibernating adults. Spray with lime-sulfur, winter strength, when the blossom clusters appear, to destroy eggs.

Summer treatment.—Spray with "Black Leaf 40" tobacco extract just as the last of the petals are falling to kill young. Repeat if necessary.

PEAR THRIPS (*Euthrips pyri*).—Minute insects one-twentieth inch in length, dark brown when adult, white with red eyes when young, that attack the opening buds and young fruits in early spring. They suck the sap from the tender growth, and the females lay eggs in the fruit-stems, causing a loss of the crop. The nymphs hibernate in the ground a few inches from the surface. A serious pest in California and recently introduced into New York.

Treatment.—Thorough cultivation during October, November, and December (in California). Make two applications of "Black Leaf" tobacco extract, one gallon in sixty gallons of 2 per cent distillate oil emulsion, the first just as the fruit-buds begin to open, the second just after the petals fall. In the East it may be controlled by timely applications of tobacco extract and whale-oil soap.

PEAR-TWIG BEETLE (*Xyleborus pyri*).—Brownish or black beetle, one-tenth inch long, boring in twigs, producing effect much like pear blight, and hence often known as "pear-blight beetle." It escapes from a minute perforation at base of bud; probably two broods.

Treatment.—Burn twigs before the beetle escapes.

Pecan. BUD-MOTH (*Proteopteryx deludana*).—A brownish caterpillar about ½ inch in length, feeding on the opening buds in early spring and on the under side of the leaves in summer.

Treatment.—Arsenate of lead in summer to kill larvæ of second brood. Lime-sulfur and arsenate of lead in dormant season just before buds open, to destroy hibernating larvæ.

CASE-BEARER (*Acrobasis nebulella*).—A small caterpillar living inside a case which it carries with it. It attacks the opening buds.

Treatment.—Arsenate of lead as soon as the buds begin to open. Repeat if necessary.

BORER (*Sesia scitula*).—A wood-boring caterpillar working in the sap-wood.

Treatment.—Digging out.

PECAN WEEVIL (*Balaninus caryæ*).—A dull, dark brown beetle with a long and slender snout with which it punctures the husk and shell of the maturing nuts for oviposition. The grubs live within the nut feeding on the kernel.

Treatment.—Destroy all infested nuts. This should be as soon as they fall.

ROSE-CHAFER.—See *Grape.*

ROUND-HEADED BORER.—See *Apple.*

SLUG.—See *Cherry.*

TWIG-GIRDLER (*Oncideres cingulatus*).—A brownish gray beetle, about ½ inch long, which girdles twigs in August and September. The female lays eggs above the girdle. The twigs soon fall.

Remedy.—Burn the twigs, either cutting them off or gathering them when they fall.

TWIG-PRUNER.—See *Apple.*

Persimmon. TWIG-GIRDLERS.—See *Pecan.*

WHITE PEACH-SCALE (*Diaspis pentagona*).

Remedy.—Lime-sulfur when the trees are thoroughly dormant.

Picea. SPRUCE BUD-WORM (*Tortrix fumiferana*).—Small caterpillar feeding on the young foliage, causing the tips of the twigs to turn reddish, due to the dying of the foliage. Frequently serious in forests.

SPRUCE GALL APHID (*Chermes abietis*).—Plant-lice causing cone-shaped, many-celled galls at the bases of young shoots.

Treatment.—Spray with whale-oil soap, one pound in two gallons of water, in early spring. Cut off all galls and burn before the lice leave them.

Pine. PINE LEAF-SCALE (*Chionaspis pinifoliæ*).—Small white scales frequently abundant on the foliage.

Treatment.—Kerosene emulsion or tobacco extracts when the young are hatching.

PINE WEEVIL (*Pissodes strobi*).—Small grub working in the terminal branch, which is killed, causing distorted trees.

Treatment.—Cut out and burn infested branches.

Pineapple. KATYDID (*Acanthacara similis*).—A large katydid which attacks, among other plants, the leaves of the pineapple.

Remedy.—Arsenicals, before the plants are mature.

MEALY-BUGS (several species).—These mealy white insects attack the plant at the base of the leaves, usually underground.

Treatment.—Set only clean plants, or dip them in resin wash or kerosene emulsion. In the field apply tobacco dust freely in the bud before the bloom begins to appear, or spray with kerosene emulsion.

PINEAPPLE SCALE (*Diaspis bromeliæ*).—Circular, thin, pure white scales with yellow exuviæ infesting leaves and fruit.

Treatment.—Kerosene emulsion and resin wash.

RED-SPIDER (*Stigmæus floridanus*).—Minute mites occurring in great number at the base of the leaf, where they induce rot.

Treatment.—Tobacco dust applied to bud.

DISEASES AND INSECTS

CATALOGUE OF INSECTS, continued.

Plum. CANKER-WORM.—See *Apple.*
CURCULIO (*Conotrachelus nenuphar*).—Larva, a whitish grub, feeding in the fruit.
Remedies.—Arsenate of lead, six pounds to one hundred gallons of water; apply as soon as the calyx falls, and repeat two or three times at intervals of about ten days. Jarring the beetles on sheets very early in the morning, beginning when trees are in flower, and continuing from four to six weeks, is probably the most certain procedure. There are various styles of sheets or receptacles for catching the insects as they fall from the tree. Clean culture.
FLAT-HEADED BORER.—See *Apple.*
PEAR-TWIG BEETLE.—See *Pear.*
PLUM-GOUGER (*Coccotorus prunicida*).—A small larva, feeding upon the kernel of the plum. The beetle bores a round hole in the plum instead of making a crescent mark like the curculio.
Remedy.—Catch the beetles in a curculio-catcher.
SAN JOSÉ SCALE.—See *Apple.*
EUROPEAN FRUIT SCALE (*Lecanium corni*).—A large circular scale occurring on plum; occasionally very destructive.
Remedy.—Thorough spraying with kerosene emulsion, one part to five of water, in the winter. More dilute emulsion or tobacco extracts in midsummer, when the young insects are on the leaves and young shoots. Miscible oils when trees are dormant.
SLUG.—See *Cherry*
TENT CATERPILLARS.—See *Apple.*
TWIG-PRUNER.—See *Apple.*

Poinsettia. MEALY-BUGS.—See *Citrus.*

Pomegranate. BLACK SCALE; CITRUS THRIPS; FLORIDA WAX SCALE.—See *Citrus.*
OLEANDER SCALE.—See *Hedera.*
WHITE-FLY.—See *Citrus.*

Pomelo.—See *Citrus.*

Populus. BLACK SCALE.—See *Citrus.*
COTTONWOOD LEAF-BEETLE (*Lina scripta*).—A striped beetle feeding on the leaves and shoots of poplars and willows.
Remedy.—Arsenicals.
OYSTER-SHELL SCALE.—See *Apple.*
POPLAR BORER (*Cryptorhynchus lapathi*).—A whitish grub burrowing in the wood.
Treatment.—In nurseries, spray thoroughly about the middle of July with arsenate of lead to kill the parent beetles.

Potato. COLORADO POTATO-BEETLE (*Leptinotarsa decemlineata*).—Beetle and larva feed upon the leaves.
Remedies.—Arsenicals, either dry or in spray, about a third stronger than for fruits. Hand-picking the beetle.
FLEA-BEETLE (*Halticini*).—Small, dark-colored jumping beetles that riddle the leaves with holes.
Preventive.—Bordeaux mixture as applied for potato blight acts as a repellent.
POTATO TUBER-WORM (*Phthorimæa operculella*).—A small caterpillar burrowing in the stems and tubers both in the field and in storage.
Preventives.—Clean cultivation, sheep and hogs to destroy the small potatoes left in the field after digging. Crop-rotation over a considerable area. On digging, remove the potatoes at once to an uninfested storeroom. Do not leave them on the field over night.
STALK-WEEVIL (*Trichobaris trinotata*).—A grub boring in the stalk of the potato near or just below the ground. Serious in the West and in some places eastward.
Remedy.—Pull all infested vines as soon as they wilt, and spread them in the sun where the insects will be killed. Burn the vines as soon as the crop is harvested. Destroy all solanaceous weeds.
WIRE-WORMS.—See *Corn.*

Primula. WHITE-FLY.—See *Citrus.*

Privet or Prim. PRIVET WEB-WORM (*Diaphania quadristigmalis*).—Small larva feeding in webs on the young shoots of the privet, appearing early in the season; two to four broods.
Remedies.—Trim the hedge as soon as the worms appear, and burn the trimmings. Probably the arsenicals will prove useful.

Prune.—See *Plum.*

Prunus.—See *Plum.*

Pseudotsuga. SEED CHALCIS (*Megastigmus spermotrophus*).—Small whitish grub devours the kernel of the seed, often destroying the whole crop.
No known remedy.

Pyrus.—See *Apple.*

Quince. GREEN APHIS.—See *Apple.*
QUINCE CURCULIO (*Contrachelus cratægi*).—This curculio is somewhat larger than that infesting the plum, and differs in its life-history. The grubs leave the fruits in the fall, and enter the ground, where they hibernate and transform to adults the next May, June or July, depending on the season.
Treatment.—When the adults appear, jar them from the tree onto sheets or curculio-catchers and destroy them. To determine when they appear, jar a few trees daily, beginning the latter part of May. Arsenicals. Pick and burn all infested fruits a month before harvest.
ROUND-HEADED BORERS.—See *Apple.*
SLUG.—See *Cherry.*

Radish. MAGGOT (*Pegomya brassicæ*).—Treated the same as the *Cabbage Maggot*, which see.

CATALOGUE OF INSECTS, continued.

Raspberry.—See *Bramble Fruits.*

Rhododendron. BORER (*Sesia rhododendri*).—Whitish caterpillars burrowing in the trunk and larger branches which are often killed.
Treatment.—Dig out borers or cut out infested branches and burn.
LACE BUG (*Leptobyrsa explanata*).—Small, lace-winged bugs on the under side of the leaves, causing them to turn brown and die.
Treatment.—Spray with soap solution.

Rhubarb. RHUBARB-CURCULIO (*Lixus concavus*).—A grub ¾ inch long, boring into the crown and roots. It also attacks wild docks.
Remedy.—Burn all infested plants and keep down the docks. Hand-picking.

Rhus. APPLE TREE-BORER.—See *Apple.*
JUMPING SUMAC-BEETLE (*Blepharida rhois*).—Larva, ½ inch long, dull greenish yellow, feeding on leaves; two broods.
Remedy.—Arsenicals.

Ribes.—See *Currant.*

Robinia. LEAF-MINER (*Odontota dorsalis*).—A black and yellowish white grub about ¼ inch in length, mining the leaves, causing blister-like spots.
Treatment.—Arsenate of lead the last of July to first of August.
LOCUST-BORER (*Cyllene robiniæ*).—Large, brownish yellow grub burrowing in the trunk, causing large ugly scars. The beetle is black prettily marked with yellow stripes and bands.
Remedy.—None known.

Rose. MEALY-BUG.—Tobacco extracts; syringe the plants in the morning, and two hours later syringe again with clean water.
ROSE APHIS (*Macrosiphum rosæ* and *Myzus rosarum*).—Greenish plant-lice, attacking leaves and buds.
Treatment.—Tobacco extracts and soap solutions.
ROSE-CHAFER, ROSE-BEETLE, or "ROSE-BUG."—See *Grape.*
ROSE LEAF-HOPPER (*Typhlocyba rosæ*).—A very small hopper, white, often mistaken for thrips, living on the leaves of roses.
Remedies.—Whale-oil soap; kerosene; kerosene emulsion; dry pyrethrum blown on bushes when leaves are wet; tobacco extracts.
ROSE MIDGE (*Neocerata rhabdophaga*).—Small maggots, distorting leaf and flower-buds.
Treatment.—No satisfactory treatment known.
ROSE SCALE (*Aulacaspis rosæ*).—Small, whitish circular scales.
Treatment.—Soap solutions or tobacco extracts when young are hatching.
WHITE-FLY.—See *Tomato.*

Rubus.—See *Bramble Fruits.*

Salix. COTTONWOOD LEAF-BEETLE.—See *Populus.*
OYSTER-SHELL SCALE.—See *Apple.*
POPLAR-BORER.—See *Populus.*
WILLOW-WORM (*Euvanessa antiopa*).—Larva nearly 2 inches long, black, feeding upon leaves of willow, elm, and poplar; two broods.
Remedy.—Arsenicals.

Salvia. ORTHEZIA.—See *Coleus.*
WHITE FLY.—See *Tomato.*

Scilla. NARCISSUS BULB FLY.—See *Narcissus.*

Smilax. CITRUS WHITE FLY.—See *Citrus.*

Solanum.—See *Potato.*

Sorbus. SAN JOSÉ SCALE; SCURFY SCALE.—See *Apple.*

Spinach. FLEA-BEETLE.—See *Potato.*
LEAF-MINER (*Pegomya vicina*).—Small maggot mining the leaves.
Treatment.—Clean cultivation to destroy its wild food plant (lamb's quarters). Destroy all infested leaves. By raising spinach as an early or late crop, much of the damage can be avoided.
SPINACH APHIS (*Myzus persicæ*).—Same as green peach aphis.
Treatment.—Spray at first appearance of lice with "Black Leaf 40" tobacco extract, three-fourths pint to one hundred gallons of water, adding four pounds of soap.

Squash. CUCUMBER BEETLES.—See *Cucumber.*
MELON APHIS.—See *Muskmelon.*
SQUASH APHIS (*Nectarophora cucurbitæ*).—Large, light green plant-louse attacking the leaves.
Treatment.—Same as for melon aphis.
SQUASH LADY-BIRD.—See *Cucumber.*
SQUASH STINK-BUG (*Anasa tristis*).—Large, dark brown bug hibernates as adult under rubbish. Female lays large brown eggs in patches on the leaves. The young are greenish, feed in colonies on under side of leaves, causing them to wilt and die.
Treatment.—Trap adults in spring under boards laid on the ground. Destroy eggs by hands. Young can be killed with "Black Leaf 40" tobacco extract, one pint in one hundred gallons of water, adding four to five pounds of soap.
STEM-BORER (*Melittia satyriniformis*).—Soft, white, grub-like larva which bores inside the stem and causes rot to develop, killing the vine.
Preventives.—Plant early squashes as traps. As soon as the early crop is gathered, burn the vines to destroy eggs and larvæ of the borer. Fall harrowing of infested fields will help to expose the pupæ to the elements. Cut out borers whenever found. After the vines have grown to some length, cover some of the joints with earth, so that a new root-system will develop to sustain the plant in case the main root is injured.

CATALOGUE OF INSECTS, continued.

Strawberry. CROWN-BORER (*Tyloderma fragariæ*).—White grub, ⅛ inch long, boring into the crown of the plant in midsummer. The mature insect is a curculio or weevil.
Preventives.—Rotation of crops. Isolation of new beds from infested beds. Plant uninfested plants.
FULLER'S ROSE-BEETLE (*Aramigus fulleri*).—White grub, ⅛ inch long, feeding in the crown. The adult is a grayish brown snout-beetle with a whitish bar on each wing-cover.
Treatment.—Short rotation. Plant on uninfested land.
LEAF-ROLLER (*Ancylis comptana*).—Larva less than ½ inch long, feeding on the leaves, and rolling them up in threads of silk; two broods.
Treatment.—Turn under in the fall all old beds that have become worthless. Spray with arsenate of lead, four pounds in one hundred gallons of water, after the eggs are laid but before the leaves are folded—the first half of May in the latitude of New Jersey.
ROOT-BORER (*Anarsia sp.*).—Larva about ½ inch long, whitish, boring into the crown of the plant late in the season, and remaining in it over winter.
Remedy.—Burn the plant.
ROOT-BORER (*Typophorus canellus*).—A whitish grub ⅛ inch in length feeding on the roots. The parent beetle is brownish, and appears in great numbers in May.
Treatment.—Arsenicals to kill the beetles. Plant new beds at a distance from old ones.
ROOT-LOUSE (*Aphis forbesii*).—From July to the close of the season the lice appear in great numbers on the crowns and on the roots of the plants.
Remedies.—Rotation in planting. Disinfect plants coming from infested patches by dipping the crowns and roots in kerosene emulsion, or tobacco extract. Fumigation.
SAW-FLY (*Emphytus maculatus*).—Larva nearly ¾ inch long, greenish, feeding upon the leaves; two broods.
Remedies.—Hellebore; arsenicals for second brood.
WEEVIL (*Anthonomus signatus*).—Beetle ⅛ inch long, reddish black, feeding on flower-buds, particularly those of the pollen-iferous varieties.
Preventives.—Plant principally profusely flowering varieties. Clean culture. Destroy all wild blackberry and raspberry vines in the vicinity.
WHITE GRUBS.—See *Corn.*

Sweet Pea. TARNISHED PLANT-BUG.—See *Aster.* (They puncture and kill the flower-stems.)

Sweet Potato. CUTWORMS.—Poisoned bait; late planting; keep the land free from weeds the previous fall.
FLEA-BEETLE (*Chætocnema confinis*).—Small, dark-colored beetles, which attack the plants soon after they are reset.
Treatment.—Dip the plants in a strong solution of arsenate of lead before resetting, spray once or twice later with the same. Rotation of crops. Destroy all bindweed and wild morning-glory plants.
ROOT-BORER (*Cylas formicarius*).—A whitish grub ¼ inch in length, burrowing through the tubers.
Preventive.—Burn infested tubers and the vines.
SAW-FLY (*Schizocerus ebnus* and *S. privatus*).—Small larva about ¼ inch long, working upon the leaves. The fly is about the size of a house-fly.
Remedies.—Hellebore and arsenicals.
TORTOISE BEETLES (*Cassidini*).—Beetles of brilliant colors and their slug-like larvæ which eat holes in the leaves of newly reset plants.
Treatment.—Same as for next.

Tamarix. CANE-BORER (*Schistocerus hamatus*).—Whitish grub, ⅔ inch in length, burrowing in the twigs.
Treatment.—Cut and burn all infested branches.

Theobroma. CACAO BEETLE (*Steirastoma depressum*).—Large grubs, 1½ inches long, burrowing under the bark.
Control.—Dig out or kill with a wire.
CACAO FRUIT FLY (*Ceratitis punctata*).—A small maggot attacking the pods.
Treatment.—Spray when flies appear with sweetened arsenate of lead, four pounds to one hundred gallons of water.
CACAO THRIPS (*Heliothrips rubrocincta*).—Small active insects attacking leaves and pods. In the young the abdomen is banded with red.
Treatment.—Careful cultivation to produce vigorous growth.

Thuya. BAGWORM.—See *Juniper.*

Tomato. FLEA-BEETLES.—Dip the young plants in a strong solution of arsenate of lead. Bordeaux mixture acts as a repellent.
FRUIT-WORM (*Heliothis obsoleta*).—Larva 1 inch in length, pale green or dark brown, faintly striped, feeding upon the fruit. Also on corn and cotton.
Treatment.—Hand-picking. Avoid planting close to corn or cotton, or after either of these crops or after peas or beans. Practise fall or winter plowing.
TOMATO-WORM (*Phlegethontius sexta* and *P. quinquemaculata*).—A very large green worm feeding upon the stems and leaves of the tomato and husk tomato. Seldom abundant enough to be very serious; kept in check by parasites.
Remedies.—Hand-picking; rotation of crops; clean culture; turkeys.
WHITE-FLY (*Aleyrodes vaporariorum*).—Tomatoes grown under glass are often badly infested with white flies, the young of which are scale-like and occur on the under side of the leaves.
Treatment.—Fumigation.

Toxylon. BAGWORM.—See *Juniper.*
SAN JOSÉ SCALE.—See *Apple.*

CATALOGUE OF INSECTS, continued.

Tropæolum.—See *Nasturtium.*

Tsuga. BAGWORM.—See *Juniper.*

Turnip.—See *Cabbage.*

Ulmus. CANKER-WORM.—See *Apple.*
ELM LEAF-BEETLE (*Galerucella luteola*).—A small beetle, imported from Europe, which causes great devastation in some of the eastern states by eating the green matter from elm leaves, causing the tree to appear as if scorched.
Remedy.—Arsenate of lead, six pounds to one hundred gallons, just as the eggs are hatching.
ELM SAW-FLY LEAF-MINER (*Kaliosysphinga ulmi*).—A greenish white larva feeding between the two layers of the leaf, causing large blotches; when abundant, the leaf dies and falls. They sometimes kill the trees in two or three years.
Treatment.—While the blotches are small, spray with "Black Leaf 40," tobacco extract, one gallon in 800 gallons of water, adding four pounds of whale-oil soap to each hundred gallons.
LEOPARD MOTH (*Zeuzera pyrina*).—White to pinkish caterpillars boring at first in the smaller twigs and branches. Later the nearly mature caterpillars attack the larger branches and trunk, doing very serious injury. The white moths, beautifully marked with black and blue, have a wing expanse of about 2½ inches.
Treatment.—Cut off and destroy all infested branches. The spread of the pest is very slow if the branches of the trees do not interlace.
WILLOW-WORM.—See *Salix.*

Violet. APHIS.—Fumigation when grown under glass.
GALL-FLY (*Contarinia violicola*).—The adult is a minute mosquito-like fly. The whitish or yellowish maggot feeds in folds of the opening leaves, which become deformed, turn brown, and die.
Treatment.—Fumigation is practically of no value. Thorough hand-picking as soon as any sign of injury is noticed. Do not let the pest become established in the house.
RED-SPIDER (*Tetranychus bimaculatus*).—Minute mites which cause the leaves to turn paler and become yellowish.
Treatment.—On greenhouse violets there is nothing better than a stiff spray of clear water so applied as not to drench the beds. Repeat the spraying once or twice a week.

Vitis.—See *Grape.*

Walnut.—See *Hickory.*

Watermelon. MELON APHIS.—See *Muskmelon.*

Yucca (*Lonchæa chalybea*).—Small maggot destroying the buds. Very serious pest.
Treatment.—Collect and burn all infested shoots.
LONG-HORNED BEETLE (*Lagochirus obsoletus*).—A white grub 1½ inches in length when mature, boring in the trunk and doing great damage. The adult is a large reddish brown beetle and feeds on the foliage.
Treatment.—When beetles are most abundant prune plants to the ground and burn. Spray with arsenicals to destroy beetles.
SPHINX CATERPILLARS (*Dilophonota ello*).—Large caterpillar feeding on the foliage. The parent moth is a large hawk-moth rather showily colored.
Treatment.—Arsenate of lead, six pounds to one hundred gallons of water.

Zea.—See *Corn.*

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Spraying.

Spraying is the art of protecting cultivated plants from insect enemies and vegetable parasites by covering them with a material which shall have a toxic or physically injurious effect upon the animal or vegetable organism.

Historical sketch.

The history of spraying is interesting. The story of its progress in America differs in details from the history of its development in Europe, but the main features in each country are very similar. In both places, insect enemies made the first draft on the ingenuity of man in devising methods by which to hold them in check. Vegetable parasites were studied afterward. It is a curious fact that, in the case of both insects and fungi, in America, some of the most injurious forms came from Europe and were the means of directing attention to wholesale methods of destroying them. Some of these enemies, comparatively harmless in their native home, like the currant-worm and codlin-moth, have done more to forward spraying methods in the United States than anything else.

The first insecticides used in America, as well as in Europe, were not of a poisonous nature. They were

DISEASES AND INSECTS

substances that had an injurious effect on the body of the insect. These were of two kinds, mainly: infusions which were astringent, and caustic substances which burned the tissues. Tobacco water and alkaline washes have been used for many years. One of the first poisons to be used was white hellebore. The employment of arsenical poisons may be said to belong to America, and even at the present time has small place in the economy of fruit-growing in Europe. The widespread use of arsenical poisons is largely due to the influence of the incursion of the potato-bug. There are no reliable records which give us the exact date of the first use of paris green. It probably occurred about 1865 or 1866. However, towards 1870 paris green was used very generally throughout the western region in which the potato-bug first appeared. At this time it was applied almost exclusively in the dry form diluted with gypsum or flour. From potato to cotton, tobacco and finally to fruit trees, is the development of this poison for destroying leaf-eating insects. So far as records are available, it appears that fruit trees were first sprayed with paris green between 1873 and 1875. Among pioneer sprayers, should be mentioned the names of C. V. Riley, United States Entomologist; LeBarron, State Entomologist of Illinois; William Saunders, London, Ontario, Can.; J. S. Woodward, Lockport, N. Y.; T. G. Yeomans & Sons, Walworth, N. Y.; A. J. Cook, Agricultural College, Mich.



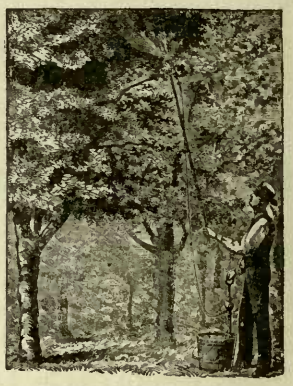
1326. Apple cluster ready for the spray. The blossoms have not yet opened.

Following paris green came london purple, then white arsenic, and later arsenate of lead. Since that time many different forms of arsenical poisons have been compounded, offered to the public and frequently used. A few years ago paris green was used extensively, but its popularity now is decreasing, probably because it contains a large percentage of soluble arsenic, which increases the danger of foliage injury. London purple has been largely dropped by fruit-growers, owing to its variable quality. White arsenic, in combination with soda and with lime, forms a reliable insecticide and is used by some growers, especially those who make a practice of preparing the home-made solutions. Arsenate of lead is the insecticide used most widely by the growers at the present time. It possesses several advantages, the more important of which are a small percentage of soluble arsenic and better sticking qualities.



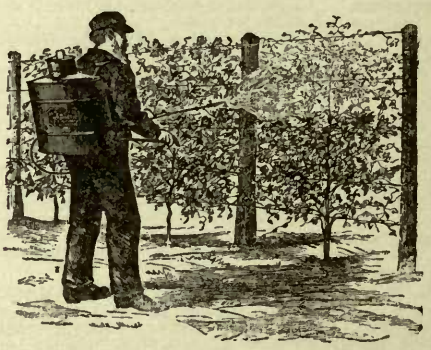
1327. Splint broom for applying spray. An early device.

The sucking insects presented a more difficult problem of control than the biting insects, and a longer time elapsed before effective methods had been devised for treatment. One of the first efficient sprays for these insects was kerosene in the form of a soap-and-water emulsion, which was recommended by Riley and Hubbard. Among the earlier sprays for these insects was also tobacco and whale-oil soaps, both of which are used rather widely at the present time. Later the miscible oils were introduced. These proved to be very effective and are still used. The most important step in the control of the sucking insects is marked by the introduction of the lime-sulfur wash. This mixture, which was originally developed as a dip for the control of scab on sheep, was first used as an insecticide on fruit trees in 1886 by F. Dusey, of Fresno, California. The wash proved very efficient and with modifications came quickly into favor. Now lime-sulfur is the leading insecticide for the control of certain scale insects and also, in a more dilute form, the leading fungicide for the more troublesome diseases of the apple.



1328. A bucket pump.

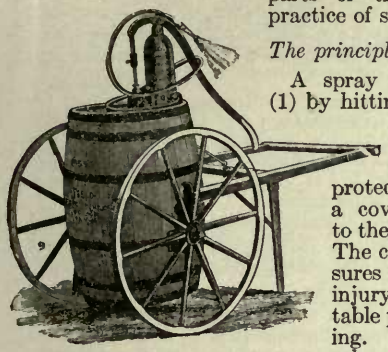
The treatment of fungous diseases of plants by liquid applications began with the discovery of bordeaux mixture. Early in the 1880's, diseases of grape-vines threatened the extinction of French vineyards. The situation engaged the attention of French investigators. Notable among them were A. Millardet and his co-workers of the Academy of Science, Bordeaux, France. He, with others, discovered partly by accident and partly by experiment that solutions of copper prevented the development of downy mildew. After much experimentation, "bouillie Bordellaise" was found to be effective in preventing the growth of downy mildew and other plant parasites infesting the grape in that region. The announcement was definitely made in 1885. The following year the European formula for bordeaux mixture was published in several places in the United States, and immediately there began an unparalleled period of activity in economic vegetable pathology. This mixture, though somewhat modified and developed, continues to be a leading fungicide. The value of lime-sulfur as a fungicide applied to the peach during the dormant season to control the leaf-curl has been recognized. About 1907,



1329. Knapsack pump.

Cordley discovered that lime-sulfur in more dilute form may be applied to the apple and some other tree fruits in foliage without danger of foliage injury, and that in addition to being as effective as bordeaux it produces no spray injury on the fruit. Since then lime-sulfur as a fungicide has practically replaced bordeaux in the case of those fruits for which it can be used on the foliage with safety. The self-boiled lime-sulfur was developed about 1907 as a fungicide for the control of the brown rot of the peach.

The rapidity of the spread of spraying knowledge among fruit-growers is remarkable. Only a few years ago it was an unknown art by the rank and file. Today agricultural clubs and granges purchase their spraying materials by the carload direct from the manufacturer. The American farmer leads his fellow-workers in all parts of the world in the practice of spraying.



1330. A garden barrel pump.

The principles of spraying.

A spray may be effective (1) by hitting the enemy, (2) by placing poison before the depredator, and (3) by protecting the plant with a covering unfavorable to the growth of the pest. The cautious farmer insures his crop against injury by insect or vegetable parasites by spraying. The fruit-grower asks, "Do I need to spray this year? My trees are not blossoming." "Certainly," we answer, "spray to protect the foliage from possible injury by insect or fungous disease." Healthy foliage is essential to the protection of health and vigor and fruit-buds. Spray this year for next year's crop.

Insecticides kill by contact or by means of a poisonous principle; their efficiency depends largely on the time and thoroughness of the application. If applied too soon they may be dissipated before the insects appear; if applied late the injury is only partly prevented, because insects feed less voraciously and are harder to kill as they approach maturity in the larval stage. With the vegetable parasite, the case is not essentially different. The tree is covered with a thin coating which destroys spores of fungi resting there and prevents other spores from germinating. Fig. 1326 shows the stage of development of fruit-bud calling for bordeaux mixture and paris green. The keynote to success is thoroughness. Hasty sprinklings are worse than useless; they discourage and disappoint the beginner. Full protection is not afforded unless each leaf, twig and branch has been covered. Time is the next most important factor bearing on success. The early spray is most effective. This applies particularly to the treatment of fungous diseases. Spray before the buds open. Get ahead of the enemy.

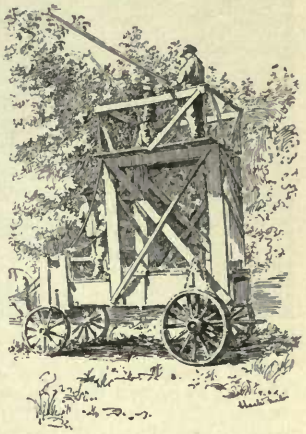
Spraying machinery.

Bordeaux mixture was first applied with a broom (Fig. 1327). Poison distributors were first made in America for the protection of cotton, potato and tobacco. There are five general types of pumps: (1) The hand portable pump, often attached to a pail or other small reservoir, suitable for limited garden areas. (2) The knapsack pump carried on a man's back and operated by the carrier. The tank is made of copper, holds five gallons and is fitted with a neat pump which may be operated with one hand while the nozzle is directed with the other. This pump has been modified recently so that all the pumping is done when the sprayer is filled and before it is placed on the shoulders.

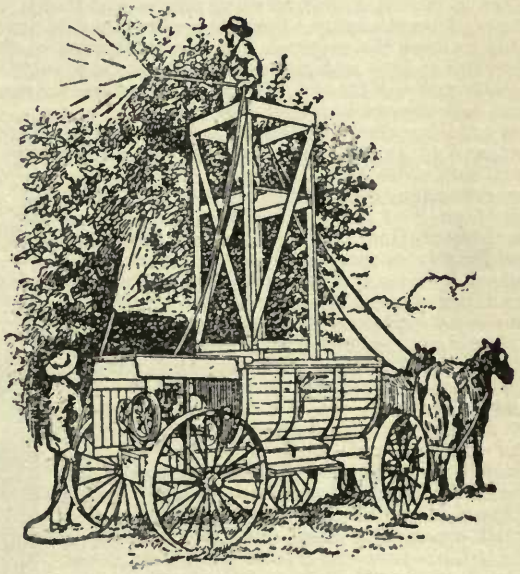


1331. An orchard barrel pump.

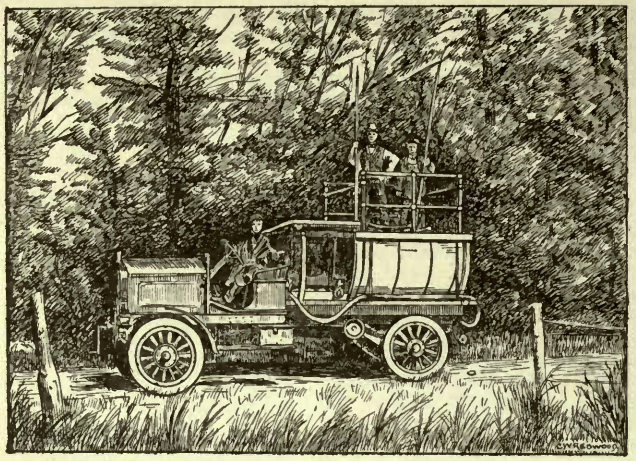
Excellent for spraying small vineyards and vegetable-gardens. (3) A barrel pump; a strong force-pump fitted to a kerosene barrel or larger tank suitable for spraying young trees; may be mounted on a cart, wagon, or stone-boat, depending on the character of the ground and size of trees. (4) A gear-sprayer; being a tank provided with a pump and mounted on wheels. The pump is operated by power borrowed from the wheels as they revolve, and transferred by means of chain and sprockets. Suitable for vineyards and field crops, which may be satisfactorily covered by the spray as the machine moves along. For this reason it is not adapted to orchard work. (5) The power sprayer; power being furnished generally by gasolene, sometimes by compressed air. When the trees are large and the orchard over 5 acres in extent, a power sprayer will usually pay. Some of these various types of machinery are shown in Figs. 1328–1335. In recent years the spraying of field crops and shade trees has developed rapidly. The spray pumps have been adapted to this work by the use of special attachments. For the field crops, nozzles are distributed along a horizontal arm, which makes it possible to cover a wide strip. The sprayers for shade trees are equipped with a more powerful pump, which is usually multiple-cylinder. The pump must be capable of delivering a large quantity of material each minute under a pressure of 200 to 300 pounds. The nozzles for this work are of the solid stream type and are usually fitted with interchangeable tips varying from $\frac{1}{8}$- to $\frac{1}{4}$-inch aperture. In order that the tops of high trees may be reached by the spray mixture, it is necessary to use a long extension rod, as well as very high pressure.



1332. Square tower, giving more working space for the nozzle-men than the conical form.



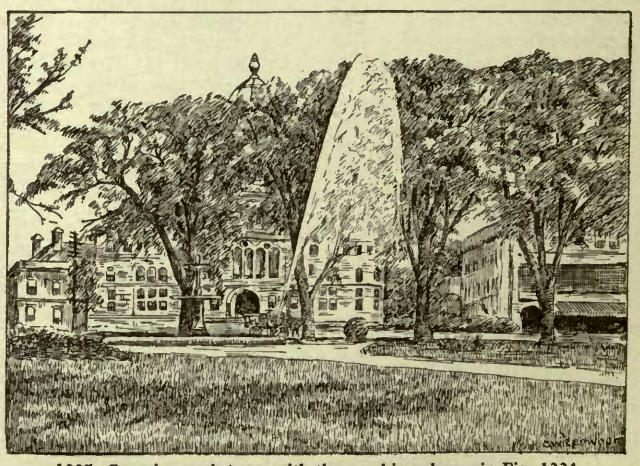
1333. A power sprayer for orchard use.



1334. A traction power sprayer, for street and park trees.

The essentials of a good pump are (1) durability: secured by having working parts made of material least susceptible to the action of the various spray solutions, friction considered; (2) strength: obtained by a good-sized cylinder, substantial valves, wall and piston; (3) easily operated: found in a pump with a long handle, large air-chamber and smoothly finished working parts. A pump should be strong enough to feed two leads of hose and throw a good spray from four nozzles. Nearly all spray mixtures require constant stirrings to prevent settling and insure uniformity, and an agitator is a necessary part of the equipment.

Nozzles.—Much of the efficiency of a spraying machine depends upon the nozzle. It should be chosen for the particular work to be done, rather than for any special design. The development of nozzle construction has been rapid, new features being embodied as necessity demanded, until today there are four main types, each of which is intended for specific work: (1) The Bordeaux nozzle is the oldest of the modern types. It came into general use about 1890 and was at first universally adopted for all spray work. It throws a stream which may be regulated from a solid jet to a coarse fan-shaped spray, both of which are too coarse for general use. The Bordeaux has, however, one place in the list of modern spray nozzles and that is for the codlin-moth spray. For this application it is desirable to force the material into the calyx cups of the developing fruit and no nozzle does this quite so efficiently as the Bordeaux. (2) The Vermorel was the next step in development after the Bordeaux. It was very much superior to the latter, breaking the material up into finer particles, and was generally used until about 1906. This nozzle, however, does not possess any desirable features not found in the disc types and therefore has no special uses in modern spraying. (3) The disc nozzles are standard for general spraying work. They are represented by a large number of sorts, each made by different manufacturers, but all working on the same principle. The material is whirled inside of the nozzle before it reaches the final outlet, thus breaking it up into finely divided parts and producing the desired mist. The material is lastly passed through a disc, which may have either a large or small opening. For orchard and small crop spraying, the small opening is used, in which case the nozzle should be 3 to 7 feet from the object to be sprayed. For taller orchard trees and for small ornamental trees, the large opening is used. This produces a solid jet which breaks into finer particles at a distance from the nozzles, depending upon the pressure used. (4) Shade tree nozzles, to be used only for spraying very tall ornamental trees, and in connection with at least 300 pounds pressure. They throw a solid stream 30 or more feet in the air, at which point the material is broken into a coarse mist. This type came into use at the time of the introduction of the brown-tail and gypsy moths in the New England states, and has since been widely used for parks, estates and forest spraying. C. S. Wilson.



1335. Spraying park trees with the machine shown in Fig. 1334.

DISÉMMA: *Passiflora.*

DISOCÁCTUS (*two-shaped Cactus*). *Cactàceæ.* Bushy cactus, 2–3 ft. high, sometimes seen as a pot-plant in collections.

Stems terete, usually erect: branches flattened as in Epiphyllum: fls. regular, with very short tube; petals few, elongated, spreading; ovary nearly naked, small.

bifórmis, Lindl. (*Phyllocáctus bifórmis,* Lab.). Soon pendulous, the branches cylindrical: short branches lf.-like, the lower egg-shaped, the upper more lengthened: fls. small, purple-red, less than 2 in. expansion; ovary without angles and with minute scales. Honduras. B.M. 6156. V. 2:159. J. N. Rose.

DÍSPORUM (Greek, *double one-seeded*). Syn. *Prosártes. Liliàceæ.* Fairy Bells. Small perennial rhizomatous herbs, sometimes planted in the wild garden.

Allied to Smilacina and Streptopus, being leafy-stemmed, but fls. in umbels (or solitary): perianth 6-parted, with narrow deciduous segms.; stamens 6, the filaments filiform or slightly flattened and longer than the extrorse anthers; ovary 3-celled, the ovules 2 or more in each cell, the stigma 3-cleft or entire: fr. a red or reddish few-seeded berry.—About 20 species, in N. Amer. and in the Himalayan region, Java to China and Japan. Little known to horticulturists; probably require no particular skill in cult.

A. *Lvs. rarely cordate at base.*

B. *Style 3-cleft.*

Ménziesii, Nichols. (*Prosártes Ménziesii,* Don). More or less soft-pubescent: st. 2–3 ft. long, forking, arching above: lvs. ovate to ovate-lanceolate, narrowly acuminate or the lowest acute, sessile, 2–3 in. long, often resin-dotted: fls. 1–3, greenish, cup-shaped, from the topmost axils, nodding, 9–12 lines long; pedicels puberulous; perianth-segms. nearly erect, acute, 6–11 lines long; stamens a third shorter; anthers included, 1½–2 times shorter than the filaments: fr. oblong-

obovate, narrowed to a short beak, salmon-colored. Calif. to Brit. Col.

lanuginòsum, Nichols. Woolly-pubescent: lvs. oblong-lanceolate, narrowly acuminate: perianth-segms. greenish, linear-lanceolate, acuminate, spreading, 6–9 lines long, stamens a third shorter; style and narrow ovary glabrous: caps. oblong-ovate, obtusish or with a very short, stout beak, glabrous; cells 1–2-seeded. Ont. to Ga. and Tenn. B.M. 1490. (as Streptopus).

BB. *Style entire.*

trachycárpum, Benth. & Hook. (*Prosártes trachycárpa,* Wats.). More or less pubescent: st. 1–2 ft. high, forking, with foliage on the upper half: lvs. ovate to oblong-lanceolate, acute or rarely acuminate, 2–4 in. long: pedicels pilose; perianth-segms. whitish, slightly spreading, more narrowly oblanceolate than in *D. Menziesii,* acute, 6–7 lines long, about as long as the stamens: fr. obtuse, rather deeply lobed, papillose. Neb. to Manitoba and Ore. and Wash.

AA. *Lvs. mostly cordate-clasping.*

oregànum, Benth. & Hook. (*Prosártes oregàna,* Wats.). More or less woolly-pubescent: lvs. ovate to oblong-lanceolate, long-acuminate: perianth-segms. spreading, acute, narrowed below, very distinctly net-veined, 5–7 lines long, as long as or shorter than the stamens: fr. ovate, acutish, somewhat pubescent. Ore. and Idaho to Brit. Col.

D. Hoòkeri, Nichols. (P. lanuginosa var. Hookeri, Baker). More or less rough-pubescent, with short, usually spreading hairs: lvs. ovate or sometimes oblong: perianth rather broad at the base: fr. obovate, obtuse, red. Calif.—*D. Leschenaultiànum,* D. Don, differs from the others here described by having white fls. India, Ceylon. B.M. 6935.—*D. pìllum,* Salisb. Readily told from American forms by its brown or purplish green fls. India, Java, China. B.M. 916.

WILHELM MILLER.
L. H. B.†

DISSÒTIS (*of two kinds,* referring to the unlike anthers). *Melastomàceæ.* Some 60 or more species of bristly-hairy or villous shrubs, sub-shrubs or herbs of Trop. and S. Afr., some of which may occur sparingly in choice collections of coolhouse and warmhouse plants: lvs. opposite, short-stalked, linear, ovate or orbicular, usually entire, 3–5-nerved, more or less strigose above: fls. bracted, about 1 in. or more across, purple or violet, solitary, or capitate or paniculate at the ends of the branches; calyx 4–5-lobed; petals 4 or 5, obovate; stamens 8 or 10, very unequal, the anthers linear-subulate, usually beaked, with 1 pore, the larger set being joined to the filament by a long connective and the other set with much shorter or nearly obsolete connective: fr. an included coriaceous caps. 4- or 5-valved at the apex. Apparently none is in the American trade. *D. Irvingiàna,* Hook. f. Annual from upper Guinea, 1–3 ft.: lvs. linear-oblong to lance-oblong, acute, 3-nerved: fls. reddish purple, to 1¼ in. across; petals obovate. B.M. 5149. *D. incàna,* Triana, of Trop. and S. Afr., shrub, 2–3 ft.: lvs. linear to linear-oblong, obtuse: fls. rose-purple, to 1½ in. across. B.M. 3790. *D. plumòsa,* Hook. f. Shrubby, with long and slender shoots which are densely covered with small deep green lvs.: fls. bright magenta-rose, 1½ in. across. Trop. Afr. *D. Mahònii,* Hook. f. Prostrate, the sts. 6–8 in. long: lvs. short-stalked, nearly or quite orbicular: fls. rose-purple, 2 in. across, solitary. Uganda. B.M. 7896. *D. modésta,* Stapf. Slender: lvs. oblong, minutely serrulate: fls. few, crowded at ends of branches; petals obovate-elliptic; stamens blue-purple, reddish and yellow; style purple. Uganda. L. H. B.

DISTÍCHLIS (Greek, *two-ranked*). *Gramìneæ.* SALT-GRASS. MARSH SPIKE-GRASS. Rigid erect perennials, with extensively creeping wiry rootstocks: spikelets several-fld., compressed, dicœcious; lemmas coriaceous, rigid, faintly many-nerved.—Species about 6, in salt marshes on the coastal regions of Amer. and in alkaline soil of the interior. One species, *D. spicàta,* Greene, with stiff, distichous involute blades and small narrow panicles is found in alkaline soil throughout the U. S. (Dept. Agric., Div. Agrost. 20:143). It is a good grass for binding soils subject to wash. Probably not in cult.

A. S. HITCHCOCK.

DÍSTICTIS (Greek *dis,* twice and *stiktos,* dotted; meaning obscure). *Bignoniàceæ.* Five or 6 species in Cent. and S. Amer., very similar in fl. to Pithecoctenium, but caps. smooth, oblong, curved, and branchlets not angular: lvs. 2- or 3-foliolate, with simple or 3-fid. tendril: fls. large in ample terminal panicles; calyx tubular-campanulate, truncate, often splitting; corolla funnelform-campanulate, leathery, curved; stamens inclosed; ovary with the seeds in many rows. Adapted for cult. in subtropical regions only; treatment and prop. like Bignonia, which see. The following species is cult. in S. Calif. **D. cinèrea,** Greenm. (*Pithecoctènium cinèreum,* DC.). Tall climber, grayish tomentose throughout: tendrils 3-fid.: lfts. 2–3, ovate or oval, obtuse and mucronulate or acutish, entire, 1–2 in. long: corolla purple, tomentulose outside, 2–3½ in. long and 1½–2½ in. across at the mouth. Mex.—The plant cult. under this name in Calif. is said to have white fls. and may not be the plant described above.

ALFRED REHDER.

DISTÝLIUM (Greek, *dis,* twice, *stylos,* style; in reference to the two slender styles). *Hamamelidàceæ.* Ornamental woody plants grown for their handsome evergreen foliage.

Evergreen trees or shrubs: lvs. alternate, short-petioled, entire, or dentate, penninerved; stipules deciduous: fls. polygamous or dicœcious, apetalous, in axillary racemes, subtended by small bracts; sepals 1–5, or wanting; stamens 2–8 with short filaments; pistillate fls. with a superior stellate-tomentose ovary, with 2 slender styles, with several stamens or without stamens: fr. a woody dehiscent caps., 2-celled, with 1 seed in each cell.—Six species in Japan, China, Himalayas and Java. Hardy only in warmer temperate regions. Prop. is by seeds and layers.

racemòsum, Sieb. & Zucc. Tall tree, in cult. usually shrubby: lvs. elliptic to elliptic-oblong, sometimes obovate, acute or obtusish, narrowed at the base, dark green and lustrous above, paler beneath, glabrous, 1¼–3 in. long: racemes stellate-pubescent; anthers red: caps. ovoid, 2-pointed, tomentose, ½in. long. March, April. Japan. S.Z. 1:94. S.I.F. 2:25. I.T. 3:113.—The staminate fls. are conspicuous by the red color of their anthers. Var. **variegàtum,** Carr. Lvs. bordered with yellowish white.—*D. chinénse,* Hemsl. (*D. racemòsum* var. *chinénse,* Franch.), a shrub with oblong-obovate lvs. ¾–1½ in. long and usually sparingly toothed above the middle from Cent. China is now possibly also in cult. H.I. 29:2835. ALFRED REHDER.

DITTANY is an old English word which in England often means *Dictamnus albus,* a plant of the rue family. The name is supposed to be derived from Mt. Dicte, in Crete, where the ancient dittany grew. The Cretan dittany is supposed to be *Origanum Dictamnus,* a plant of the mint family, and of the same genus with the wild marjoram. The plant commonly called dittany in the eastern United States is *Cunila origanoides,* Brit. (*C. Mariana,* Linn.), another mint, native in dry lands. See *Cunila.* It has been used as a substitute for tea, and is a gentle aromatic stimulant. All these plants yield an oil used as a mild tonic.

DIÙRIS (Greek, *double-tailed,* alluding to the sepals). *Orchidàceæ.* Twenty or more glabrous terrestrial orchids of Austral., rarely seen in collections in cool or warm glasshouses. The lvs. are at or near the base of the bracted st. (which is usually 1–2 ft. high), few, narrow: fls. 1 to several in a terminal raceme, conspicu-

ous from the elongated tail-like lateral green sepals; remainder of perianth yellow, purple or white, sometimes purple-blotched or -spotted; dorsal sepal remaining close to and over the column; lip 3-parted. The species are attractive or even handsome. *D. longifòlia*, R. Br., has fls. several, yellow and purple, moderately large; dorsal sepal broadly ovate, the lateral long and narrow; lip as long as dorsal sepal, lobed from the base: lvs. linear, one of them often very long. *D. maculàta*, Smith, is rather slender, usually under 1 ft. tall, with long-pedicelled yellow much-spotted fls.; dorsal sepal erect and rigid, embracing the column at the base but open at the top; lip shorter than dorsal sepal, lobed from base: lvs. narrow. B.M. 3156. *D. punctàta*, Smith. St. 1–2 ft. or more: lvs. usually 2, and 3–6 in. long: fls. 2 or 3, blue or purplish, often dotted but not blotched; dorsal sepal typically broadly ovate-oblong; lip about as long as dorsal sepal, divided to base. L. H. B.



1336. Spinage dock.

DIZYGOTHÈCA (Greek, in allusion to the anthers having double the usual number of cells). *Araliàceæ*. Graceful hothouse plants, grown practically exclusively for foliage; usually known as Aralia.

Usually shrubs, sometimes small trees, entirely unarmed, and differing in this from some hardy aralias: lvs. always digitate, of 5–9 lfts., varying much in adult and juvenile characters, sometimes slender and threadlike, again broad and leathery, usually long-stalked: calyx and corolla 5-parted; stamens 5, with thick anthers; ovary 10-celled; styles 10. All these fl.-characters are drawn from wild plants, as the cult. specimens are not known to flower.—Only 3 or 4 species are known in the wild state, all from the tropical isls. of the Pacific. The many names in horticultural literature are probably referable, ultimately, to some of these species, but their true position will be settled only when they flower. Here must be sought all the digitate-lvd. tender aralias of the first edition of this cyclopedia, the pinnate-lvd. species going to Polyscias. R.H. 1912, p. 491.

Dizygothecas require light rich soil, made up of equal parts of sandy loam and peat or leaf-mold. They require plenty of water and a moist warm atmosphere. Scale pests are numerous and must be kept down by frequent sponging with weak solutions of whale-oil soap, fir-tree oil or other insecticide.

The names here used are retained in the absence of specific information as to what wild species of Dizygotheca they are to be associated with. Only complete flowering material can settle this much-vexed question. All of the following are distinct horticulturally.

Kerchoveàna, Hort. Lvs. the shape of a Ricinus, the 7–11 lfts. elliptic-lanceolate or oblong-lanceolate, with undulate and serrate margins and a pale midrib. S. Sea Isls. Certificated in England in 1881 (Gn. 19, p. 457). R.H. 1891, p. 225.—Slender-stemmed, of beautiful habit. According to Harms, perhaps better put in Pseudopanax.

Veìtchii, Hort. Lfts. 9–11, very narrow or almost filiform, undulate, shining green above and red beneath. New Caledonia.—One of the best and handsomest species. Var. **gracíllima,** Hort. (*Aràlia gracìlima*, Lind.). Lfts. still narrower, with a white rib. R.H. 1891, p. 226. Gn. 39, p. 565. I.H. 22:225.—Very desirable. Originally described as *Aralia gracilina* (*thin-lined*), which name has been mistaken for *gracillima* (*very graceful*).

elegantíssima, Veitch. Petioles mottled with white; lfts. 7–11, filiform and pendulous. New Hebrides. G.Z. 21, p. 28.—Excellent. Thought by Guillemin to be the juvenile form of some Dizygotheca. Many of the greenhouse aralias have a permanent juvenile condition.

leptophýlla, Hort. Slender plant: lfts. filiform and drooping, broadened at the extremities, deep green. Australasia.

Regìnæ, Hemsl. (*Aràlia regìna*, Hort.). Graceful: petioles olive, pink and brown; lfts. drooping, very narrow, not undulate. New Hebrides. I.H. 26:337.

The following greenhouse aralias, with showy lvs., probably belong to Dizygotheca, unless otherwise noted:

A. Chabrièri, Hort. See Polyscias.—*D. crassifòlia*, Soland. See Pseudopanax.—*D. lóngipes*, Hort. Lvs. digitate, the lfts. oblong-lanceolate, acuminate, wavy. N. Austral.—*D. nóbilis*, Hort. "A theophrasta-like plant, with closely packed, bold foliage, the lvs. oblong obovate-acuminate, undulate at the margins." Not certainly referable to Dizygotheca.—*D. Osyàna*, Hort. Like A. leptophylla, but lfts. deeply bifid, and nerves and veins brown. S. Sea Isls.—*D. quercifòlia*, Hort. Lfts. 3, sinuate: lvs. opposite. New Britain. Perhaps not of the Araliaceæ. The plant has opposite lvs.—*D. rotúnda*, Hort. Lf. of a single orbicular-cordate lft. or sometimes 3-foliolate, white-toothed. Polynesia. Not certainly referable to Dizygotheca.—*D. spectábilis*, Hort.=?—*D. splendidíssima*, Hort. Lvs. pinnate, the lfts. shiny green. New Caledonia=Polyscias.—*D. ternàta*, Hort. Lvs. opposite, ternate, or 3-lobed, the lfts. oblong-lanceolate and sinuate. Not certainly referable to Dizygotheca.—*D. Victòriæ*, Hort.=Polyscias. N. TAYLOR.

DOCK. A name applied to various species of Rumex (*Polygonàceæ*). The commonest species—growing in fields and yards—are the curled or narrow-leaved dock (*R. crispus*, Linn.) and the bitter or broad-leaved dock (*R. obtusifolius*, Linn.). These are introduced from the Old World. Several species are native. See *Rumex*.

Various species of docks and sorrels have long been cultivated as pot-herbs. Some of them are very desirable additions to the garden because they yield a pleasant food very early in spring, and, once planted, they remain for years. The Spinage dock and the Large Belleville are amongst the best kinds. The former (Fig. 1336) is the better of the two, perhaps, and it has the advantage of being a week or ten days earlier. The crisp leaves (blade 1 foot long) appear early in April, when there is nothing green to be had in the open, and they can be cut continuously for a month or more. This dock is the herb patience (*Rumex Patientia*, Linn.). It has long been an inhabitant of gardens, and it has sparingly run wild in some parts of this country. It is a native of Europe.

The Belleville (Fig. 1337) is also a European and northern North American plant. It has also become spontaneous in some of the eastern portions of the country. It is really a sorrel (*Rumex Acetosa*, Linn.). It has thinner, lighter green and longer-stalked leaves than the Spinage dock, with spear-like lobes at the base. The leaves are very sour, and will probably not prove to be so generally agreeable as those of the Spinage dock; but they are later, and afford a succession. In some countries this sorrel yields oxalic acid sufficient for commercial purposes. The round-leaved or true French sorrel (*Rumex scutatus*, Linn.) would probably be preferable to most persons.

All these docks are hardy perennials, and are very acceptable plants to those who are fond of early "greens." Some, at least, of the cultivated docks can be procured of American seedsmen. They are readily grown from seeds, and give a good produce the second year and subsequently, and often yield good leaves the first season. L. H. B.



1337. Belleville dock.

DOCỲNIA (derivation unknown). *Rosàceæ*, subfamily *Pòmeæ*. Ornamental woody plants grown for their handsome foliage and white flowers appearing in spring.

Evergreen or half-evergreen trees: lvs. alternate, entire, or serrate, sometimes slightly lobed: fls. short-stalked, in umbels before or with the lvs.; calyx densely tomentose, with lanceolate lobes; petals 5; stamens 30–50; styles 5, connate at the base and woolly; stigma 2-lobed; ovary 5-celled with 3–5 ovules in each cell: fr. a subglobose, ovoid or pyriform pome with persistent calyx.—Four species in China, Himalayas and Annam. Closely related to Malus, chiefly distinguished by the 3–5-ovuled cells and the 2-lobed stigma.

The species are very little known in cultivation and none of them seems to be in the trade. *D. Delavayi* has been introduced only very recently; *D. Doumeri* has been recommended as a stock for apples in tropical and subtropical countries and tried in Annam (R.H. 1904, p. 246); *D. indica*, though known for about 100 years, does not seem to be at present in cultivation either in Europe or in this country. They are adapted only for warmer temperate or subtropical regions. The fruits are more or less acid and are used for cooking; possibly they could be improved by selection and hybridization and might be developed into valuable fruit trees for warmer climates. Propagation is by seeds and possibly by grafting on apple stock.

D. Delavàyi, Schneid. (Pyrus Delavayi, Franch.). Spiny tree, to 30 ft.: lvs. evergreen, ovate-lanceolate, rounded or broadly cuneate at the base, entire, glossy above, white-tomentose below, 2–4 in.: fr. ovoid, about 1 in. long. S. W. China. Franchet, Plant. Delavay. 47.—*D. Doùmeri*, Schneid. (Pyrus Doumeri, Bois). Unarmed tree: lvs. ovate to ovate-lanceolate, entire or sparingly serrulate, white-tomentose below, 1–2½ in. long: fr. subglobose, about 2 in. across. Annam. Jour. Soc. Bot. France, 51:114, 115.—*D. indica*, Decne. (Pyrus indica, Wall. D. Griffithiana, Decne.). Small tree: lvs. ovate to oblong-lanceolate, entire or serrulate, lobed in young plants, woolly while young, finally glabrescent, 2–4 in. long: fr. subglobose, 1–1½ in. across. E. Himalayas. Wallich, Pl. As. Rar. 2:173.—The closely related *D. Hookeriàna* has larger lvs. and elongated fr. Nouv. Arch. Mus. Hist. Nat. Paris. 10:15.

ALFRED REHDER.



1338. Dodecatheon Meadia, the common shooting-star. (×¼)

DODÁRTIA (Denis Dodart, physician and botanist, born in Paris in 1634). *Scrophulariàceæ*. One erect perennial herb related to Mimulus. *D. orientàlis*, Linn., grows in S. Russia and W. Asia, and may be found in choice collections of outdoor herbs: fls. purplish, in terminal racemes: plant with rush-like few-lvd. branches: lvs. opposite below, alternate above, linear and entire or broader and somewhat dentate: corolla with a cylindrical or flaring tube, 2-lipped; stamens 4, didynamous, included, the anther-cells distinct: caps. subglobose, dehiscent, the many seeds somewhat immersed in the more or less fleshy placenta. July, Aug. B.M. 2199.—Apparently of minor horticultural value.

DODDER: *Cuscuta*.

DODECÀTHEON (Greek, *twelve gods*, old name of no application here). *Primulàceæ*. SHOOTING-STAR. AMERICAN COWSLIP. Small perennial herbs with cyclamen-shaped flowers on scapes, sometimes grown in wild or hardy gardens.

Glabrous, with a tuft of ovate or oblong entire or dentate lvs. at the base, and a slender single naked scape: fls. few or many in an umbel, nodding, white, rose or purple; corolla-lobes (5) and calyx reflexed; stamens 5, attached in the throat of the short corolla-tube, the short filaments more or less conjoined at base and the long slender anthers connivent into a cone: fr. an oblong or somewhat cylindrical 5- or 6-valved caps. —Dodecatheon is a puzzling genus to systematic botanists. It is found from Maine to Texas and from the Atlantic to the Pacific; and along the Pacific slope, from the islands of Lower Calif. to those of Bering Strait. In this vast region, it varies immensely. It is also found in Asia, especially northeastward. This wonderful distribution and variability is all the more remarkable if, as Gray once thought, it is all one species, because monotypic genera are considered, as a rule, to be comparatively inflexible or invariable. Pax & Knuth, on the other hand (Engler's Pflanzenreich, hft. 22, 1905), recognize 30 species. There is singular lack of agreement in the characterization of accepted species. Dodecatheon belongs to the same family with Primula and Cyclamen, but in a different tribe from the former, while its reflexed corolla-lobes distinguish it from most genera of its family. Many species and varieties may be expected to appear in the lists of dealers in native plants.

Shooting-star is an appropriate name. The flowers have been compared to a diminutive cyclamen, for they are pendulous and seem to be full of motion (see Fig. 1338). The stamens in *D. Meadia* and all eastern species come to a sharp point and seem to be shooting ahead, while the petals fall behind like the tail of a comet. The flowers represent every shade from pure white, through lilac and rose, to purple, and they all have a yellow circle in the middle, i.e., at the mouth of the corolla. After the flowers are gone the pedicels become erect. Some forms have all their parts in fours. There are a number of good horticultural forms offered abroad.

They require an open well-drained soil, not too dry, and moderately rich, and a shady or partially shady position. They are propagated by division or by seeds, the latter method being rather slow.

Mèadia, Linn. (*D. ellípticum*, Nutt. *Mèadia Dodecàthea*, Crantz. *M. Dodecàtheon*, Mill. *M. caroliniàna*, Kuntze). Fig. 1338. Erect and strong, to 2 ft.: lvs. ovate-oblong or oblong-linear, nearly or quite obtuse, dentate-crenate or nearly entire, 1–2 in. wide, tapering into a more or less margined petiole: scape smooth, usually purple-spotted; fls. 10–20; calyx deeply parted, the parts lanceolate; corolla-lobes linear-oblong, somewhat obtuse, rose-colored and whitish at base; anthers reddish yellow, the connective body purple and broadly ovate: caps. scarcely longer than calyx, with persistent style. May, June. Woods and prairies, Pa., W. and S. B.M. 12.—This species runs

into many forms, some of which may be specifically distinct. Var. **splèndidum**, Hort., is an improved form, crimson with a yellow circle. Var. **gigantèum**, Hort., is larger in all its parts: lvs. paler: fls. somewhat earlier, in some forms white. Var. **élegans**, Hort. Lvs. wider and shorter than the type: scape shorter; fls. more numerous, dark-colored. (The old generic name *Meadia* commemorates Dr. Richard Mead, 1673–1754.)

Jéffreyi, Van Houtte (*Mèadia Jéffreyi*, Kuntze). Plant somewhat glandular-viscid: rhizome vertical and short, strong: lvs. oblanceolate, erect, entire, somewhat acute, mucronulate: scape 12–24 in. or more, bearing a many-fld. umbel; calyx-lobes lanceolate; corolla deep red-purple; connective-body of anthers very narrow or subulate at apex, colored same as stamens. Mts., Calif. and Ore. F.S. 16:1662.

tetrándrum, Suksdorf, has the general aspect of *D. Jeffreyi*, but the lvs. are ampler and relatively broader: roots, as in *D. Jeffreyi*, are abundant, fleshy, fibrous, persistent: roots, lvs. and scapes form a short, vertical crown: whole plant glabrous: corolla purplish, with a yellow ring near the base; segms. and stamens usually only 4: caps. circumscissile very near the apex. Mts., Wash. and Ore.

frígidum, Cham. & Schlecht. Plant 1 ft. or less: lvs. obovate to ovate or oblong, acutish, entire or somewhat dentate: scape much exceeding the lvs., 2–3-fld.; calyx-lobes longer than the tube; corolla-lobes oblong-linear, violet: caps. oblong, twice longer than calyx. Bering Strait to Rockies and Sierras. B.M. 5871.

latílobum, Elmer (*D. dentàtum*, Hook. *D. Mèadia* var. *latílobum*, Gray). Larger than the last: lvs. with blade 1–4 in. long, oval or ovate to oblong, repand or sparingly dentate, abruptly contracted into long-winged petioles, obtuse: fls. 2–4; calyx-lobes deltoid; corolla-lobes oblong, yellowish white: caps. but little longer than calyx, opening from the apex by valves. Wash., Ore., Idaho.

Hèndersonii, Gray. About a foot high, glabrous, deep green: lvs. small, obovate or elliptic, 1 in. or more long, narrowed to a short petiole: fls. rather few; calyx-lobes triangular, acuminate, twice exceeding the tube; corolla-lobes dark purple with a yellow base, the staminal tube dark purple; anthers oblong, obtuse, short-apiculate; connective-body deep purple: caps. ovoid, much exceeding the calyx, dehiscent by a circumscissile apex and splitting into 10 valves. Calif. to Wash. G. 33:391.

Clèvelandii, Greene. One to 1½ ft. tall, glabrous: lvs. pale green, thickish, spatulate-ovate, petioled: fls. 2–10; calyx-lobes ovate-lanceolate, acute, glandular; corolla-lobes purple with yellow base and a few purple spots in throat; anthers purple, the connective-body yellow: caps. oblong, circumscissile at apex. Feb.–May. S. Calif.—Fls. said to vary to pure white. Fragrant.

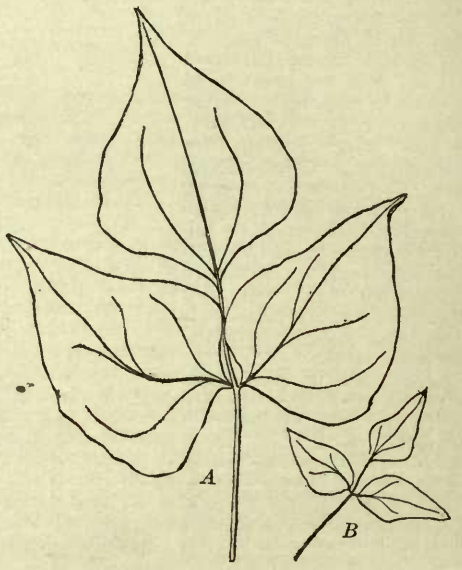
radicàtum, Greene. Glabrous: root short and corm-like with fibrous rootlets: lvs. 3–5, thin, light green, oblong-spatulate, crenate or nearly entire, blade attenuate into petiole of about equal length: fls. 3–5 or more on a stout scape 8–16 in. tall; calyx-lobes lanceolate, about as long as the tube; corolla pinkish or bluish violet, the lobes oblong-linear and erect-spreading; staminal tube short; anthers purple, acute: caps. narrow-ovate, only slightly surpassing calyx-lobes. April. Wyo. to New Mex.—Recommended for alpine and rock-gardens. L. H. B.†

DODONÆA (Rembert Dodoens, or Dodonæus, about 1518–1585, royal physician and author). *Sapindàceæ*. Trees and shrubs, somewhat planted in S. Fla. and S. Calif. for ornament.

Leaves alternate, without stipules, simple or pinnate: fls. small, polygamous, unisexual, often diœcious, terminal or axillary, solitary or in racemes or panicles; sepals 5 or fewer; petals wanting; stamens mostly 8 (5–10) with very short filaments; ovary 3–6-celled, each cell 2-ovuled: caps. winged on the back of each valve.—About 50 species, mostly in Austral., a few in Afr. and in Hawaii and N. Amer. Lvs. sometimes glandular and exuding resin-like or varnish-like substance.

viscòsa, Linn. Shrub, to 15 ft., viscid: lvs. mostly oblong, cuneate at base, entire, with resinous dots on both surfaces: fls. greenish, in short terminal or axillary racemes; sepals ovate: caps about ¾in. long and somewhat broader, broadly 3-winged, notched at apex, more or less cordate at base. B.R. 13:1051 (as *D. oblongifolia*).—A poorly defined plant, widely distributed in warm countries, occurring in Austral., S. Afr., in Mex., and forms of it in Fla. and Ariz. Lvs. varying from broadly spatulate to oblong to nearly or quite linear.

Thunbergiàna, Eckl. & Zeyh. Shrubs, 6–10 ft., glabrous, much branched: lvs. lanceolate or linear-lanceolate, narrowed at base, somewhat denticulate and somewhat viscid: fls. green, polygamous, racemose: caps. ½in. long, resinous and shining, 2–3-winged, as long as the stalk or longer. S. Afr.



1339. Leaves of Dolichos. *A*, D. Lablab; *B*, D. lignosus.

triquètra, Andr. Erect shrub, the young branches flattened or very angular: lvs. oval-elliptic to oblong-lanceolate, acuminate, to 4 in. long, entire or very nearly so: fls. in short oblong compact panicles or racemes; sepals minute: caps. of *D. viscosa*, middle-sized. Austral.

cuneàta, Rudge. Much-branched bush, usually viscid: lvs. small (usually under 1 in. long) obovate or cuneate, at the end rounded or truncate or toothed, on the sides entire or rarely obscurely toothed, short-petioled: fls. in short terminal scarcely branched racemes, or sometimes few in axillary clusters; sepals ovate-oblong: caps. of *D. viscosa*, the wings usually not very broad. Austral. L. H. B.

DOGBANE: *Apocynum.*

DOG'S-TAIL GRASS: *Eleusine indica.*

DOGTOOTH VIOLET: *Erythronium.*

DOGWOOD: *Cornus*

DOLICHÁNDRA: *Macfadyena.*

DOLICHODEÌRA: *Sinningia.*

DÒLICHOS (old Greek name). *Leguminòsæ.* Tropical twiners (a bush variety of *D. Lablab* is now being offered by seedsmen), of which a few forms are in cultivation, some for ornament and some for forage.



1340. Types of styles. *1*, D. Lablab; *2*, Vigna sinensis; *3*, V. sesquipedalis.

Keel of the corolla narrow and bent inward at right angles, but not distinctly coiled; style bearded under the stigma, which is terminal; stipules small. For botanical distinctions between Dolichos, Phaseolus and Vigna see *Vigna*. The styles are points of difference (Fig. 1340). *D. japonicus*, a most worthy ornamental vine, will be found under *Pueraria*. For *D. sesquipedalis*, see *Vigna*—Perhaps 50–60 species, widely distributed. Three species of Dolichos are now grown in Amer.

A. *Style bearded only on a ring surrounding and just below the stigma.*

biflòrus, Linn. This species is now being intro. from India, where it is frequently used as a forage plant. It differs from *D. Lablab* in having the upper lip of the calyx 2-toothed and from *D. Lablab* and *D. lignosus* in having only a ring or brush of hairs just beneath the stigma, whereas the styles of the other species are bearded on a line extending down the inner face. The seeds are small (average weight .035 gram) and rather strongly flattened. Their approximate dimensions are length ⅕–¼in., width 1/7–⅛in., thickness 1/12in. (2–2½ mm.).

AA. *Style bearded along the inner side.*

B. *Seeds small, ⅛–⅕in. long by ⅛–⅙in. broad, average weight .02 grams.*

lignòsus, Linn. Australian Pea. Fig. 1339. Evergreen: fls. white or rosy purple: lvs. much smaller than in *D. Lablab*. A perennial rapidly growing vine, suitable for covering fences and outbuildings in warm countries; highly recommended in S. Calif. and Ariz. B.M. 380.—A form with white fls. is offered by seedsmen as *D. alba*.

BB. *Seeds large, ⅓–½in. long by ¼–⅔in. broad, average weight .10–.30 grams.*

Láblab, Linn. (*D. cultràtus,* Thunb. *D. purpùreus,* Lindl. *Láblab cultràtus,* DC.). Hyacinth Bean. Figs. 1339, 1340, 1341. Tall-twining (often 10–20 ft.): lfts. broad-ovate, rounded below and cuspidate-pointed at the apex, often crinkly: fls. purple or white, rather large, 2–4 at the nodes, in a long erect raceme: pods small (2–3 in. long) and flat, usually smooth, conspicuously tipped with the persistent style; seed black, mahogany or gray, in the white-fld. varieties, white, small (average weight about ¼ gram). Tropics. B.M. 896. B.R. 830. A.G. 14:84.—Cult. in this country as an ornamental climbing bean, but in the tropics the pods and seeds are eaten. Annual. It is easily grown in any good garden soil. Like common beans it will not endure frost. It is very variable. White-fld. and dwarf bush forms are now offered by seedsmen. A form with white fls. and very large growth is known among horticulturists as **D. gigantèus** (Fig. 1342).



1341. Calyx cups and styles of Dolichos. *1*, D. lignosus; *2*, D. Lablab.

D. pseudopachyrrhizus, Harms, recently intro. into some of the European gardens from Trop. Afr., is a perennial form with a large tuberous rootstock: sts. long, round or angular: lvs. long-stalked, 3-foliolate; lfts. very variable in shape, the lateral often ovate or elliptic and the terminal broadly rhomboid, 3¼–8 in. long, 2½–7 in. broad: fls. small, chiefly violet-blue, in racemes ½–1¾ ft. long.

Geo. F. Freeman.

DOMBÈYA (after Joseph Dombey (1742–1795) French botanist and companion of Ruiz and Pavon in Peru and Chile). Syn. *Assònia, Astrapæ̀a. Sterculiàceæ.* Shrubs or small trees of continental Afr., Madagascar and Seychelles, sometimes planted in Fla. and Calif.: lvs. often cordate, palmately nerved, frequently lobed: fls. rosy or white, numerous, in loose axillary or terminal cymes, in umbels, or crowded into dense heads, often very showy; calyx 5-parted, persistent; petals 5; stamens 15–20, 5 sterile, the remainder shorter, united into a tube or cup; ovary 2–5-celled; stigmas 5: fr. a loculicidal caps.—Probably 100 species, many new kinds having been made known recently with the opening of Trop. Afr. The dombeyas are yet little known in this country, although some of them promise well for lawn and park planting far south.

natalénsis, Sond. Distinguished by its cordate, acute lvs. and the narrowly awl-shaped lfts. of the involucre: lvs. long, petioled, somewhat angular, toothed, with minute stellate pubescence, 5–7-ribbed: umbels 4–8-fld. Natal. —Cult. in S. Fla. and North under glass. Very rapid-growing, foliage poplar-like: fls. pure white, large, sweet-scented; a very good winter-blooming plant in S. Calif.



1342. Dolichos Lablab (form giganteus). (×⅓)

spectábilis, Bojer. Small tree: lvs. cordate, orbicular or oblong, acute, undulate, 5–9-nerved, rough above and rusty or whitish pubescent beneath, the petioles downy: fls. ¾in. across, white, in many-fld. much-branched axillary and terminal cymes; sepals lanceolate, shorter than corolla; petals roundish; stamens united only at base. E. Trop. Afr.—A plant under this name is catalogued in this country as "a tall shrub with straw-colored and pink fls."

acutángula, Cav. (*Astrapæ̀a tiliæfòlia,* Sweet). Low tree or shrub, with lvs. crowded at ends of branches: lvs. thin, round-cordate, nearly glabrous, palmately 3–5-lobed: fls. in 2-parted cymes; bracteoles large, ovate, falling; sepals ⅓in. or less long, reflexing; petals white or reddish, ½in. long, oblique-obovate; stamens 18, being exceeded in length by the staminodia; ovary densely tomentose, and styles free at top only. Mauritius and Bourbon. B.M. 2905 (form with entire lvs.).

punctàta, Cav. Tree, the young parts hairy: lvs. smooth and firm, orbicular and deeply cordate, acute, 3–4 in. long, obscurely crenate: fls. 10–20 in a simple umbel that has a peduncle 2–3 times the length of the petiole; sepals linear-lanceolate, reflexed; petals rather longer than sepals, obdeltoid; ovary tomentose. Mauritius and Bourbon. Intro. in S. Calif.

nairobénsis, Engler. Shrub or tree with terete branches that become glabrous or nearly so: lvs. ovate-cordate, acuminate, somewhat 3-lobed, irregularly crenate, 7-nerved, hairy, and tomentose beneath: fls. on long hispid pedicels in an umbel; bracteoles ovate-lanceolate; sepals lanceolate, becoming reflexed, tomentose outside; petals oblique and obtuse, scarcely

exceeding petals; staminodia narrowly spatulate; ovary tomentose. Nairobi.

Wállichii, Benth. & Hook. (*Astrapæa Wállichii,* Lindl.). Tree, to 30 ft.: lvs. large, velvety, cordate, angularly lobed, with leafy stipules: fls. scarlet (pink?), in drooping umbels, the peduncles long and hairy. Madagascar.—A very showy plant when in bloom.

D. Búrgessiæ, Gerrard. Lvs. pubescent, cordate, but with 2 deep, wide cuts, and 2 shallow ones besides the basal one: fls. numerous, large, white, rosy at center and along veins; petals rounded. S. Afr. B.M. 5487.—*D. calántha,* Schum. Shrub, 10–12 ft.: lvs. large (1 ft. across), 3–5-lobed, coarsely toothed, cordate at base, pubescent above and tomentose beneath, with long petioles: fls. rose-colored, 1½ in. across. British Cent. Afr. B.M. 8424.—*D. Cayeùxii,* Hort., is a hybrid of D. Mastersii and D. Wallichii: fls. beautiful pink in pendulous, many-fld. umbels: lvs. cordate, acute, dentate, with long petioles.—*D. Còria,* Baill. Tall tree: lvs. cordate or somewhat 3-lobed, 6 in. long and nearly as broad, toothed or crenulate, pubescent beneath: fls. lilac-rose, 2½ in. across. Madagascar. R.H. 1911:84.—*D. Dàvaei,* Hort., is a hybrid of D. spectabilis and D. natalensis: fls. rose-colored; also a white-fld. form (var. alba). R.H. 1912, p. 178–9.—*D. Mástersii,* Hook. Shrub, 4–5 ft. high: lvs. velvety, heart-shaped, serrate: fls. fragrant, white, with thinner veins of rose than in D. Burgessiæ; petals acute. Trop. Afr. B.M. 5639.—*D. viburniflòra,* Bojer, has very numerous white fls. with narrower petals than any here described: lvs. cordate, 3-lobed, the cuts not so wide as in D. Burgessiæ. Comoro. B.M. 4568.

L. H. B.†

DÓNDIA: *Hacquetia.*

DOÒDIA (after Samuel Doody, London apothecary). *Polypodiàceæ.* Greenhouse ferns.

Sori curved, placed in one or more rows between the midribs and the margins of the pinnæ: lvs. rigid. A genus of diminutive ferns related to Woodwardia.—Species 4 or 5. Ceylon to New Zeal.

All doodias, except *D. blechnoides,* are of dwarf habit, and are useful for fern-cases and for edgings of window boxes. Cool and intermediate temperatures are best. They are excellent for forming an undergrowth in coolhouses, as they seldom are infested with insects, and endure fumigation. Schneider recommends three parts of peat and one of silver sand. Loam does not help, but a little chopped sphagnum does. They are very sensitive to stagnant water, and do not like full exposure to sunlight. Always propagate by spores, but division is possible.

A. *Lvs. pinnatifid.*

áspera, R. Br. Lvs. 6–18 in. long, 2–4 in. wide, pinnatifid, narrowed gradually below: sori in 1 or 2 rows. Temp. Austral.—Crested varieties occur in cult.

AA. *Lvs. pinnate in the lower half.*

mèdia, R. Br. Lvs. 12–18 in. long, with pinnæ 1–2 in. long, the lower one gradually smaller. Austral. and New Zeal.—*D. Kunthiàna,* Gaud., from the Hawaiian Isls. has close median pinnæ. *D. supérba,* Hort., is a larger garden form.

caudàta, R. Br. Lvs. 6–12 in. long, with pinnæ about an inch long, the spore-bearing ones shorter; apex often terminating in a long point. Austral. and New Zeal.

blechnoìdes, Cunn. Lvs. 18 in. long; lf.-blades 15 in. long, 6 in. broad, broadest at the middle, the lowest pinnæ considerably narrowed; margins serrate: sori in an irregular row near midrib. New S. Wales.

L. M. Underwood.
R. C. Benedict.†

DORÈMA (*dorema,* a gift, an allusion to the gift of gum ammoniac). *Umbellíferæ.* About 4 odd large perennial herbs of S. W. Asia, yielding gum-resins, likely to be met with in collections of economic plants. Usually glaucous, with pinnately decompound lvs., and small white or yellow fls. in close woolly umbels: calyx-teeth wanting or nearly so; petals ovate: fr. ovate, plano-compressed. *D. Ammoniàcum,* D. Don, an erect fleshy-stemmed herb to 7 ft., with a few lvs. near the base and bracts above, yields gum-ammoniac, a medicinal product. This resin exudes on the sting of insects, occurring in yellowish brown "tears" or drops; it has a balsamic odor and bitter unpleasant taste. The plant is native in Persia and Afghanistan. Other species yield similar exudation.

DORÓNICUM (Latinized Arabic name). *Compósitæ.* Leopard's Bane. Hardy herbaceous plants, 1–2 feet high, with yellow many-flowered heads.

Stems little branched or not at all: lvs. alternate, radical ones long-stalked, st.-lvs. distant, often clasping the st.: heads mostly one on a st. and 2–3 in. across, borne high above the basal crown of foliage, from April to June.—From 20–30 species, natives of Eu. and Temp. Asia. The genus is allied to Arnica and distinguished by the alternate lvs. and by the style.

The plants are of easy culture in rich loam except *D. cordifolium,* which is an alpine species. The flowers are numerous and good for cutting. Doronicums have been strongly recommended for forcing.

A. *Root-lvs. not notched at the base, ovate.*

plantagíneum, Linn. Glabrous, but woolly at the neck, with long, silky hairs: root-lvs. ovate or oval, wavy-toothed; st.-lvs. nearly entire, the lower ones narrowed into a petiole and not eared, the upper ones sessile, oblong, acuminate: rhizome tuberous, roundish, or creeping obliquely: stalk of the root-lvs. about 3 in. long: typically about 2 ft. high. Sandy woods of Eu. G.C. III. 17:229. J.H. III. 55:109. Gn. 60:151. Var. **excélsum,** Hort. (*D. excélsum,* Hort. *D. "Harpur Crew,"* Hort.), is more robust, grows about 5 ft. high and is probably more cult. than any other kind of doronicum. Fls. sometimes 4 in. across. Gn. 47, p. 269; 28:512; 38:437. G.C. II. 20:297. G. 19:441; 27:225. Gn. W. 24:221.

Clùsii, Tausch. (*Árnica Clùsii,* All.) Lvs. ovate or oblong; st.-lvs. half clasping, with distant teeth or many small ones. One subvariety has long, silky hairs on its lvs., while another has none. Swiss and Austrian Alps.—"Soft, downy foliage," J. W. Manning. "Grows 2 ft. high," Woolson. "Larger and later fls. than *D. caucasicum,*" Ellwanger and Barry.

AA. *Root-lvs. notched at the base, heart-shaped.*

B. *Root tuberous.*

Pardaliánches, Linn. Hairy: lvs. toothed; lower st.-lvs. eared at the base of the stalk, subovate, upper ones spatulate-cordate, highest ones cordate-clasping, acute. Woods of lower mountains of Eu. G. 22:499.—While all species are typically 1-fld., any of them may have now and then more than 1 fl. on a st., and this species particularly may have 1–5 fls.

BB. *Root not tuberous.*

caucásicum, Bieb. Glabrous except as noted above: lvs. crenate-dentate, lower st.-lvs. eared at the base of the stalk, the blade subcordate, highest ones cordate to half-clasping; lvs. near the infl. linear-lanceolate. Shady woods of Caucasus, Sicily, etc. B.M. 3143. Gn. 28 p. 512., which shows sts. with 1 fl. and 1 lf.—Fls. 2 in. across.

cordifòlium, Sternb. (*D. Colúmnæ,* Tenore). Glabrous, the st. very fibrous toward the base, scarcely 5 in. tall: radical lvs. cordate-kidney-shaped, the upper lvs. st.-clasping: heads solitary on the sts., the small lvs. near it ovate-lanceolate, acuminate. An alpine species from S. E. Eu. and adjacent Asia.

austrìacum, Jacq. A trifle hairy: lvs. minutely toothed, lower st.-lvs. spatulate-ovate, abruptly narrowed at the base, half-clasping, highest ones cordate-clasping, lanceolate. Subalpine woods, Eu.

D. draytonénse, Hort., is a list name, not referable to any known species. It seems not to occur in horticultural or botanical literature.—*D. magníficum,* Hort., described as a "very attractive perennial with large yellow fls. somewhat like a single sunflower," is also doubtful. It may be D. plantagineum var. excelsum.

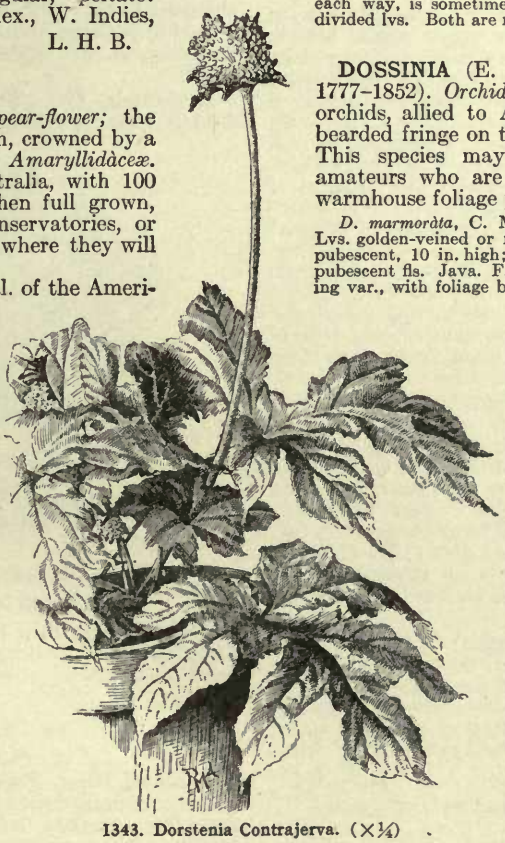
Wilhelm Miller.
N. Taylor.†

DORSTÈNIA (Theodor Dorsten, professor of medicine at Marburg, died 1539). *Moràceæ.* About 50 tropical herbs or small shrubs, remarkable for the dilated receptacle in which the unisexual fls. are borne, being imbedded in the surface. Both staminate and pistillate fls. are without perianth; stamens 1–4; ovary 1-loculed; stigma 2-lobed. Dorstenias are easily grown in warm shady glasshouses. The plants are not in the American trade, but they are often grown in botanical establishments to illustrate morphology. The fig is a hollow receptacle formed of the axis of the fl.-cluster; the dorstenia bears a flattened or cup-like receptacle, and is an intermediate stage between the fig and other plants. One of the common species is *D. Contrajérva,* Linn. (Fig. 1343), which is native to Trop. Amer.: fls. on a scape: lvs. round-cordate, palmately lobed or parted, the segms. ovate or oblong and more or less toothed: receptacle irregularly rectangular, peltate: rhizome cylindric, nodose. Mex., W. Indies, Venezuela, Colombia. L. H. B.

DORYÀLIS: *Aberia.*

DORYÁNTHES (Greek, *spear-flower;* the flowering stem 8 to 25 feet high, crowned by a spike of flowers 3 feet high). *Amaryllidàceæ.* Great desert plants from Australia, with 100 or more leaves 6 feet long when full grown, being impressive for large conservatories, or for open ground in the South, where they will stand slight frost.

The representative in Austral. of the American Furcræa and Agave: lvs. in a dense basal rosette, those on the st. much reduced: fls. large, bright red (often replaced by bulblets), in a large thyrse-like or panicled infl.; perianth with little or no tube, the segms. long and falcate; stamens 6, attached at base of perianth, the filaments filiform: fr. a turbinate caps., 3-valved. —Three or 4 species. Little known under glass, as they require too much room. A plant of *D. Palmeri* remained at Kew 16 years before flowering. Plants of doryanthes are prop. by suckers, which are produced only after flowering. The process is very slow. The young plants must be repotted for several years until they have attained a large size. They are said to do best in a compost of loam and leaf-mold in equal parts.



1343. Dorstenia Contrajerva. (×¼)

excélsa, Correa. SPEAR-LILY. Lvs. sword-shaped, not ribbed, smooth, entire, with a very narrow cartilaginous margin, lower ones recurved, others erect: scape clothed with lanceolate lvs., which sheath the st. at their base; fls. in a globular head, deep crimson or maroon inside and out (there is a white-fld. form). B.M. 1685. R.H. 1865, pp. 466, 471; 1891, p. 548. G.C. II. 11:339. Gn.W. 16:681. G.W. 9, p. 521. H.F. II. 7:136.

Pálmeri, W. Hill. Even more gigantic than *D. excelsa:* lvs. longer and broader, slightly ribbed and a longer brown point: fls. in a thyrsoid panicle, bright scarlet outside, whitish within. B.M. 6665. F.S. 20:2097. R.H. 1891:548. G.C. II. 17:409. G.W. 12, p. 222. New shoots are said to be produced at the base, which bloom in one or more years.

D. Guilfòylei, F. M. Bailey, QUEENSLAND-LILY, is a large and fine species from N. Queensland, perhaps a form of D. Palmeri: lvs. 9 ft. long, over 8 in. wide: fls. rich crimson, 4 in. long. It yields a good fiber. Gn. 44, p. 69. G.C. III. 45:383.

WILHELM MILLER.
L. H. B.†

DORYÓPTERIS (Greek, *lance-fern*). *Polypodiàceæ.* Small pot ferns with oddly pretty leaves.

Leaves with continuous marginal sori and copiously anastomosing veins.—About 20 species, in warm countries. Sometimes joined to Pteris, which see for culture. Not to be confused with Dryopteris.

palmàta, J. Smith. Lvs. 4–9 in. each way, with 5 or more triangular lobes or the fertile still more divided; ribs black. W. Indies to Brazil.—Sometimes considered to be a variety of *D. pedata,* Fée.

nóbilis, J. Smith. Larger: lvs. sometimes 1 ft. long, pedately bipinnatifid; ribs chestnut. S. Brazil.

D. decípiens, with lvs. resembling a geranium lf., 3–6 in. each way, is sometimes cult., as is *D. décora,* with more divided lvs. Both are natives of the Hawaiian Isls.

L. M. UNDERWOOD.

DOSSINIA (E. P. Dossin, Belgian botanist, 1777–1852). *Orchidàceæ.* One species of terrestrial orchids, allied to Anœctochilus, but lacking the bearded fringe on the lower part of the labellum. This species may possibly be cult. by a few amateurs who are skilled in the cult. of dwarf warmhouse foliage plants.

D. marmoràta, C. Morr. (Anœctochilus Lowei, Hort.). Lvs. golden-veined or marbled, 4–5 in. long, elliptic: scape pubescent, 10 in. high; spike 5 in. long, with many white, pubescent fls. Java. F.S. 4:370.—There is a stronger-growing var., with foliage better colored.

DOUGLÁSIA (after David Douglas, the Scotch botanist, who explored California, Oregon and British Columbia in 1823 and 1829). Incl. *Arètia. Primulàceæ.* Low tufted perennial herbs, one of which is used in alpine gardening.

The genus is closely allied to Androsace and Primula, but in those two genera the lvs. come from the root, while Douglasia has branches, though very short ones, which are densely clothed with lvs. Douglasia has a corolla-tube equaling or exceeding the calyx, somewhat inflated toward the top, with 5 scales or crests beneath the sinuses; calyx 5-lobed, persistent; stamens 5, included; ovary 5-ovuled: fr. a turbinate 1- or 2-seeded caps.—Seven or 8 species in mountains of Eu., and W. N. Amer., considered to be 6 by Pax & Knuth in Engler's Pflanzenreich, hft. 22 (1905). The fls. are yellow in *D. Vitaliana,* which is the cult. species, but otherwise rose-purple. The plants require the treatment accorded to other alpines; see *Alpine Plants,* Vol. I.

Vitaliàna, Hook. f. (*Prímula Vitaliàna,* Linn. *Androsace Vitaliàna,* Reichb. *Arètia Vitaliàna,* Lodd. *Gregòria Vitaliàna,* Duby). Height 2 in.: sts. numerous, prostrate, somewhat woody: branches denuded of lvs. at the base, but at the tips clothed with overlapping linear entire pilose lvs.: fls. nearly stalkless, solitary or 2 or 3, yellow, rather large; corolla-tube 2 or 3 times longer than the calyx, the lobes ovate-lanceolate, obtuse. Alps, Pyrenees. L.B.C. 2:166.

Some of the American douglasias, all with rose or purple fls., are sometimes listed by foreign specialists in alpines.—*D. árctica,* Hook. Glabrous: lvs. ciliate with short and simple hairs, apex obtuse: fl. 1 on a scape; corolla-tube about equaling calyx: plant loosely cespitose. High arctic Amer.—*D. dentàta,* Wats. Like D. nivalis and by some considered to be a form of it, but coarser and

with broader often spatulate lvs. which are entire and sparingly denticulate. Cascade Mts., Wash.—*D. lævigàta*, Gray. Mature lvs. coriaceous, the margin smooth or rarely minutely ciliate, blade oblong or oblong-lanceolate and obtuse: fls. 2–5; corolla-tube almost twice as long as calyx. Ore., Wash.—*D. montàna*, Gray. Mature lvs. prominently ciliate on the margins, destitute of forked hairs, the blade very small and linear or lanceolate: fls. single, the corolla-tube less than the calyx or just equaling it. Mts., Wyo., Mont. Runs into several forms, 2 of which have been described as species (D. biflora, Nelson and D. or Androsace uniflora).—*D. nivàlis*, Lindl. Mature lvs. covered with minute 2–3-forked pairs, margins not ciliate, blade linear and usually entire: fls. 3–7, the corolla-tube hardly exceeding the calyx. Columbia River. L. H. B.†

DOUGLAS SPRUCE: *Pseudotsuga Douglasii.*

DOWNÍNGIA (after Andrew Jackson Downing, famous American pomologist and landscape gardener). *Campanulàceæ;* or *Lobeliàceæ* when this family is kept distinct. Low herbs, much branched, sometimes grown as garden annuals; flowers blue with white or yellow markings or blotches.

Leaves alternate, entire, passing above into bracts: fls. in the axils of the lvs. or upper sessile bracts; corolla 2-lipped, the upper lobes much narrower than the 3 lower ones; tube of stamens free from the corolla: seeds numerous, small, oblong to spindle-shaped, in a very long linear caps. that bears at its apex the leafy linear calyx-lobes and is dehiscent lengthwise by 1–3 valves or fissures.—Six to 8 species, mostly in Calif. (1 in Chile), usually in moist places and margins of spring pools, sometimes in salty marshes or in mountains. Rafinesque's name Bolelia (anagram of Lobelia) is older, but is discarded by the list of "nomina conservanda" of the the Vienna code. The plants are little known in American gardens. They are easily grown annuals, and are said to make interesting pot-plants. The species are often not well distinguished, and some of them may be color forms. The plants grow about 6 in. high, and have been recommended for edgings.

pulchélla, Torr. (*Clintònia pulchélla*, Lindl.). Erect or ascending, 2–10 in., usually simple: lvs. oblong-ovate to linear, ½in. long, obtuse: fls. deep blue, the center of lower lip yellow with a white border, and marked with violet and yellow in throat; lower lip with 3 roundish apiculate lobes; upper lip deeply 2-cleft with spreading oblong-lanceolate segms. May, June, in Calif. B.R. 1909. R.H. 1861: 171. G.W. 15, p. 213. R.H. 1895, p. 19, shows its straggling habit as a pot-plant. Many of the branches fall below the top of the pot.

élegans, Torr. (*C. élegans*, Douglas). St. usually simple, 4–7 in.: lvs. ovate to lanceolate: the broad lip moderately 3-lobed; the 2 divisions of the smaller lip lanceolate, parallel; lower lip sky-blue with darker veinlets and the main part white with 2 green or yellowish spots; the throat often purple-spotted and yellow-lined. May. Calif. B.R. 1241. L. H. B.†

DOXÁNTHA CAPREOLÀTA, Miers: *Bignonia capreolata.*

DRÀBA (Greek name for a cress). *Crucíferæ.* Whitlow-Grass. One of the important groups of spring-flowering plants for the alpine garden.

A large and widely scattered genus of tufted hardy annual or perennial herbs, with stellate hairs: lvs. often in a rosette, mostly uncut: scapes or sts. leafy or not; racemes short or long; fls. without bracts, small, white, yellow, rosy or purple; stamens 6: fr. an oval, orbicular or linear flat pod with several to many marginless seeds in 2 rows in each cell; cotyledons accumbent.—Some 150 species in temperate and arctic regions of the world, many of them in mountains. Many species occur in the lists of alpine gardeners. They are more or less alyssum-like.

Drabas are very pretty dwarf compact alpine plants, with small but numerous flowers admirably adapted for the rockery or front part of a sunny border. They require a sunny position and an open soil. It is important that they be well matured by the autumn sun. The plant forms a dense little rosette of lvs., and has a neat appearance at all times. In spring, drabas are thickly covered with their little flowers and when planted in masses are decidedly effective. Propagation is chiefly by division; also by seed, which may be sown in the fall if desired. (J. B. Keller.)

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A. *Fls. rose or purple.*

1. **pyrenàica,** Linn. Rock Beauty. Height 2–3 in.: lvs. wedge-shaped, 3-lobed at apex: fls. white at first, changing to rosy pink. May. Mts., S. Eu. B.M. 713. —Said to be easily prop. by cuttings. This is *Petrocallis pyrenaica,* R. Br., under which name it will be found again.

2. **violàcea,** DC. St. woody at base, branched: 6–12 in.: lvs. obovate-oblong, obtuse, equally woolly on both sides: scapes leafy; petals obovate, dark purple. Andes of Ecuador at elevations of 13,000–15,000 ft. B.M. 5650.



1344. Draba Dedeana.

AA. *Fls. white (sometimes yellowish in No. 6).*

B. *Plants biennial or annual.*

3. **cinèrea,** Adams. St. nearly simple: lvs. oblong-linear, stellate pubescent: petals twice longer than calyx: pods oblong, pubescent, shorter than the pedicel. Early spring. Siberia.

BB. *Plants perennial.*

C. *Lvs. rigid.*

4. **Máwii,** Hook. Forming low, densely tufted, bright green patches: st. much branched, densely clothed with spreading, rosulate lvs.: lvs. linear-oblong, obtuse, bristly, with a prominent midrib below: scape very short, woolly, 2–4-fld., very short-pedicelled; petals thrice as large as the sepals, obcordate, white: pods ellipsoid, compressed. Spain. B.M. 6186.

5. **gìgas,** Stur (properly *Árabis Carduchòrum,* Boiss.). Lvs. rosulate and rigid, linear and obtusish, ciliate: scape 1 in. or less, the fruiting raceme short and contracted; fls. white: fr. glabrous, elliptic-linear, the style very short, the valves 1-nerved and keeled. Armenia.

CC. *Lvs. not rigid.*

6. **fladnizénsis,** Wulf. (*D. androsàcea,* Willd. *D. Wáhlenbergii,* Hartm. *D. lappónica,* Willd.). Plant 2–3 in., much branched at base: lvs. rather loosely rosulate, oblong-linear to lanceolate, ciliate, usually somewhat villous or stellate-pubescent, less than ½in. long: scape usually glabrous or only slightly villous; fls. sometimes yellowish: pods elliptic-oblong to ovate-lanceolate, not hairy. Arctic regions and Cent. Eu.



XXXVII. Dracæna Goldieana, a "foliage plant" from tropical Africa.

AAA. *Fls. yellow.*

B. *Lvs. rigid, keeled, ciliate.*

7. aizoïdes, Linn. Cespitose, 2–3 in.: lvs. linear and acutish: scape glabrous, the raceme elongating in fr.; petals yellow, twice exceeding the calyx; anthers about equaling the petals: fr. oblong-elliptic, glabrous or setulose; style as long as the pod is wide. March. Cent. and S. Eu.—B.M. 170. Variable.

8. Aizòon, Wahl. About 3 in. high: lvs. broad-lanceolate, strongly ciliate: scape hairy, with sulfur-yellow fls., the filaments being paler or greenish. April. Eu.—Diverse in habit.

9. Dedeàna, Boiss. & Reut. Fig. 1344. Densely cespitose: scape and pedicels pubescent: lvs. oblong-linear, attenuate at base: petals broadly obcordate-cuneate; stamens scarcely longer than calyx: fr. elipsoidal or ovoid. Spain.—In habit like *D. azoides*; fls. paler yellow.

10. cuspidàta, Bieb. Cespitose: lvs. linear-acute: scape villous or woolly, the fruiting raceme short; petals yellow, twice exceeding the calyx; anthers equaling the petals: fr. lanceolate and somewhat turgid, setulose. Asia Minor.—Aspect of *D. aizoides*, but scape shorter and pod somewhat inflated.

11. olýmpica, Sibth. (*D. bruniæfòlia*, Stev.). Densely and broadly cespitose, about 4 in. high: lvs. narrowly linear, somewhat keeled: petals deep golden, twice as long as the calyx and stamens: fr. small, turgid-compressed; style very short. June. Greece, Orient.—Runs into many forms.

12. rígida, Willd. (*D. bryoïdes*, DC.). Powdered: lvs. minute, and very short, oblong-linear and keeled, obtusish, the margin more or less ciliate: scape glabrous, bearing a rather long raceme; petals deep golden yellow, much exceeding calyx: fr. elliptic or nearly linear. Caucasus, Armenia.

13. imbricàta, Meyer. Very dwarf, much powdered: lvs. very small, oblong, obtuse, 3-sided, ciliate, densely imbricate: raceme nearly sessile, glabrous, 3–5-fld.; petals deep golden, twice exceeding the calyx; filaments exceeding calyx: fr. ovate-orbicular, glabrous, nearly plane; style very short. Caucasus.—An excellent little rock alpine.

BB. *Lvs. not rigid or keeled.*

14. híspida, Willd. (*D. tridentàta*, DC.). About 3 in. high: lvs. obovate, narrowed into a long petiole, obscurely 1–3-toothed at the apex, somewhat bristly: scape not hairy; petals yellow, cuneate, retuse, twice longer than calyx: fr. oblong-linear, not hairy. Russia, Caucasus.

15. alpìna, Linn. Densely cespitose, with a much-branched caudex: lvs. lanceolate or oblong, obtuse or acute, pubescent: flat: scape more or less hairy: pods oblong to ovate; style very short. April. Greenland, N. Eu., Asia.

16. aùrea, Vahl. Doubtfully perennial or biennial, pubescent throughout with stellate hairs, the caudex simple or little branched: lvs. oblanceolate to lanceolate, to 2 in., entire or remotely serrate: petals bright yellow to almost white: pods lanceolate to linear, acute, often twisted. New Mex., and Ariz. in mountains and north. B.M. 2934.

D. boreàlis, DC. Fls. white: stellate-pubescent, more or less cespitose, st. 2–12 in., simple or sparingly branched: lvs. ovate to oblong-ovate, flat, ½in. or less: style short and stout. Brit. Col. to the high N., Japan.—*D. elàta*, Hook. f. Fls. yellow: tall biennial, the st. about 1 ft. high from the previous year's rosette of spatulate lvs. Himalayas.—*D. frígida*, Saut. Fls. white: scape about 2-lvd., loosely pubescent: lvs. lanceolate or elliptic, stellate-tomentose: fr. oblong, glabrous, the style very short or almost none. Alps.—*D. Gilliesii*, Hook. & Arn. Fls. white, ¾in. or less across: tufted perennial, 1–10 in., variable: lvs. ovate-oblong, coarsely toothed: fls. few to many in an erect raceme. Chile. B.M. 7913. Gn. 63, p. 243.—*D. grandiflòra*, Hook & Arn. Fls. white, in racemes: plant small and tufted, with tomentose lvs. oblong-spatulate. High Andes. Gn. 63, p. 242. Showy; hardy in England.—*D. Salamònii*, offered abroad, is described as "very close, compact tufts, white fls."—*D. vérna*, Linn. Whitlow-Grass. A winter annual, widely naturalized from Eu., with white fls., bifid petals, oblong-obovate to oblanceolate rosulate lvs., slender scapes 2–6 in., and glabrous round-oval to oblong pods.

L. H. B.†

DRACÆNA (*female dragon;* the dried juice supposed to resemble dragon's blood). *Liliàceæ.* Dracena. Ornamental hothouse or stove plants, frequently with variegated leaves.

Often arborescent, with sword-shaped or broad lvs. mostly crowded at the summit of the st.: fls. clustered in panicles or heads, greenish-white or yellowish; perianth salver-form or campanulate; lobes 6, spreading; stamens 6: fr. a 3-celled berry. Differs from Cordyline in having larger fls., and solitary instead of many ovules in each cell of the ovary.—About 40 tropical woody plants, a few being in cult. See Baker, Journ. Linn. Soc., vol. 14, for a monograph of the genus.

Dracæna Draco, of the Canaries, is the dragon tree. It reaches a height of 30 to 60 feet, branching when of great age. The dragon tree of Teneriffe, famous for centuries, was 70 feet high, and one of the oldest of known trees. See *Cordyline* for other names not found in this article; also for culture.

The following key to the cultivated species of both Dracæna and Cordyline is based upon the lvs.

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KEY TO THE SPECIES.

A. *Lvs. long and sword-shaped, sessile.*
B. *The lvs. glaucous beneath, 2–5 in. wide*.....C. indivisa
BB. *The lvs. with both faces similar, narrower.*
C. *Of mature plants narrow (6–15 lines broad)*.....C. stricta
CC. *Of mature plants broader (1–2 in.).*
D. *Margins green.*
E. *Color of lvs. glaucous-green, costate, 1½–2 ft. by 15–21 lines*.....D. Draco
EE. *Color of lvs. green, costate, undulate below, 2–3½ ft. by 1½–2 in.*.....D. umbraculifera
EEE. *Color of lvs. green, costa obscure, 3–4 ft. by 13–18 lines.*C. australis
DD. *Margins white-pellucid*.....D. Hookeriana
AA. *Lvs. oblanceolate, broadly petioled or sessile.*
B. *Size of lvs. 3–4 in. by 1½–2 in., opposite or whorled*.....D. Godseffiana
BB. *Size of lvs. 12–15 in. by 18–21 lines, alternate*.....C. rubra
BBB. *Size of lvs. 1½–3 ft. by 2–4 in., alternate.*
C. *Pedicels 1–1½ lines long; perianth 5–7 lines long*.....D. fragrans
CC. *Pedicels 1½–2 lines long; perianth 7–8 lines long*.....D. deremensis
AAA. *Lvs. ovate, lanceolate, or elliptical; petioles narrow.*
B. *The lvs. 4–8 in. by 2–2½ in., oblong-falcate, green*.....C. Haageana
BB. *The lvs. 7–8 in. by 4–5 in., oblong, white-spotted*.....D. Goldieana
BBB. *The lvs. 7–10 in. by ½–1½ in., lanceolate, white-margined*.....D. Sanderiana
BBBB. *The lvs. 10–18 in. by 1–3½ in., elliptical*.....C. terminalis

1. Dràco, Linn. Dragon-Tree. Arborescent (60 ft. high), branched: lvs. very numerous, crowded, sword-shaped, erect or the outer recurved (1½–2 ft. x 1¼–1¾in.), scarcely narrowed below, long-attenuate at the apex, glaucous-green: pedicels 3–6 lines long: bracts minute, lanceolate: perianth 4 lines long, green-

ish; filaments flat: berries orange. Canary Isls. B.M. 4571. R.H. 1869, p. 416; 1880, p. 196. G.C. II. 14:749. G.W. 12:233. J.F. 2, pl. 124.—Fine for conservatory. **D. Bœrhàvii,** Tenore, is a garden form, with elongated lvs., all recurved.

2. **umbraculífera,** Jacq. Arborescent (3–10 ft. high), simple: lvs. very numerous, crowded, sword-shaped (2–3½ ft. x 1½–2 in.), outer recurved, all green and shining, attenuate at the apex, scarcely narrowed toward the conspicuously undulate base, costa distinct on both faces: pedicels 4–6 lines long: bracts minute, deltoid: perianth large, 2 in. long, white, tinged with red; filaments filiform. Mauritius. L.B.C. 3:289.

3. **Hookeriàna,** Koch (*C. Rúmphii,* Hook. *D. Rúmphii,* Regel). Trunk 3–6 ft. high, sometimes branched: lvs. numerous, densely clustered, sword-shaped (2–2½ ft. x 1½–2 in.), outer reflexed, all long-attenuate at the apex, scarcely narrowed below, margin white-pellucid, lower face concave, indistinctly costate beneath: bracts 1½–3 in. long, white: pedicels 3–4 lines long; perianth greenish, 12–15 lines long; filaments filiform: berries orange. Cape of Good Hope. **D. latifòlia,** Regel, is a horticultural variety, with lvs. 3–3½ in. wide. G.C. III. 20:305 (var. *latifolia*). B.M. 4279 (as *Cordyline Rumphii.*) Var. **variegàta,** Hort. Variegated foliage.

4. **fràgrans,** Ker-Gawl (*Áletris fràgrans,* Linn. *Sansevièria fràgrans,* Jacq.). Arborescent (20 ft. high or more), sometimes branched: lvs. (1½–3 ft. x 2½–4 in.) sessile, oblanceolate, lax and spreading or recurved, flaccid, green and shining, acute, indistinctly costate:



1345. Dracæna fragrans var. Lindenii.

bracts minute, scarious, deltoid: pedicels 1–1½ lines long; fls. glomerate; perianth 6–8 lines long, yellow: berry orange-red. Guinea. B.M. 1081. A.G. 18:389. F.R. 4:189. Gn. M. 8:270. G.W. 12:232. G. 2:286. —Much used for greenhouse and table decoration. **D. Knérkii,** Hort. Form with glossy light green, less pendulous lvs. **D. Rothiàna,** Hort. A garden form. I.H. 43, p. 97. R.H. 1877, p. 68. **D. Victòria,** Hort. A garden form. Gn. 63, p. 77. Var. **Líndenii,** Hort. (*D. Líndenii,* Hort.). Fig. 1345. Lvs. recurved, traversed from base to apex by creamy white bands. Very decorative. I.H. 27:384. F.R. 4:191. G.W. 14:321. A.F. 35:1241. G.C. III. 30:176. Var. **Massangeàna,** Hort. (*D. Massangeàna,* Hort.). A broad yellow stripe along the center of the lf. throughout its entire length. F.R. 4:193.

5. **deremènsis,** Engler. Plant 9–15 ft. high, branched: lvs. 1½ ft. long, 2 in. wide, narrowed into a broad petiole-like base: infl. large; fls. on pedicels 1½–2 lines long; perianth 7–8 lines long, with tube 4 lines long, dark red without, white within, unpleasant scented. Afr. G.C. III. 50:23. G.M. 54:523. G.W. 11:505 (all as var. *Warneckii*).

6. **Goldieàna,** Hort. Plate XXXVII. Trunk simple, slender: lvs. distant, spreading, thick-oblong (7–8 in. x 4–5 in.), cuspidately pointed, base broadly rounded or cordate, glossy green, conspicuously white-spotted and banded, young lvs. often tinged with red; petioles erect (2–3 in. long), deeply grooved: fls. unknown. W. Trop. Afr. B.M. 6630. R.H. 1878, p. 15. I.H. 25:300; 42, p. 257. G.C. II. 17:49. G.Z. 22:1. G. 2:271; 14:239. G.W. 12:235.—A fine foliage plant.

7. **Sanderiàna,** Hort. (*D. thaloìdes* var. *variegàta,* Hort.?). Slender: lvs. distant, alternate, spreading or recurved (7–10 x ½–1½ in.), narrowly lanceolate, acuminate, on rather broad petioles (1–3 in. long), glossy-green, broadly margined with white. Congo. A.F. 8:1281; 11:235. I.H. 40:175. G.C. III. 13:445. G.W. 14:322. Gn.W. 14:617. G. 23:533. G.L. 16:235. —Intro. in 1893.

8. **Godseffiàna,** Hort. Woody, but very slender, rather diffuse: lvs. at many nodes small, erect, scale-like and lanceolate, the others opposite or in whorls of 3, oblong or obovate, spreading, cuspidate, sessile (3–4 x 1½–2 in.), firm, green, with copious white spots: raceme short-peduncled: bracts small: fr. globular, greenish yellow or red, nearly 1 in. diam. Congo. G.C. III. 21:347. Gn. 50, p. 276; 51:298, and p. 299. A.F. 13:1340. F.E. 10, supp. 2:12. Gng. 6:294. G. 19:388.—Fine for decorative purposes.

The following are apparently not in the American trade: *D. americàna,* Donnell Smith. Twenty to 40 ft. high: lvs. linear-sword-shape, 8-15 in. long, green: fls. white, small, in dense panicles. Allied to D. Draco. Cent. Amer. S.T.S. 1:207. New.—*D. arbòrea,* Link. Lvs. green, sword-shaped, dense, sessile. Gt. 46:1438; and p. 226. G.W. 8:260; 12:232.—*D. Broòmfieldii,* Hort. Lvs. spreading or recurved, strap-shaped, undulate, sessile, deep green bordered with broad white margins. J.H. III. 33:541. G.C. III. 20:667; 23:249; 33:249 (var.) G. 27:597. G.W. 13:4.—Botanical status obscure. —*D. concínna,* Kunth. Lvs. oblanceolate, green, purple on the margin, green-petioled.—*D. cylíndrica,* Hook. Lvs. linear-lanceolate, or obovate-lanceolate, bright green, spreading. B.M. 5846. —*D. Eeckhántii,* Hort. F.R. 4:46. Gn.W. 16:697.—*D. ellíptica,* Thunb. Lvs. spreading, petioled, thickish, elliptic-lanceolate, glossy, acute, longitudinally striate. B.M. 4787. G.C. II. 17:261 (var. maculata).—*D. ensifòlia,* Hort. Amer.=Dianella ensifolia. —*D. kewénsis,* Hort. Lvs. dark green, broadly oblong-lanceolate-acute; petiole red, half as long as the blade. New Caledonia. New. May be a form of C. terminalis. G.C. III. 33:265. F.E. 15:619.—*D. marginàta,* Lam. Lvs. sword-shaped, dense, spreading, green, margined and veined with red. G.W. 12:235.—*D. marmoràta,* Hort. B.M. 7078.—*D. phrynioìdes,* Hook. Lvs. petioled, mostly oval, acuminate, coriaceous, spotted with yellowish white, pale beneath. B.M. 5352.—*D. reflèxa,* Lam. Lvs. lanceolate or sword-shaped, acute, contracted into a petiole.—*D. Saposchnikòwi,* Regel. Lvs. sword-shaped, crowded, green. Gt. 705.—*D. Smíthii,* Baker. Lvs. large, narrowly sword-shaped, crowded, bright green. B.M. 6169.

Some trade names, the botanical status of which is in doubt, are the following: *alba-marginata, albanensis, Alexandria, angustifolia, angustata, argenteo-striata, DeSmetiana, edmontoniensis, elefantissima, Elizabethiæ, Frederica, Hendersonii, imperator, Jamesii, Janssesii, Lacourtii, Mayi, Mandæana, Offeri, perelyares, recurva, Salmonea, Sheperdii, spectabilis. D. nova-caledonica* is probably Cordyline neocaledonica, Lindl., with bronze lvs.

K. M. Wiegand.

DRACOCÉPHALUM (Greek, *dragon's head,* from the shape of the corolla). *Labiàtæ.* Hardy herbaceous annual and perennial plants of easy culture and of minor importance.

Allied to Nepeta, differing in having the calyx mostly straight rather than curved and unequally toothed: mostly erect herbs, with opposite entire, toothed or deeply cut lvs., the upper ones passing into bracts: fls. in many-fld. verticils which are axillary or terminal, blue or purple or rarely white; calyx tubular, about 15-nerved; corolla, upper lip somewhat notched and arched, the lower one 3-cleft and the middle part notched or 2-cleft; stamens 4, didynamous, the 2

anther-cells divaricate.—Forty species in Eu. and Asia and very sparingly in N. Amer.

Sandy loam, moderately rich, and a rather moist, partially shaded situation will suit these plants best. In a sunny dry border they are never very showy; the flowers are of short duration, and are seldom at their best except in very moist seasons. Propagation is by division or seeds. The species described below are erect-growing.

A. *Lvs. entire, not cut in any way.*

Ruyschiàna, Linn. (*Ruyschiàna spicàta,* Mill.). Perennial, 2 ft.: sts. slightly pubescent: lvs. linear-lanceolate, glabrous: bracts ovate-lanceolate, entire: whorls in somewhat interrupted spikes; fls. 1 in. long, purplish blue or purple; anthers villous. Siberia. Var. **japónicum,** Hort., has white fls. shaded with blue, and is a distinct improvement. G.C. II. 12:167.—According to Vilmorin, this species has been sold as *D. altaiense* (see *D. grandiflorum*).

AA. *Lvs. deeply 3–5-cleft.*

austrìacum, Linn., has the habit of the above, and belongs to the same subgenus Ruyschiana, but the lvs. are divided and more distinctly revolute at the margin. About 1–1½ ft. high: fls. blue, 1½ in. long and more: perennial. July, Aug. Eu., Caucasus.

AAA. *Lvs. cut only at the margin; mostly crenate.*

B. *Whorls crowded together into spikes or heads.*

grandiflòrum, Linn. (*D. altaiénse,* Laxm.). Perennial, about 1 ft. high: root-lvs. long-stalked, oblong, notches at base; st.-lvs. few, short-stalked, ovate, not notched at base, the uppermost still more rounded: whorls in spikes 2–3 in. long, the lowest whorl usually at some distance: fls. 2 in. long, blue. June, July. Siberia. B.M. 1009. P.M. 13:51.

speciòsum, Benth. Allied to *D. grandiflorum,* but st. pubescent instead of pilose above: root-lvs. more broadly heart-shaped, and all lvs. pubescent beneath instead of nearly glabrous, and wrinkled: fls. purplish to deep purple. June, July. Himalayas. B.M. 6281.

BB. *Whorls distant, in long racemes.*

Moldávica, Linn. (*Moldávica punctàta,* Moench). Lvs. lanceolate, inciso-crenate, the floral ones narrower and pectinate: fls. in few-fld. loose clusters; corolla 2 or 3 times as long as calyx, blue or white. European annual, 1–2 ft., sparingly run wild in N. Amer. Eu., N. Asia.

Rùprechtii, Regel. Perennial: dwarf or compact, 1–1½ ft.: lvs. ovate-lanceolate, incised and toothed: fls. rosy purple or lilac, about 1 in. long, in axillary clusters. Turkestan. Gt. 1018.

nùtans, Linn. Perennial, 1 ft.: lvs. ovate-crenate, the floral ones oblong-lanceolate and more nearly entire: fls. blue. May–July. N. Asia. Mn. 4:137. B.R. 841. Var. **alpìna,** Hort., is advertised.

D. canariénse=Cedronella triphylla.—*D. canéscens,* Linn.=Lallemantia.—*D. virginiànum,* Linn.=Physostegia.

WILHELM MILLER.
L. H. B.†

DRACÓNTIUM (derived from the Greek word for *dragon*). *Aràceæ.* Greenhouse or hothouse plants, grown more for curiosity than for beauty.

Herbs with long-petioled lvs.: petioles verrucose; blades deeply 3-parted, these again parted: spathe oblong, convolute below; spadix short-stalked, short, cylindric, free, densely many-fld.; fls. perfect, with a perianth: fr. a 2–3-celled berry, each cell 1-seeded.—About a half-dozen species in Trop. Amer. Cult. as for Amorphophallus.

ásperum, Koch (*Amorphophállus nivòsus,* Lem.). Petioles up to 9 ft. long and over 1 in. thick, roughened toward base with small warts conjoined in series, marked with large livid green and brown spots; blades up to 3 ft. broad, 3-parted, the divisions bipinnate, the ultimate segms. oblong to lanceolate: peduncles 4 in. or more long; spathe up to 10 in. long; spadix 1½–2 in. long. Brazil. I.H. 13, p. 14; 12:424.

GEORGE V. NASH.

DRACÚNCULUS (Latin, *a little dragon*). *Aràceæ.* Odd tuberous plants sometimes grown under glass.

This plant has interesting dragon-fingered lvs. and a terrifying odor when in flower. Its tubers are sold by bulb dealers under the name of *Arum Dracunculus.* The monographer of this order (Engler, in DC. Mon. Phan., vol. 2, 1879) puts this plant into the genus Dracunculus because the ovules are attached to the base of the ovary, while in Arum they are attached to the side. The lvs. of the true arums are always arrow-shaped, while in Dracunculus they are sometimes cut into finger-like lobes. There are only 2 species. The common one is an entertaining, not to say exciting, plant. It is well worth growing for the experience, though its stench is not quite so bad as that of a helicodiceros, sold as *Arum crinitum,* which makes any house unbearable in which it flowers. Nearly all arums are ill-smelling. For cult., see *Arum.*



1346. Dracunculus vulgaris.

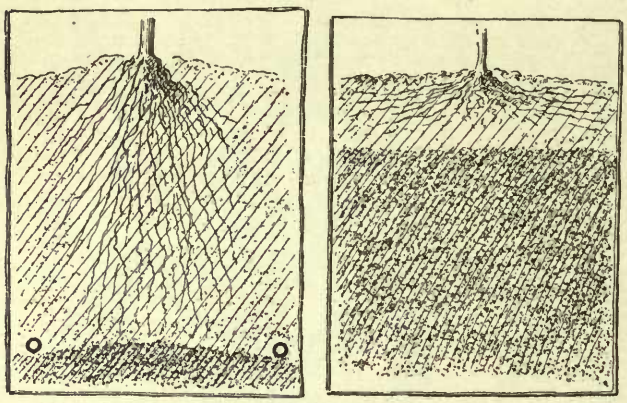
vulgàris, Schott. Fig. 1346. Sheath of lvs. livid, spotted; stalks green; blades with 10 fingers projecting from a bow-shaped base: tube of spathe streaked with purple except at the bottom; spathe purple all over and much darker along the wavy border. Medit. regions. G.C. III. 47:198.

WILHELM MILLER.

DRAGON PLANTS. The dragon arum, dragon root or green dragon, is the native *Arisæma Dracontium.* The dragon plant of Europe is *Dracunculus vulgaris.* The dragon's head is not an aroid, but a Dracocephalum, a genus of mints. False dragon's head is Physostegia. The dragon's blood of commerce is a dark red, astringent, resinous secretion of the fruits of a palm,

Dæmonorops Draco. Other kinds of dragon's blood are produced by *Dracæna Draco* and *Ecastophyllum monetaria* (now referred to Dalbergia). "Sticks," "reeds," "tears" and "lumps" of dragon's blood are known to commerce. The resin is used in coloring varnishes, dyeing horn in imitation of tortoise shell, and in the composition of tooth-powders and various tinctures. The dragon tree is *Dracæna Draco.*

DRAINAGE. Underground or sub-drains serve to relieve the land of free water, which is harmful to most plants if left to stagnate in the surface soil or subsoil. They serve not only to dry the land in early spring, but indirectly to warm it, for if the water is removed the sun's heat warms the soil instead of cooling it by evaporating the surplus water. Tenacious lands devoted to gardening and small-fruits are made more productive, warmer and earlier by sub-drainage. Drains promote nitrification, assist in liberating mineral plant-food and cheapen tillage. They serve not only to remove deleterious stagnant water, but they promote aëration as well, and this hastens beneficial chemical changes in the soil. Drainage promotes the vigor, healthfulness and fruitfulness of plants. Tenacious soils are made more friable by drains, thereby giving

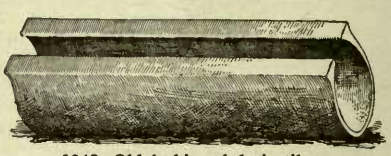


1347. Diagrams to explain the effect of lowering the water-table by means of under-draining. On the undrained soil, the roots do not penetrate deep; and when droughts come, the plants suffer.

easier access to plant roots, while the percolation through the soil of rainwater, which carries some plant-food, is hastened. Rain-water in the spring is warmer than the soil; in midsummer it is cooler than the soil: therefore, percolation of rain-water warms the soil in the spring and cools it in extremely hot weather. Drains serve not only to relieve land of free water, but they impart to it power to hold additional available moisture, which materially benefits plants during droughts.

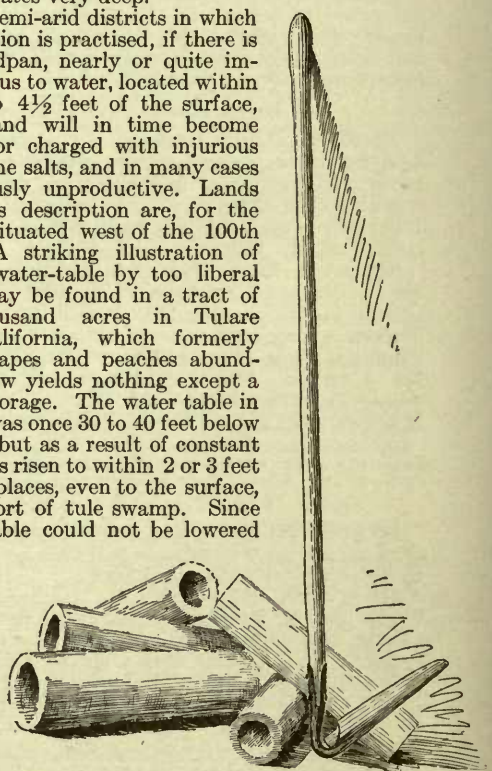
Drainage is of two kinds, surface and sub-drainage. On land on which large outlays of money are to be expended, as in horticultural plantations, it is of the utmost importance that the soil be freed to considerable depths from stagnant water. Trees, many shrubs, and even some garden crops send their roots deeper into the subsoil than most of the cereals, hence they require a greater depth of drained feeding-ground. In horticulture the planting may often precede the harvest by five to ten years, while with many farm crops the harvest follows the planting in a few months. If the grain-raiser loses one crop, an annual, by planting on wet land, the loss is not great, but if the orchardist loses fifteen to twenty years of labor by planting on undrained lands, before the mistake is discovered, the losses are serious. Some lands require little more than to be relieved from surplus surface water in early spring. This may be accomplished by forming ridges and open furrows as far asunder as the rows of trees are to be placed. But it is only rarely that surface drainage fully prevents serious damage from surplus moisture. Surface drainage may be considered a cheap way of temporarily alleviating undesirable conditions. It does not always eradicate them. Fig. 1347 illustrates how sub-drainage lowers the water-table (or the area of standing water), and thereby ameliorates the soil.

Sub-drainage consists in placing conduits of tile or other material in the ground at depths varying from 2½ to 4 feet, and at such distances apart as will serve to relieve the subsoil of deleterious stagnant water. When suitable stones are at hand, they are sometimes used instead of tile for forming drainage conduits. If such use is made of them, the drains should be somewhat deeper than tile drains, since the stones which form the drain occupy nearly a foot of the depth of the ditch and are more likely to become obstructed, especially if placed near the surface, than are tile drains. The throats or openings of stone drains are irregular in size, while those of tile drains are smooth and uniform in size, and are, therefore, most desirable. Years ago, various flat-bottomed tiles (Fig. 1348) were employed, but the style in general use at present is the cylindrical unglazed tile shown in Fig. 1349. They should be hard-burned. Because of the low cost of cement, tiles made of sand and hydraulic cement have recently come into use; they require no burning, are stronger than tiles made of clay and are just as efficient, except in alkali and where frost penetrates very deep.



1348. Old-fashioned drain-tile.

In semi-arid districts in which irrigation is practised, if there is a hardpan, nearly or quite impervious to water, located within 3½ to 4½ feet of the surface, the land will in time become sour or charged with injurious alkaline salts, and in many cases ruinously unproductive. Lands of this description are, for the most part, situated west of the 100th meridian. A striking illustration of raising the water-table by too liberal irrigation may be found in a tract of several thousand acres in Tulare County, California, which formerly produced grapes and peaches abundantly but now yields nothing except a little hardy forage. The water table in this region was once 30 to 40 feet below the surface, but as a result of constant irrigation has risen to within 2 or 3 feet and, in low places, even to the surface, forming a sort of tule swamp. Since the water-table could not be lowered enough to restore the land by under drainage, for lack of an outlet within reasonable distance, it is probable that the only way to reclaim it

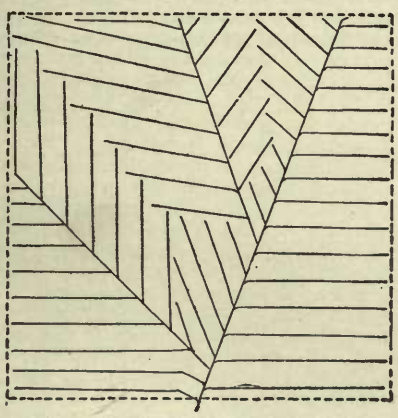


1349. Common cylindrical drain-tile; and a scoop for preparing the bed for the tile.

would be to sink a well and pump the surplus water into a surface ditch. Irrigation with pure water would then sweeten the soil and render it again productive; and the whole process of restoration need not be excessively expensive.

If the hardpan is less than 2 feet in thickness, the land may be improved greatly for orchard and vineyard purposes by the use of dynamite. Blasting should be deep enough to allow the surplus water to escape into the porous earth or gravelly soil beneath the hardpan. On the Pacific coast this method of draining orchard and vineyard land has been quite successful. In any case, unless the soil has good natural sub-drainage, it is both wise and economical to blast out holes for trees and vines; for the cost of digging holes, if they are as large and deep as they should be, is lessened by an amount almost equal to the cost of blasting.

Recently, powerful tractors have solved, to some extent, the problem of drainage in many cases by making deep plowing possible before planting and during the first few years of subsequent tillage of the orchard or vineyard. This machine with the tillage implement turns easily at the ends of the field within the space allowed for turning a span of horses and a plow; it can pass under limbs where a 14-hand horse (56-inch) can

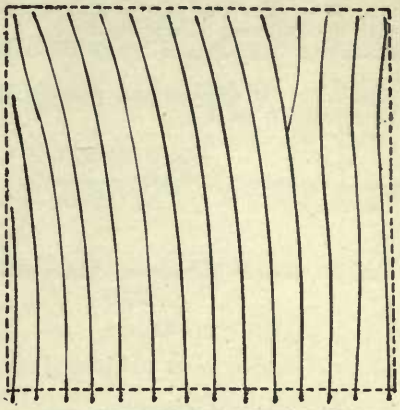


1350. Improper method of draining a field.

pass, and as close to the plants as a span of horses can. It furnishes also power and locomoton for spraying and for opening trenches to a considerable depth (18 to 44 inches) for the reception of drain-tile.

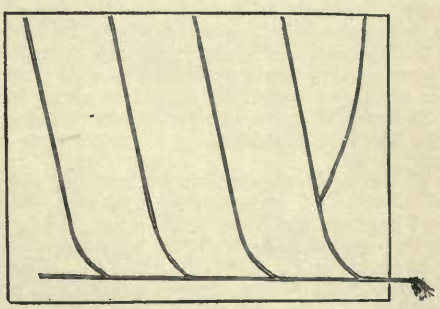
In some regions, drains are placed 200 to 300 feet apart, and serve their purpose well. In others they should not be placed farther apart than 20 to 30 feet. Wherever the subsoil is composed of tenacious fine clay, through which the water moves upward or downward with difficulty, the narrower intervals are necessary. In some instances the surplus water in the subsoil is under pressure by reason of water which finds its way into it from higher levels, and if this is not removed, the water has a constant tendency to rise to the surface. In many such cases drains placed at wide intervals may serve to relieve the pressure and drain the land. Since sub-drains are designed to be permanent, are expensive to construct and difficult to repair, the principles of drainage should be well understood, and the work should be undertaken only after a most careful inspection of the land and after the fundamental principles of the subject have been mastered.

Mains and sub-mains should be avoided so far as possible, since they greatly increase cost, tend to become obstructed, and are often unnecessary. The three long mains in Fig 1350 are not drains, strictly speaking, since the land may be as fully drained without them, as shown in Fig. 1351; therefore, they serve only to conduct the water of the drains proper. Tiles of 3 to 4 and 5 inches diameter should be used when the drains are infrequent and the flow of water considerable. Smaller ones, 2 to 3 inches in diameter, will suffice when the intervals between the drains are narrow.



1351. Best method of draining a field.

Drains should have as uniform a fall as possible, and no abrupt lateral curves or sharp angles should occur as are seen in many places in Fig. 1350. If the drain has a rapid fall in its upper reaches, as is often the case, and but slight fall in the lower, a silt basin should be constructed at the point at which the rapid changes into the slight fall, if obstructing silt is present. All drains which may be necessary should be placed before the planting occurs. Orchard lands may be drained in the spring, fallowed in the summer, and planted in the fall or the following spring. Drains placed at frequent intervals because of the tenacity of the soil should be comparatively shallow, for if placed deep or at wide intervals, the water will be too long reaching them. If drains are placed at wide intervals they should be at least 3½ feet deep to be most efficient. If the parallel system is adopted (Fig. 1351), there may be more outlets to construct and maintain than is desirable; if so, the system might be modified by constructing a submain, one side of which will serve also as a drain, and but one outlet will be required (Fig. 1352). Drains through which water runs for the greater part of the year are likely to become obstructed by roots, if water-loving trees, such as the willow, soft maple, and elm, are



1352. Showing how the drains may be gathered into one when there is only one place at which an outlet can be secured.

allowed to grow near them. If floating silt is present, the joints of the tiles should be protected for two-thirds of their upper circumferences by a narrow strip of tarred building paper (Fig. 1353), or collars should be used. Stone drains should receive a liberal covering of straw or some similar material before they are filled.

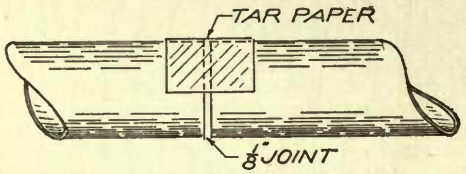
I. P. Roberts.

Drainage for landscape work.

The value of a thorough knowledge of the possibilities of drainage in landscape work has been overlooked until recent years as a definite field entirely apart from general drainage for agricultural purposes.

Drainage under the headings of this article is installed with the following objects in view:

1. Maintaining well-drained areas for firm lawn surfaces.
2. Maintaining well-drained and firm surface conditions for recreation areas.



1353. Covering a joint.

3. Draining of surface water and ground water from roads.
4. Draining foundations for walks.
5. Preserving the normal soil conditions for newly planted trees.
6. Draining swamp and marsh areas to prevent breeding of mosquitos.

1. Drainage for lawns.

The secret of a perfect lawn is attributed to drainage conditions which provide a well-drained subsoil and a firm surface that may be readily freed from any excess water during heavy rains. The installation of drainage for this purpose is required only in the more compact soils that do not drain naturally. Sandy soils seldom require artificial drainage unless immediately underlaid with a stratum of impervious clay. On any lawn the topography of which does not permit the ready surface run-off and the subsoil of which is compact clay, the necessity of installing sub-surface drainage is strongest.

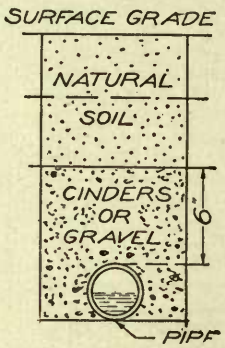
A drainage system for providing ideal soil conditions for perfect lawns must be installed carefully. Four-inch tile, is often used in the lateral systems while either 6-inch vitrified pipe, or the No. 2 quality of 6-inch round tile, is used for the main lines. All drains should be laid on an even grade of not less than ⅛ of an inch fall to each linear foot of drain, and preferably not less than ¼ of an inch fall for each foot of drain. If perfect drainage is desired, the distance apart of these drains should not exceed 20 feet. In accordance with the general laws of drainage, tile should be laid at a more shallow depth in the heavy soils than in the lighter soils, and should be spaced at closer intervals than 20 feet, this space varying largely with the desire to free the lawn immediately of any excess surface water.

In all tile drainage whether for lawns or other purposes, a space of approximately ⅛ inch should be allowed between the ends of the pipes. The covering of tar paper and cinders should be placed over each joint as shown in Fig. 1353. The tile should be placed on a firm bottom of clay or other natural soil, and surrounded on all sides, and covered to a depth of not less than 6 inches with cinders, crushed stone, or washed gravel (Fig. 1354). In very heavy clay, the trench excavated for the tile should be filled with cinders, crushed stone or gravel to a line separating the looser top soil from the clay subsoil (Fig. 1355). In heavy soil and for perfect lawn drainage, the lines of tile ought not to be laid deeper than 2½ feet and the cinder fill should not be less than 15 inches in depth. In the lighter sandy loam soils, the tile may be laid to a depth of 3 to 3½ feet.

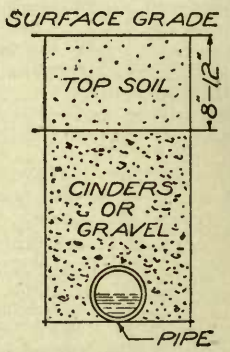
It is often found necessary when lawns are constructed on sandy soil to prevent excessive drainage, rather than to encourage drainage conditions. In these extreme sandy soils, the surface water seeps away so readily that the lawns become exceedingly dry during the warm and dry months. To prevent this condition a layer of clay 4 inches deep should be distributed over the sandy sub-grade prepared for the lawn, at a depth varying between 10 and 18 inches below the proposed finished surface of the lawn. This clay is thoroughly compacted and serves as a partial barrier against abnormal seepage which would otherwise occur, and thereby retains the moisture necessary for the capillary attraction to feed the roots of the lawn grasses.

2. Recreation areas.

Areas naturally falling under this heading are tennis-courts (clay and turf), bowling-greens, clock-golf areas, and croquet-lawns. All of these require a more careful study of drainage conditions than is given to the average lawn. It is essential that such areas be so completely drained that the surface condition is always firm, even after the average continuous heavy rains.

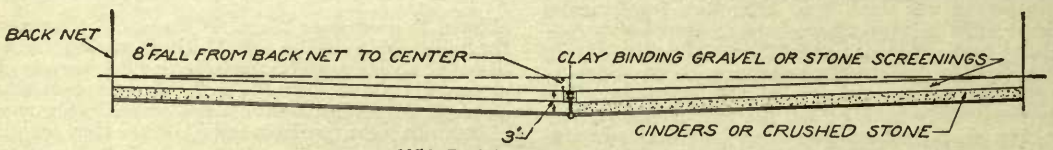


1354. The filling of a drain.



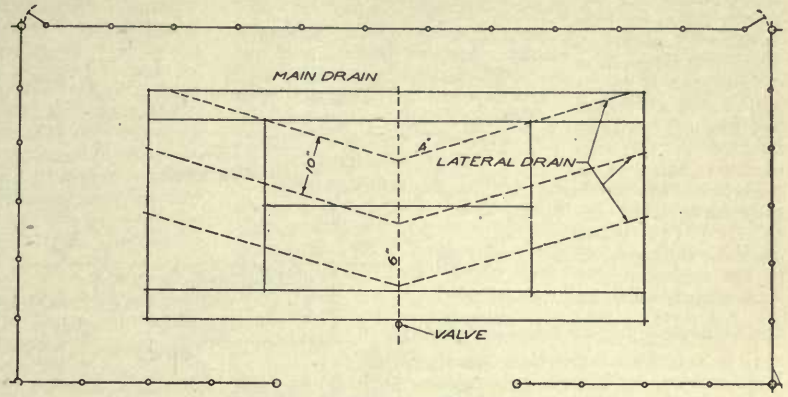
1355. Applying good top soil.

Tennis-courts.—These areas require the most careful study of drainage conditions. The average tennis-court requires two types of drainage,—surface and sub-surface. Surface drainage is cared for in two ways, (1) either by giving the court a gradual slope to one end, or (2) as shown in Fig. 1356, where the surface of the court is sloped from either end toward the middle line. This method, shown in Fig. 1357, gives probably the most satisfactory results, because, in this way, if surface conditions at the middle of the court are correct, the surface water is cared for most readily and with the shortest possible run-off. This drain across the middle of the court may be either an open concrete drain with a plank laid over the top and flush with the surface of the court, or a blind drain filled with a



1356. Draining a tennis-court.

coarser crushed stone and fine crushed stone, over which is spread a thin layer of washed sand. The bottom of the drain ought to be approximately 6 inches lower, at the point where the outlet to the sub-drain is located, than the elevation at the extreme high points of the drain. The method of establishing these grades varies largely with the requirements of this particular problem. The water, as it reaches the low point in the drain, is conducted at once into the main 6-inch drain, which also takes ground-water from the underground system of drains. When the court is so constructed that one end is lower than the other, in order to assist surface-drainage conditions the courts should be level from side to side. Fig. 1357 shows the general distribution of the system of tile to care for the sub-surface water in tennis-court construction. This would apply equally well to the construction of other recreation areas, including clock-golf-greens, bowling-greens and croquet-lawns. In the construction of all tennis-courts, the trenches excavated for the tile should be filled with cinders or an equally porous material to a height not less than 6 inches below the proposed finished grade of the court.



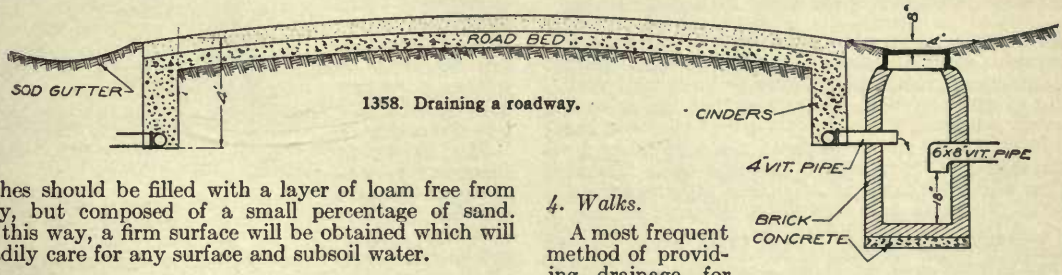
1357. Draining a tennis-court.

Clock-golf-greens, bowling-greens, and croquet-lawns.— A thorough distribution of tile drains installed as outlined below, should meet all the requirements commonly imposed from the drainage standpoint upon the construction of these recreation areas. Lines of 4-inch tile should be placed, at intervals of not more than 10 feet. For the most thorough and ideal drainage of these areas, provided the cost is not prohibitive, the construction would be as follows: A neat sub-grade should be made at a depth not exceeding 15 to 18 inches below the proposed finished surface of the recreation area. The necessary lines of tile should be laid in trenches at a depth varying between 2 and 2½ feet below the finished grade, these trenches to be filled with cinders, crushed stone or gravel (Fig. 1355). On this sub-grade, thus completed, the entire recreation area should be filled to a point approximately 6 inches below the proposed finished grade, with cinders, or some equally porous material. On this finished surface, the remaining 6 inches should be filled with a layer of loam free from clay, but composed of a small percentage of sand. In this way, a firm surface will be obtained which will readily care for any surface and subsoil water.

3. Roads.

The secret of a perfect road surface lies (1) in the proper crown of the road, and (2) in the adequate drainage of the subsoil or foundation. The first provision cares for the surface water, and the second provision eliminates any surplus ground-water.

On all private estates on which roads are constructed on heavy clay soils and not on grades greater than 4 per cent, the secret of success depends upon drainage installed in either of the two ways shown in Fig. 1358 or Fig. 1359. Installing a line of drains under the middle of the road is used in soils in which the ground-water level is abnormally high. Such drains should range in depth from 2 to 3½ feet below the finished surface of the road, and the trenches should be filled with a porous material and not with the natural soil. The method of installing drainage under the sides of the road, as shown in Fig. 1358 is used in heavy clay soils, and serves to keep the foundation of the road on well-drained soil. These drains are installed at a depth varying from 2 to 3 feet in trenches filled with cinders or equally porous material.



1358. Draining a roadway.

Turf pleasure roads, so frequently constructed on private estates, should be thoroughly drained with a line of tile placed under the middle of the road, unless the road is constructed on a heavy foundation of field-stone or gravel which forms a natural drain path for surface-water and soil-water.

In providing drainage along the sides of roads constructed on clay soils through virgin woods, it is sometimes necessary to carry these drainage lines a considerable distance through the woods to suitable outlet points. The joints of all such lines of drainage should be cemented, otherwise the artificial conditions produced by the increased drainage will work serious injury to many large trees growing on either side. In general it is very unsafe to install drainage lines through virgin woods, without this precaution. Roads constructed through such woods would better be drained by laying a line of tile under the middle of the road as shown in Fig. 1359.

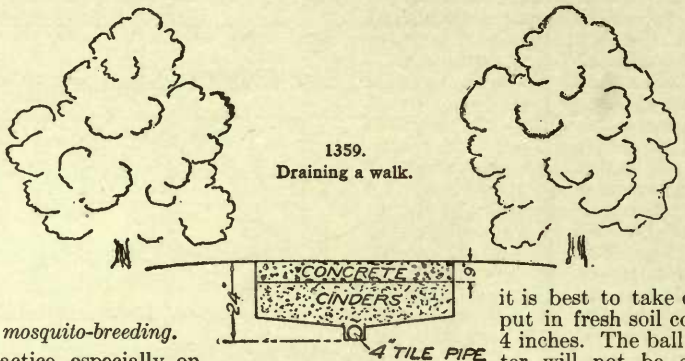
4. Walks.

A most frequent method of providing drainage for walks is that shown in Fig. 1359. A line of 4-inch tile is laid at a depth varying between 18 inches and 30 inches below the finished grade of the walk and following the middle line of the walk. The trench for the tile is filled with a porous material to a height even with the bottom of the cinders used for the foundation of the walk, or laid as shown in Fig. 1359.

5. Newly planted trees.

All trees planted in clay soil require drainage. If the pockets in which such trees are planted are not

thoroughly drained, the area excavated and re-filled with soil when the trees are planted becomes a pocket for ground-water. This pocket or reservoir collects the water, which, if not carried off by means of drains, will very likely cause the death of the trees. All large trees, especially those which do not grow best with their roots in the water, must be provided with drainage. The common method of drainage is to install a line of 4-inch tile leading from the bottom of the excavated hole to a main line of tile which may have been installed for other drainage purposes, or to the nearest outlet if no such line exists.



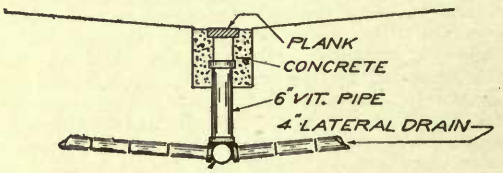
1359. Draining a walk.

6. Drainage to prevent mosquito-breeding.

It is a frequent practice, especially on large estates, to install open ditches from 50 to 100 feet apart in swamps and in salt marshes, in order to provide a means for draining such areas, and thus preventing the presence of stagnant water, which is conducive to the breeding of mosquitos. These trenches are excavated at depths varying from 2 to 3½ feet. The more frequent the trenches, the shallower they may be made and still provide adequate drainage.

The foregoing article pertains only to the particular phases of drainage especially to be considered in connection with landscape work. For additional information on the general details concerned with drainage, refer to the main article upon drainage, p. 1072.

A. D. Taylor.



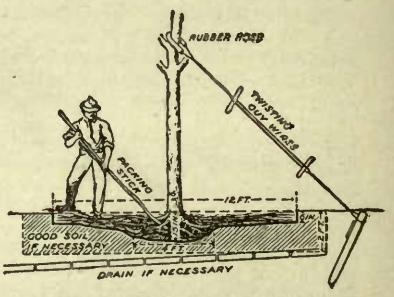
1360. Detail of drain connections. (See Fig. 1356.)

Drainage and watering for newly transplanted trees.

Drainage is an essential in all retentive soils and is a safeguard even on sandy gravelly subsoils against overwatering. Drainage is likely to be vetoed on the score of expense or on the excuse that the subsoil is gravelly; whereas, there are only gravel stones in hardpan which holds water. A drain made by filling a pit with stones is frequently inadequate as it fills with water, which backs up into the hole, saturates the soil around the roots and rots them. Rotting of only a part of the roots may injure the tree more than the cutting off of that amount of roots.

The soil in which to plant should be open, porous and aërated. Soil which has been piled up as in grading operations is likely to be sour from the decay of the sod and from the packing by teams and scraper. Muck from ponds which has been piled and mixed with lime for a year may still be sour. Clay soil packed by the water and packing-sticks may remain too compact and not aërated enough, may be too much saturated with water and, therefore, rot the roots. Manure should not be mixed in the soil around the roots on account of the danger of souring and rotting the roots. This rotting is determined by digging down to the roots and finding them of blue-black color with a sour smell. Sometimes this decay has not reached through the bark of the roots and other times it has penetrated the bark and turned the cambium blue-black. Sour soil is likely to be of bluish or greenish color rather than chocolate-brown, and have a sour smell like that underneath a manure heap. The smell is most readily detected by breaking open a lump of soil. In digging into sour soil and soil that is over-saturated, the spade makes a peculiar sucking noise as in digging in a bog. If at the time of examination the soil is already become sour, it is best to take out this sour soil and put in fresh soil covering the roots only 4 inches. The ball of earth in the center will not be so liable to get sour because it has not been disturbed. As brought out by Stringfellow in the "New Horticulture," soil that is dug over will take in water and become saturated; whereas, soil that has not been disturbed will retain air in the soil-spaces even if submerged. The ball of earth is also prevented from becoming saturated by the undisturbed feeding-roots which absorb the moisture.

Watering cannot be by rule, but must depend on examination of both ball of earth in the center and the outer roots. The difficulty will be to keep the ball of earth sufficiently damp on account of the rapid withdrawing of moisture by the roots. The danger will be that the soil outside the ball of earth will take up the water too rapidly, remain saturated several days and rot the roots. Examination is best done by shovel and fork, digging down 1½ feet both in the ball and outside. An easier way is to bore into the soil with an auger. It will usually be found that the central ball of earth is dry and dusty in the summer even if the surface and outer soil is damp. The growth of weeds and grass will indicate the same. A good way to water is to make a basin around the width of the ball of earth, fill it with water 6 inches deep, make crowbar holes into the ball for it to soak in. Many mistakes are made in overwatering—letting the hose run all night or watering every day, thereby rotting the roots.



1361. Setting a newly transplanted large tree.

Mulching is frequently neglected, the tree starving for lack of humus. A close-cut lawn around a newly planted tree may be the ideal of neatness, but it means starvation and thirst for the tree and is the principal cause of slow growth over several years, making new, bare and ugly landscapes. The mulch should extend as wide as the roots and be from 3 to 6 inches deep, of strawy manure, leaves, grass, salt hay or similar organic matter. Too much manure may sour the soil and rot the roots, if it lies heavy and compact and keeps out the air. Light strawy manure is better. If the mulch blows about and is untidy, it may be kept in position by wire netting, earth, or the planting of small shrubs.

Henry Hicks.

DRÌMIA (name refers to the acridity of the roots). *Liliàceæ*. Bulbous S. African and Trop. African plants of the Scilla tribe, with gamophyllous perianth and a campanulate tube, the segms. linear-oblong and reflexing: stamens 6, shorter than the segms., and inserted at the throat of the perianth-tube; ovary sessile, ovoid, 3-celled, becoming a loculicidally 3-valved membranous caps.: lvs. either broad and rather fleshy or narrow and rigid, often appearing at a different season from the bloom: fls. on a naked peduncle or scape, in a simple raceme.—About 30 species, none of which appears to be regularly in cult. *D. oligospérma*, C. H. Wright. Probably from S. Afr., and very recently described: fl.-clusters over 6 ft. high, much branched, the beautiful white fls. with 3 green nerves on the oblanceolate spreading petals opening late in the afternoon: bulb elliptic, 6 in. long: lvs. 12–14, rosulate, 1½ ft. long, linear-acuminate, glabrous. Likely to come into commercial cult.

DRÌMYS (from a Greek word, used in allusion to the sharp or acrid taste of the bark). *Magnoliàceæ*. About 10 evergreen trees or shrubs, allied to Illicium, distributed from Mex. to the Straits of Magellan, and in Austral., New Zeal., and islands. Glabrous and aromatic plants with pellucid-punctate lvs., and polygamous diclinous or perfect fls. on 1- to many-fld. peduncles, white, yellowish or rose-colored and showy; sepals 2–4; petals 6–∞, in 2 or more series; stamens ∞, on thickened filaments; ovaries usually 2–∞, with sessile stigma and many seeds. *D. Winteri*, Forst. (*Wintèra aromática*, Murr.), is a S. American small tree (to 50 ft.), with milk-white fls. 1 in. or more across, jasmine-scented; petals 8–12, pale cream-yellow: lvs. alternate, evergreen, elliptical or lanceolate, coriaceous, somewhat acuminate, entire, glabrous, very aromatic: branches with reddish bark: umbels (3–9-fld.) often nearly equaling the lvs.: scarcely known either as a glasshouse subject or for outdoor cult. in warm countries. B.M. 4800.

L. H. B.

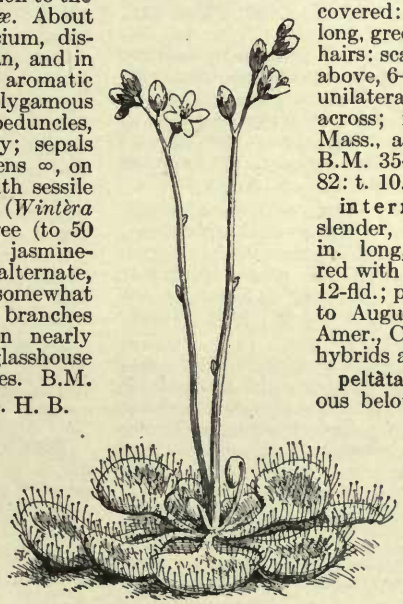
DRÓSERA (Greek *droseros*, *dewy*, from the dew-like excretions on the tips of the leaf-hairs). *Droseràceæ*. A group of carnivorous plants popularly known as the Sundews or Dew-Plants.

The sts. usually short, slender or compressed, rarely elongate and upright in such types as *D. peltata*: lvs. varying from linear through lanceolate to circular, often arranged in a rosette, and beset over their upper surfaces with fine often irritable hairs, that excrete a clear neutral viscid fluid which entangles and catches insect prey; the hairs then bend inward toward the lf.-center, the fluid becomes acid and also excretes a proteinaceous ferment by which the animal tissues are digested, the dissolved products being then absorbed for the plant's nutrition: fl.-scapes slender, ending in curved scorpioid cymes of blooms, ¼–1½ in. across, and varying from white through pink to scarlet or crimson; sepals, petals and stamens 5 each, while the carpels vary from 5–3, are syncarpous with parietal placentation, and bear as many style-arms or lobes: fr. a caps.—About 90 species scattered over the world, though most abundantly in Austral. Monograph by Diels in Engler's Pflanzenreich, hft. 26. The species usually grow in moist muddy soil, at times almost floating in water, as in the common N. J. species, *D. intermedia*. Some Australian kinds form tubers, and can then survive through dry periods. The lvs. in our native species wither in autumn, and a small winter bud-rosette is formed, which unfolds its lvs. in the succeeding spring.

The native and exotic species all grow well if treated as greenhouse plants, and grown in fine muddy loam topped by a little sphagnum. They should also be kept constantly moist in their root extremities, and exposed to bright light. The following native and exotic species are now often grown in collections. They can be propagated by seeds, by division of the shoots, or by cutting the slender rhizomes into short lengths of ½–1 in. The last, when placed in moist soil, root and form buds in two to three weeks.

binàta, Labill. (*D. dichótoma*, B. & S.). Sts. short: lvs. long-stalked, 6–16 in. high, once- to twice-forked into long-linear reddish green segms. that are covered with viscid hairs: scape branched above; fls. white, ½–¾in. across; fls. June, July. Austral. and N. Zeal. B.M. 3082.—Intro. in 1823. Easily grown and prop. by division of the crowns.

capénsis, Linn. St. slightly elongate: lvs. in a terminal rosette, linear to spatulate, tapered into petiole, obtuse at apex: scapes 6–10 in. long with 5–20 secund purple fls.; fls. June, July. Afr., southwestern part of Cape Colony. B.M. 6583.—Intro. in 1875.



1362. Drosera rotundifolia. (×½)

filifórmis, Raf. St. short, hair-covered: lvs. linear, erect, 6–8 in. long, greenish with abundant purple hairs: scape equal to or longer than above, 6–15-fld.; fls. rather crowded, unilateral; petals pink-purple, ⅜in. across; fls. June, July. Del. to Mass., along sandy coastal places. B.M. 3540. Torrey, Fl. N. York, 82: t. 10.

intermèdia, Hayne. Rhizome slender, 1–4 in. long: lvs. 1½–2½ in. long, long-petioled, spatulate, red with glandular hairs: scape 6–12-fld.; petals white; fls. April (Fla.) to August (New Bruns.). E. N. Amer., Cuba, and Eu.—Forms wild hybrids at times with other species.

peltàta, Smith. St. 6–10 in., bulbous below, slender elongate above ground, with scattered peltate glandular lvs., and terminating in delicate 6–10-fld. stalks: petals white to pink. From India through China, Japan and the Philippines to Austral. G.C.II.19:436.—A pretty, delicate and striking species now not uncommon in cult.

rotundifòlia, Linn. Fig. 1362. St. short, slender: lvs. ¾–2 in., with elongate non-glandular petiole and circular red-glandular blade: scape slender, 5–12-fld.; petals white, expanding in bright sunshine; fls. May (Carolinas) to Sept. (Newfoundland).—A classic plant, owing to Darwin's studies in "Insectivorous Plants."

Tràcyi, Macfarlane. Habit of *D. filiformis*. Lvs. 12–16 in., pale green with light green glandular hairs: scape 15–24 in.; fls. purple, ¾in. across. Abundant over the coastal area of the Gulf states from mid-Fla. to La. Fl. April, May.—One of the largest species of the genus.

J. M. Macfarlane.

DROSOPHÝLLUM (*dew-leaved*). One of the 6 genera of the *Droseràceæ*, comprising a single species in S. Spain, Portugal and Morocco, sometimes seen in collections of insectivorous plants, and for the interesting morphology, the lvs. being revolute rather than involute as in the droseras and other plants. *D. lusitánicum*, Link, is a sub-shrubby little plant, the simple st. 2–6 in. high bearing at the top long-linear glandular insect-holding lvs.: fls. 1½ in. across, on an elevated stalk (1 ft. high), bright yellow, with 10–20 stamens, alternating in length, bearing short yellow anthers; petals

5, obovate, thin, twisted after anthesis; styles 5, filiform: fr. a narrow caps., ¾ in. long, 5-valved. B.M. 5796.—The glands of this interesting plant are purple, some stalked and some sessile, viscid, not motile. See Diels, in Engler's Pflanzenreich, hft. 26 (1906) for monographic treatment, where the Droseraceæ is reduced to 4 genera, Byblis and Roridula being removed from the family; and Darwin studied it and described it in Chap. XV of "Insectivorous Plants." L. H. B.

DRŸAS (Greek, *wood-nymph*). *Rosàceæ*. Dwarf hardy tufted evergreen somewhat shrubby plants, sometimes transferred to gardens.

Leaves alternate, petioled, simple, entire or crenate, tomentose: fls. large, white or yellow, borne singly on slender scapes; sepals 8–10, persistent; petals 8–10, obovate or oval; stamens many, with subulate filaments; pistils many, sessile, with a terminal style that persists and elongates on the achene. High northern or mountain plants, of N. Amer., Eu. and Asia, of which 4 species are recognized by Rydberg (N. Amer. Flora, xxii, part 5, 1913); allied to Geum.

The best known cult. species, *D. octopetala*, requires a well-drained porous soil, a sunny but not dry position. It is well to shade the foliage from bright sun during the winter months with evergreen branches to prevent the foliage from having a scorched appearance. A capital plant for the rockery. Propagated by cuttings, division, or by seed. (J. B. Keller.)

octopétala, Linn. Densely cespitose with a woody caudex or st.: lvs. rugose, elliptic, oval or oblong, deeply and regularly crenate, white-tomentose beneath: scapes 2–8 in. long; fls. white, the petals elliptic or obovate-elliptic, and the sepals linear or linear-lanceolate: seeds with a feathered awn 1 in. long. North temperate and arctic regions.

Drúmmondii, Rich. Cespitose perennial with decumbent caudex: lvs. elliptic or obovate, white-tomentose beneath but nearly or quite glabrous above, somewhat rugose, coarsely crenate: fls. yellow, the petals elliptic-spatulate or obovate and almost erect, the sepals ovate or ovate-lanceolate. Que. to Ore. and N. B.M. 2972.—A good rockery plant; 4 in., more or less.

D. integrifòlia, Vahl. Fls. white; sepals linear or linear-lanceolate: lvs. lanceolate or lance-elliptic, the margins mostly revolute. High northern N. Amer.—*D. tomentòsa*, Farr. Fls. yellow; sepals ovate or ovate-lanceolate: lvs. obovate or elliptic, coarsely crenate, tomentose on both surfaces. Canadian Rockies. L. H. B.

DRYMOGLÓSSUM (Greek, *wood* and *tongue*, of no direct significance). *Polypodiàceæ*. Small ferns, 5 to 10 species, occurring wild in both tropics, with wide creeping rootstalks, and small, entire lvs.: sori resembling those of Polypodium. None is advertised in Amer. Three or 4 kinds are mentioned in horticultural literature abroad, but are not cult. here. L. M. Underwood.

DRYMÒNIA (from Greek for an oak wood: growing on trees). *Gesneriàceæ*. Prostrate or climbing woody plants, sometimes grown under glass, but apparently not offered in this country. Fls. white or yellowish, mostly large, on short axillary usually solitary pedicels; calyx large, oblique, 5-parted; corolla-tube prominently ventricose, declinate, gibbous or saccate at base, the 5 lobes broad and spreading and only slightly unlike; stamens affixed in the base of the corolla, 4 perfect; disk-glands large at rear, small or wanting in front; style elongated: fr. fleshy, ovate, becoming 2-valved: lvs. opposite, thickish.—Some 15 species in Cent. and S. Amer., closely allied to Episcia. Warmhouse plants, requiring the treatment of other gesneriads. One species is offered abroad: *D. Turrialvæ*, Hanst., from Costa Rica: tall shrub: lvs. broadly ovate, blistered, metallic-colored: fls. large, white, pendulous, the lower lobe toothed, calyx red. *D. punctàta*, Lindl.=*Episcia punctata*. L. H. B.

DRYMOPHLŒUS (Greek words meaning oak and smooth inner bark). *Palmàceæ*, tribe *Arèceæ*. Spineless pinnate palms, with slender medium caudices.

Leaves terminal, equally pinnatisect, the segms. cuneate-oblong or linear, broadly oblique, submembranaceous, 3- to many-nerved, the margins recurved at the base; rachis scaly, 3-sided; sheath long: spadix with a short peduncle and slender branches; spathes 2 or many, the lower one 2-crested. This genus contains a tropical palm, with very distinct wedge-shaped lfts. and ornamental scarlet frs., borne every year. It flowers when only a few feet high, and is suitable for pot culture.—Species 12. Australasia and the Pacific isls.

The chances are that most of the plants now known to the American trade as *D. olivæformis* are really *D. appendiculata*. The true *D. olivæformis* is said to have been offered by a few dealers as *Ptychosperma Rumphii*. *D. appendiculata* was described and figured by William Watson, in Garden and Forest, mistakenly as *D. olivæformis*, as explained in B.M. 7202. He adds, "Like all the palms of this section of the border, Drymophlœus requires a tropical moist house with abundance of water at all times." G.C. II. 24:394. The plant figured was about fourteen years old, 3 feet high, with leaves about 3 feet long. The plant takes about six months to mature its fruits.

appendiculàtus, Scheff. (*Arèca grácilis*, Giseke, not Roxbg. or Thouars). St. 6–10 ft.: lvs. terminal, 5–6 ft. long, arching: lfts. 14–20, wedge-shaped, raggedly cut, serrate: spadix from between the lvs., short-stalked, about a foot long; the yellow buds and white fls. make an attractive contrast at the flowering season (June). Moluccas, New Guinea. B.M. 7202. G.F. 4:331.—The *D. olivæformis* of most dealers not of Martius.

D. Mooreànus, Hort. "An erect-growing palm with grayish green lvs."—*D. olivæfórmis*, Mart., not the trade plant of that name, has narrower lfts. than the above, and the fr. half immersed in the greatly enlarged perianth. Jared G. Smith. N. Taylor.†

DRYNÀRIA (Greek, *oak-like*). *Polypodiàceæ*. Some 10 or more E. Indian ferns, with round naked sori, as in Polypodium, but with a fine network of netted veins which are arranged in distinctly rectangular meshes. The most distinctive feature is in the shape of the lvs. which are either of 2 sorts, as in Platycerium, the cup lf. having the shape of an oak lf.; or the base of each lf. is separately lobed and oak-like. **D. quercifòlia**, with 2 sorts of lvs., the spore-bearing 2–3 ft. long, is the commonest species. **D. rigídula**, Swartz (*D. diversifòlia*, R. Br.), a similar but larger species from the same region also appeared at one time in the American trade, but the species are seldom seen in cult. in this country. *D. musæfòlia* is occasionally seen in fine collections, where it is grown for its striking simple foliage, which reminds one of the bird's nest fern (*Asplenium Nidus*). It is really a Polypodium, which see for description. R. C. Benedict.†

DRYÓPTERIS (Greek, *oak-fern*). *Polypodiàceæ*. Wood-Fern. A widely distributed genus of handsome ferns with dissected foliage, the native species sometimes grown in the hardy border and the tropical kinds under glass.

Plants bearing round sori either naked or covered with heart-shaped or reniform indusia, which are fixed at the center or along the sinus: veins either wholly free or the lowest united.—Several hundred species have been referred to this genus. A considerable number of our common woods ferns belong to this genus. The species have been variously known under the names Lastrea, Aspidium, and Nephrodium. Other species sometimes referred to under this genus may be found under *Polystichum* and under *Lastrea*. For *D. acrostichoides*, see *Polystichum;* for *D. decurrens*, see

Tectaria. In N. Amer., known to many as *Aspidium*. For cult. see *Ferns*. Not the same as Doryopteris.

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A. *Veins entirely free.*

B. *Pinnæ lobed less than one-third to midrib.*

1. **hírtipes,** Kuntze (*Nephròdium hírtipes*, Hook.). Lvs. rather rigid, 2–3 ft. long, 8–16 in. broad, on stalks clothed with dense black scales; pinnæ with broad, blunt lobes, the lower ones not reduced in size: sori medial on the lobes. India.

BB. *Pinnæ cleft nearly to midrib, or lvs. bipinnate or tripinnatifid.*

C. *Texture thin, membranous; veins simple or once forked.*

D. *Lower pinnæ gradually reduced to mere lobes.*

2. **noveboracénsis,** Gray (*Aspídium noveboracénse*, Swartz). New York Fern. Lvs: somewhat clustered from creeping rootstocks, pale green, 1–2 ft. long, tapering both ways from the middle. Canada to N. C. and Ark.

3. **Fischeri,** Kuntze (*Lastrèa opàca*, Mett.). Lvs. 6–8 in. long, 2–3 in. wide, bipinnatifid, cut into close, entire lobes, the lowest much reduced; surfaces smooth. Brazil.

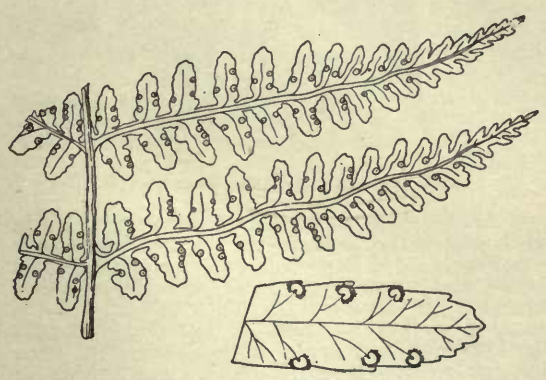
DD. *Lower pinnæ scarcely smaller than those above.*

E. *Veins forked.*

4. **Thelýpteris,** Gray (*Aspídium Thelýpteris*, Swartz). Marsh Fern. Rootstock creeping: lvs. scattered, clear green, 1–2 ft. long; margins of the spore-bearing pinnæ often strongly convolute: sori 10–12 to each segm. Canada to Fla. and Texas.—A form with pinnæ variously forked at tip is known as *Pufferæ*.

EE. *Veins simple.*

5. **simulàta,** Davenp. Rootstock creeping: lvs. yellowish green, scattered, 8–20 in. long, 2–7 in. wide, with 12–20 pairs of lanceolate pinnæ: sori rather large, somewhat distant, 4–10 to each segm. Native in N. Y. and New England, where it may be confused with *D. Thelypteris*. G.F. 9:485.



1363. Dryopteris marginalis. (Detail ×1)

6. **pàtens,** Kuntze. Lvs. clustered at the end of a thick rootstock, 2–3 ft. long, 4–10 in. wide, soft-hairy beneath; pinnæ cut three-fourths to the midrib, the basal segms. usually longer. Fla. to Texas and Calif. and Trop. Amer. A.G. 20:25.

CC. *Texture firm or subcoriaceous; veins 2–4 times forked.*

D. *Lvs. bipinnatifid or nearly bipinnate: indusia large, mostly flat.*

7. **cristàta,** Gray (*Aspídium cristàtum*, Swartz). Lvs. 1–2 ft. long, with short, triangular pinnæ 2–3 in., long, are much wider at base. Var. **Clintoniàna,** Underw. (probably a distinct species), is larger, with pinnæ 4–6 in. long, and with the sori rather near the midvein. Canada to Ark.; also in N. Eu. —Hybrids are described with *D. marginalis* and other species. G.F. 9:445.

8. **Goldieàna,** Gray (*Aspídium Goldieànum*, Swartz). Lvs. growing in large crowns, 2–4 ft. long, 12–18 in. wide, the pinnæ broadest at the middle: indusia very large. Canada to Ky.—One of our largest and most stately native species.

DD. *Lvs. mostly bipinnate: indusia convex, rather firm.*

9. **Filix-más,** Schott (*Aspídium Filix-más*, Swartz). Male Fern. Lvs. growing in crowns, 1–3 ft. long: sori near the midvein. Used as a vermifuge, as is also the next species. Eu., Canada and Colo.



1364. Dryopteris parasitica. (×⅙)

10. **marginàlis,** Gray (*Aspídium marginàle*, Swartz). Fig. 1363. Lvs. 6 in. to 2 ft. long, growing in crowns, mostly in rocky places: sori close to the margin. Canada and southward.—One of our commonest ferns, and gathered with *D. spinulosa intermedia* for use with cut-fls.

DDD. *Lvs. mostly tripinnatifid; segms. spinulose-toothed: indusia shriveling at maturity.*

E. *Lf.-stalks naked, polished.*

11. **viridéscens,** Kuntze. Lvs. 18–24 in. long, on stalks two-thirds as long; lower pinnæ largest: sori near the midribs. Japan.

EE. *Lf.-stalks scaly.*

12. **spinulòsa,** Kuntze (*Aspídium spinulòsum*, Swartz). Lvs. ovate-lanceolate, with a few pale, deciduous scales at the base: indusia smooth, without marginal glands. Var. **intermèdia,** Underwood. Lvs. evergreen, the scales more persistent, with brown centers, and the margins of the indusia with stalked glands. One of our commonest wood ferns in the northern states. Extensively gathered for use with cut-fls. Probably a distinct species. Var. **dilatàta,** Underwood, has similar scales to the last and tripinnate lvs. In woods at altitudes of 1,500 ft. upward, from Canada to Ore.; also in Eu. Probably a distinct species.

13. **Boòttii,** Underwood (*Aspídium Boòttii*, Tuckm.). Lvs. elongate-lanceolate, with broadly oblong pinnules: indusia minutely glandular. Intermediate between *D. cristata* and *D. intermedia*. Probably a hybrid. Canada, N. Y. and New England.

DDDD. *Lvs. ample, 4–5-pinnatifid.*

14. **effùsa,** Urban. Lvs. 3–4 ft. long, 2 ft. or more wide, with polished stalks and from short, creeping rootstocks: sori abundant, scattered, often without indusia. Cuba to Brazil.

15. **dissécta,** Kuntze (*Lastrèa membranifòlia,* Hort.). Lvs. 1–5 ft. long, 1–3 ft. wide, membranous, decompound; segms. broad and blunt; surfaces nearly naked: sori near the margin, abundant. India and Madagascar to Austral.

aa. *Veins not entirely free, the lower veinlets of adjoining segms. united.*

16. **Otària,** Kuntze (*Lastrèa aristàta,* Hort.). Lvs. 1 ft. long, with a long terminal pinna an inch or more wide, with lanceolate lobes, and 6–12 similar lateral pinnæ; texture thin; surfaces naked; veins united halfway from the midrib to the edge. Ceylon to the Philippines.—Good for table ferneries, but slow of growth.

17. **parasítica,** Kuntze (*Nephròdium mólle,* R. Br. *D. móllis,* Underwood, in preceding edition). Fig. 1364. Lvs. 1–2 ft. long, 8–12 in. wide, bipinnatifid, the pinnæ cut into blunt lobes; lower pinnæ distant from the others and somewhat shorter; surfaces finely villose. Tropical regions of both hemispheres.—Often grows as a weed in greenhouses.

18. **basilàris,** C. Chr. (*Nephròdium philippinénse,* Baker. *D. philippinénsis,* Underwood, in Cyclo. Amer. Hort.). Lvs. 2–3 ft. long, 12–18 in. wide, bipinnatifid, smooth, with a naked rachis; lower pinnæ scarcely smaller: sori midway from midrib to margin, with firm, smooth indusia. Philippines.

19. **crenàta,** Presl. Lvs. 1–2 ft. long, on stalks nearly as long, with a terminal pinnæ 6–8 in. long, often 2 in. wide, and 4–8 similar lateral pinnæ; margins bluntly lobed: sori near the main veins. Cuba and Mex. to Brazil.

L. M. Underwood.
R. C. Benedict.†

DRYPÈTES (probably from Greek for *drupe,* from the character of the fruit). Guiana Plum. Whitewood. *Euphorbiàceæ.* Tropical evergreen greenhouse shrubs. Glabrous: lvs. leathery, alternate, simple, mostly entire: fls. dicœcious, in axillary clusters or pistillate single, apetalous, staminate fls. with calyx imbricate and a rudimentary pistil; stigma broad, nearly sessile; pistil 1-celled, 2-ovuled.—About 10 species in Trop. Amer., 2 native in S. Fla. They do well in light loam. Prop. from cuttings in sand with heat. **D. lateriflòra,** Urban (*D. cròcea,* Poit. *Schæffèria lateriflòra,* Swartz), of W. India region, 6 ft. high, lvs. elliptical, pointed, has been in cult.

J. B. S. Norton.

DUCHÉSNEA (A. N. Duchesne, monographer of Fragaria in 1766). *Rosàceæ.* Fragaria-like perennial trailing herbs, differing in the calyx being 5-parted and the lobes alternating with larger leafy 3–5-toothed bracts, the petals yellow, and the receptacle dry and spongy rather than becoming fleshy or pulpy as in the strawberry: lvs. ternate, with short-stalked lfts.: fls. solitary, on the runners; stamens 20–25, short.—Two species in S. Asia, one of which has run wild in this country, and is useful as a basket-plant and as a low ground-cover.

índica, Focke (*Fragària índica,* Andr.). Yellow Strawberry. A neat plant trailing close on the ground, with leafy runners, pubescent: lfts. rhombic-ovate, more or less petioled, coarsely crenate, obtuse: fls. about ¾in. across, on peduncles equaling or exceeding the lvs.: fr. usually less than ½in. diam., red, insipid. In waste grounds, N. Y., west and south.

L. H. B.

DUCKWEED: *Lemna.*

DUCKWHEAT: *Fagopyrum.*

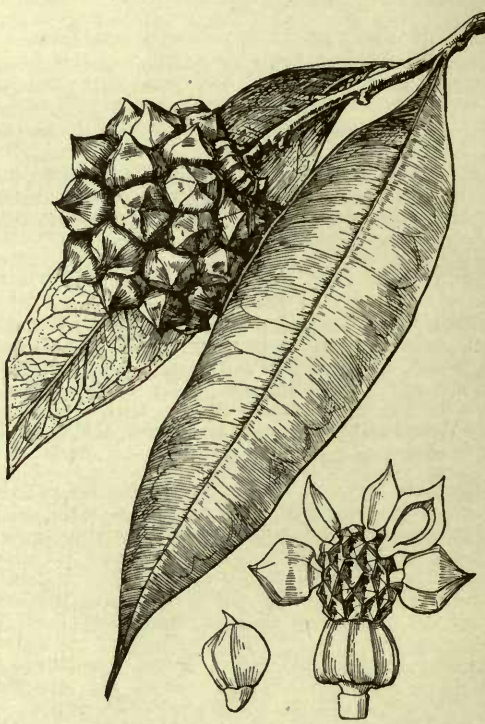
DUDAIM MELON: *Cucumis.*

DÚDLEYA (named for the late Wm. R. Dudley, professor of botany in Stanford University). *Crassulàceæ.* Shortly caulescent or acaulescent perennials, with flat, linear to ovate, acute basal lvs.: fls. in short or elongated panicles, orange-yellow or red, rarely white: lvs. on flowering branches much shorter and relatively broader than the basal ones, sessile or clasping: corolla nearly cylindrical or slightly angled, the segms. united below the middle; stamens twice as many as the calyx-lobes: carpels erect, many-sided.—Some 60 species have been described, all from the west coast of N. Amer. None of them has proved very satisfactory as a bedding plant, and as a rule the species do not compare with the echeverias in horticultural value. The following species are described in this work under Cotyledon (p. 868):

D. Cotyledon, Brit. & Rose, as *C. californica.*
D. pulverulenta, Brit. & Rose, as *C. pulverulenta.*
D. Purpusii, Brit. & Rose, as *C. Purpusii.*
D. lanceolata, Brit. & Rose, as *C. lanceolata.*

J. N. Rose.

DUGUÈTIA (named in honor of J. J. Duguet, who in 1731 wrote a work on plants). *Aberemòa,* R. E. Fries, not Aubl. *Annonàceæ.* A genus of Trop. American shrubs and trees, about two dozen species, differing



1365. Duguetia quitarensis. (Branch ×½)

from Annona in technical characters, particularly in imbricating petals and distinct angular rigid carpels becoming detached from the alveolate receptacle when mature, and usually with stellate-pubescent or scurfy indument. *D. lanceolàta,* St. Hil., the type of the genus, is a Brazilian tree. *D. quitarénsis,* Benth., Fig. 1365, with very similar fr. which turns red when ripe, has recently been collected on the Isthmus of Panama by Henri Pittier; and *D. furfuràcea,* Benth. & Hook. f., a low plant with edible orange-colored fr. as large as an apple, in the province of Minas, Brazil, by Shamel, Popenoe, and Dorsett, of the Bureau of Plant Industry. From this genus must be separated *Fusæa longifolia,* Safford (*Annona longifolia,* Aubl.), the fr. of which is a solid globose syncarpium, and the outer circles of stamens sterile and petal-like, while the indument is composed of simple silky hairs. See *Fusæa.*

W. E. Safford.

DULÍCHIUM (old Latin name). *Cyperàceæ.* One perennial species, *D. arundinàceum*, Brit. (*D. spathàceum*, Pers.), in E. N. Amer., which has been offered by collectors as a bog-plant. It is grass-like, with terete leafy culms which are hollow and unbranched, 2–3 ft. tall; it has linear flattened spikelets sessile in 2 ranks on peduncles that arise from the lf.-sheaths. It is distributed in swamps about ponds from Newfoundland across the continent and to Fla. and Texas; of no special value.

DURÂNTA (after Castor Durantes, physician in Rome and botanist, died about 1590). *Verbenàceæ.* Tropical American woody plants, some of which are cultivated outdoors in Florida and California, and in a few northern greenhouses.

Shrubs or trees, glabrous or woolly, often armed with axillary spines: lvs. opposite or in whorls, entire or toothed: racemes long and terminal or short and axillary; fls. small, short-pedicelled in the axis of a small bract; corolla-limb of 5 spreading oblique or equal lobes, the tube usually curved; stamens 4, didynamous; calyx enlarging and inclosing the fr.; stigma 4-lobed: fr. an 8-seeded juicy drupe.—Eight or 10 species, Mex., W. Indies, S. Amer., one reaching Key West.

Plumièri, Jacq. (*D. spinòsa*, Linn. *D. inérmis*, Linn. *D. rèpens*, Linn. *D. Ellísia*, Jacq. *Ellísia acùta*, Linn.). Golden Dewdrop. A variable shrub or small tree, minutely pubescent or becoming glabrous: branches 4-angled: lvs. obovate, oblong, ovate or elliptic, mostly entire, contracted into short petiole: fls. in panicled loose racemes; calyx-teeth subulate; corolla lilac, the limb less than ½in. across, the lobes ciliolate; calyx yellowish, closed into a beak and covering the yellow drupe (which may reach about ½in. diam.). Key West, W. Indies, Mex., to Brazil. B.M. 1759. B.R. 244.—Branches either armed or unarmed. Attractive forms with white fls. and with variegated lvs. are reported in cult.

Lorèntzii, Griseb. Spineless, the branchlets 4-angled: lvs. small, coriaceous, ovate or elliptic, obtusish, strongly serrate toward apex, petioled: fls. in terminal interrupted racemes (white?); calyx tubular, 5-ribbed, short-toothed; corolla-tube exserted, cylindrical; corolla-limb unequally 5-parted, the lobes oval-orbicular; stamens included, didynamous: fr. a 2-pyrenous berry. Argentina; offered in S. Calif.

stenostâchya, Tod. Closely allied to *D. Plumieri.* Spineless, to 15 ft. high, branchlets 4-angled: lvs. oblong-lanceolate, acuminate, serrate or entire, pubescent on the veins beneath, 3–8 in. long: fls. lilac, less than ½in. across, pendulous in slender racemes, 3–4 at the end of the branches, in fr. 6–12 in. long: fr. yellow, about ⅓in. across. Brazil. Offered in S. Calif.

L. H. B.

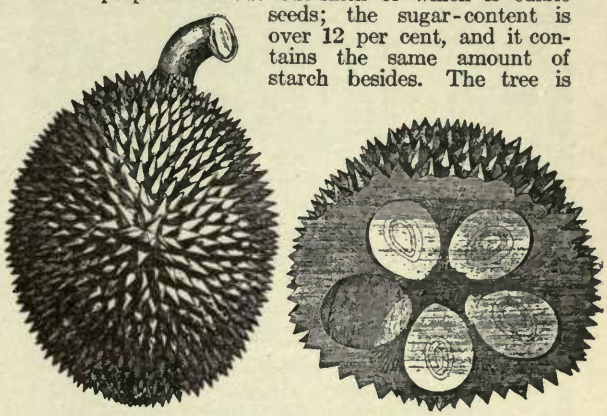
DURAZNILLO: *Jatropha.*

DÙRIO (from a Malayan vernacular). *Bombacàceæ.* Trees of the Indian archipelago and Malaysia, one of which yields the durian (*D. zibéthinus*, Linn.), a much-prized fruit of the East. Fig. 1366. There are probably a dozen other species of Durio, mostly Bornean and recently described.

The durian is a tall tree (to 80 ft.), with oblong acuminate entire lvs., colored and scaly beneath, pinnately veined, coriaceous: fls. large, whitish, in lateral cymes or fascicles; calyx bell-shaped, 5-lobed, subtended by an involucre; petals 3; staminal column divided above into many filaments in 4–6 groups, the anthers twisted; ovary 5-celled, each cell many-ovuled, bearing a long style with a capitate stigma: fr. ovoid or globular, often 10 in. long, very spiny, somewhat woody, mostly indehiscent, the large seeds and carpels surrounded by a firm cream-colored edible pulp. The fr. has a strong offensive odor.

The durian is discussed as follows by O. W. Barrett in the Philippine Agricultural Review:

"The durian has an odor that can be compared only to a mixture of old cheese and onions, flavored with turpentine; but those who eat it love it so dearly that the smell does not bother them. . . . The fruit weighs about five pounds, nearly one-third of which is edible pulp and about one-sixth of which is edible seeds; the sugar-content is over 12 per cent, and it contains the same amount of starch besides. The tree is



1366. The durian—Durio zibethinus. (×¼)
(From an early representation of the fruit.)

magnificent and stately, and grows usually in open country, in the edges of forests, around native villages, and in clearings.—It can hardly be called a cultivated tree; at least, it is hardly ever grown in orchards, although on the other hand it could hardly hold its own in the real wild. Throughout Malaysia it is considered the most delicious fruit. Europeans, of course, generally revolt at the unpleasant odor; a fair proportion, however, of the foreign residents soon grow to relish the durian. Although it would not be wise, perhaps, for one unaccustomed to the fruit to eat a large quantity of the pulp at one sitting, there is apparently no substance in it that would cause indigestion or any other result than a rather unpleasant breath for a few hours after eating. The chemical body which is responsible for the very pronounced odor is probably one of the sulfur compounds with some base perhaps similar to that of butyric acid.—Harvesting the durian is not unattended with danger, for soon after it becomes mature the heavy fruit falls, and occasionally kills or severely injures the unlucky individual underneath."

The seeds are eaten roasted, and the unripe fruit boiled as a vegetable. The tree has been successfully introduced into Jamaica, but is not in general cultivation in that island.

The specific name, *zibethinus*, is said to be derived from the practice of using the decomposed fruit as a bait for the civét-cat or zibet. Fig. 1366 is reduced from Vol. 7 of the Trans. of the Linn. Soc., 1804, illustrating König's historic account of the fruit.

L. H. B.

DUSTY MILLER: *Lychnis Coronaria;* also species of *Centaurea* and *Senecio.*

DUTCHMAN'S BREECHES: *Dicentra Cucullaria.*

DUTCHMAN'S PIPE: *Aristolochia.*

DUVÀLIA (for Duval, an early botanist). *Asclepiadàceæ.* About 20 succulent very dwarf leafless herbs, mostly of S. Afr., rarely seen in cult.: sts. decumbent or erect, sometimes subterranean and with the tips appearing above the surface, 4–6-angled and with spreading teeth, each of which bears a minute rudimentary lf.: fls. solitary or in small clusters or cymes, usually borne near the middle of the young sts.; corolla rotate, deeply 5-lobed, with a cushion-like ring around the outer corona and supporting it; corolla-lobes linear-

lanceolate to ovate, folded longitudinally backward; corona double, from near the top of the staminal column, the outer one flat and entire and angled, the inner one with turgid more or less pointed lobes; stamens affixed in the base of the corolla, united into a tube around the ovary: fr. erect smooth follicles. Cult. of Stapelia and similar succulents. The species are essentially fancier's plants and apparently not in the trade.

DUVERNÒIA (J. G. Duvernoy, pupil of Tournefort, or G. L. Duvernoy, of Strassburg, writer on natural history). *Acanthàceæ*. By some authors united with Adhatoda, which genus is by some included in Justicia. The genus comprises 15 or more herbs or shrubs: fls. single or in short spikes; calyx short, 4-toothed, the back lobe toothed or parted; corolla-tube short; limb labiate, the upper lip helmet-shaped and 2-toothed, the lower lip flat. The species seem not to be in the trade, although *D. Dewévrei*, DeWild, has been cult. in Belgium: it is a tufted herb, about 2 ft. high: lvs. oblong, petiolate: fls. paniculate; upper lip of corolla white with red stripes and the lower greenish white; corolla about ½in. long. Congo.

DWARFING. Dwarf plants are those that never attain the height or size of the usual or representative individuals of the species. Some dwarfs are "natural," being represented by varieties of prevailingly small size; and these varieties usually reproduce more or less true from seed or cuttings. Thus there are dwarf petunias, lobelias, asters, cannas, peas, beans. Such dwarfing comes within the field of breeding.

The "artificial" dwarfs are produced by more or less arbitrary manipulation, as by grafting on stocks of small growth, heading-in the top or the root or both, by confining the roots, by withholding food and water, and by various forms of contortion and constriction.

Plants are dwarfed to keep them within bounds in small areas, to increase flower-bearing and fruit-bearing in proportion to the size of the subject, to bring all parts within reach and control, to express the skill and satisfy the conceit of the gardener, and to extend the range of interesting plant forms; and plants may be adapted to adverse soils or conditions by grafting on hardy or more reliable roots that may chance to have a dwarfing tendency. Dwarf plants are very useful in flower-gardens and in landscape work. The picturesque dwarfs of the Japanese type are amongst the most curious of plant forms.

The Japanese practice of dwarfing. Figs. 1367, 1368.

The art of dwarfing trees has been long practised among the Japanese gardeners. Some trees are more adapted for this purpose than others. The following have been considered to be most suitable:

Chamæcyparis obtusa.
Pinus pentaphylla.
Pinus parviflora.
Pinus Thunbergii.
Pinus densiflora.
Larix leptolepis.
Juniperus rigida.
Juniperus chinensis var. procumbens.
Podocarpus chinensis.
Podocarpus Nageia.
Tsuga Sieboldii.
Tsuga diversifolia.
Cryptomeria japonica.
Acer palmatum.
Acer trifidum.
Styrax japonica.
Lagerstrœmia indica.
Punica Granatum.
Trachycarpus excelsa.
Rhapis flabelliformis.
Rhapis humilis.
Zelkowa acuminata.
Millettia japonica.
Wistaria floribunda.
Wistaria brachybotrys.
Prunus Mume.
Evonymus alata.
Cycas revoluta.

Various species of Japanese flowering cherries, ivies, bamboos, fruit trees, etc.

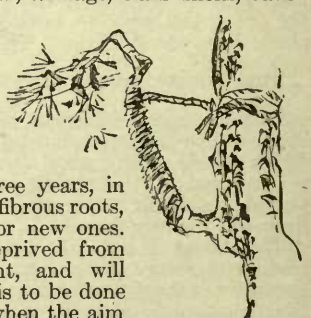
Before entering into a discussion of dwarfed trees, one should have a clear understanding between the "bonsai" or artistic plant and the "hachiuye" or ordinary potted plant.

There are two styles in which the "bonsai" is presented, one is the planting of one or more tiny trees of picturesque form in an artistic shallow pot; and the other is the representing of a part of a miniature garden or forest embracing trees, shrubs, grasses, mosses, rocks, and ponds. The former is simply an improved or modified potted plant, whereas the latter exhibits an imaginary scene, so that one might feel by glancing upon the pot in a little Japanese chamber as if he were at that moment strolling in such a garden or wandering within forest. A little piece of stone gives an idea of Mt. Fuji, and a drop of water the surface of the Japan Sea. We often suspect the tree, covered with mossed bark, of not more than ½ foot in height, would reach the cloud; or it might suggest a wintry landscape brought in amidst scorching summer days to release a man from heat.



1367. Japanese dwarf tree.

The success in raising a valuable "bonsai" depends entirely on the skill of dwarfing the trees, and it requires a long experience. Remember always what the home of the plant was, and treat it according to its habitat. In other words, climate, soil, environment, nourishment, and all other circumstances of its original state should accompany the tree; and the degree of humidity, both in the air and ground, is of prime importance in the dwarfing process. Some have the erroneous notion that the dwarfing is accomplished merely by bending the tree unnaturally. The roots are confined to check growth, without making other alteration. The shape and size of the branches or leaves are affected by the firmness of the earth, the way of watering, the kinds of fertilizer, and the degree of sunshine. Between the leaves there should be ample air and frequent sunshine. Some plants need only slight moisture, and others much. Too wet is worse than too dry. Many are thoughtless in giving water, not considering the condition of the soil. Judicious watering is one of the first requisites to success. For example, after being placed on balconies or terraces in the daytime, the potted plants should be exposed outdoors during the night, if not stormy. Japanese gardeners use many different fertilizers in accordance with the time of growth, kind of plant, and purposes (i.e., whether for branches or leaves, for flowers or fruits), some of them being: oil-cake, bone-meal, tankage, clam-shells, barn-manures, night-soil, wine lees, tea dregs, cow's milk, rice-bran, fish refuse, iron-rust, and others.



1368. Training a branch.

Plants both of "bonsai" and "hachiuye" dwarfs should be repotted every two or three years, in order to destroy the old fibrous roots, and to give a chance for new ones. Otherwise, trees are deprived from taking any nourishment, and will soon die. This practice is to be done in February or March, when the aim of dwarfing is completed; whereas the pruning is to be between April and June, to secure more or even larger flowers.

Pine.—This is one of the most difficult plants to be treated as a dwarfed tree, although it will hardly result in failure, if taken direct from the mountain or seashore while new young needles are steadily growing. Pines that have suffered through various difficult

weather are preferred. About half a year previous to removal, a ditch should be made around the plant. In removing, the main root should be carefully cut off by scissors, leaving its end downward to avoid the resin from accumulating, which otherwise might destroy the tree. For different shapes, the branches are to be twisted to and fro, as shown in the cut (Fig. 1368); bind the part with hemp-palm rope, and pull it moderately toward the trunk with a cord. The special nature of this tree is to dislike the humid earth. Having no pleasing flower or fruit, the pine must exhibit merit in the arrangement of needles or the color of the bark. The best time to transplant is in autumn. For fertilizers, one may use oil-cake or a bone-meal.

Mume (*Prunus Mume*).—This is different from the Japanese flowering cherry; the beauty of the flower should accompany the picturesque form of the tree itself. The age of the tree is highly regarded. Slender branches as well as grotesque trunks with mossy bark are usually chosen. Hence, all dwarfed Mume plants are raised by grafting. The potting of Mume may take place as soon as the flowers have fallen. The pot is to be kept in shade at least one month, the earth having been thoroughly pressed. To have more flowers, the old roots are destroyed, and the branches cut, leaving a few branchlets. Potted Mume is fertilized with thin liquid manure, oil-cakes or occasionally cow's milk, between December and February.

Pomegranate.—In this plant, the portion of the roots which is close to the main trunk may be exposed to the air. As a dwarfed tree, pomegranate is enjoyed both for fruits and flowers. All new sprouts are to be pinched off, other than those that will produce flowers. Until the fruits have grown larger, one should wait for manuring. For flowers, oil-cake, tankage, or bone-meal are used; for fruits a light fertilizer is used.

Bamboos.—Choose one of the most proper kinds and keep it in a pot for two or three years. Then wait upon several shoots coming up. One year after this, these new bamboos are transferred into other pots. The practice needs much patience and great skill, and it would hardly pay, knowing that the prime age of bamboo is only for four or five years. ISSA TANIMURA.

Dwarf fruit trees.

Generally speaking, dwarf trees are those which by various means are made to remain smaller than normal trees of the same species or variety. Three means are in common use in dwarfing trees: by growing on dwarfing stocks, restricting the root run, and by pruning to check or suppress the growth of the top. Horticulturally speaking, and particularly as the term is applied to fruit trees, dwarf trees are those which are grown on dwarfing stocks. A discussion of dwarf fruit trees is, then, most largely concerned with dwarfing stocks.

Dwarfing stocks are not modern innovations. For at least three centuries, various stocks have been used to dwarf apples, pears, plums, cherries and quinces. In fact, dwarf fruit trees were quite as common, or even more so, in Europe a century ago than they are at present. They have been grown in America, at least dwarf apples and pears, for nearly a century, during which time in recurring periods they have received much attention from fruit-growers. There is in horticultural literature much data, which, while fragmentary, is still substantial, to guide us in the use of dwarfing stocks and to indicate the value of dwarf fruit trees.

The action of dwarfing stocks is readily explained after a statement of what stocks are. A dwarfing stock is always a smaller, a weaker, or a slower-growing variety or species than the tree to be propagated on it. The top conforms to the roots chiefly because of the inability of the latter to furnish sufficient nutrition. The tree is dwarfed through starvation. Other than in size the trees are little or not at all affected, although minor changes in the fruit and in the bearing habit are supposed to be brought about by dwarfing.

Dwarf fruit trees are propagated by the same methods employed in growing standard trees with preference given to budding dwarfing stocks, whereas standard trees are still largely propagated by grafting. Propagators hold that a better union can be obtained by budding than by grafting, and since it is always difficult to secure a good union between plants as widely divergent as stock and cion in a dwarf tree must of necessity be, budding should have the preference of the two methods. In fact the chief problem in growing dwarf fruit trees is to find a stock with which the larger growing cion can easily be worked and with expectations of a close and permanent union. This brings us to the matter of stocks for the several fruits.

Dwarf apples are commonly grown on two stocks—the Paradise and the Doucin. Both of these, it must be understood, are class names, there being in the literature a dozen or more varieties of Paradise and about as many of the Doucin. Carefully compared, the many kinds in use can be reduced to the French Paradise (Pommier du Paradis), English Paradise, and the Dutch Paradise for the first class, while the Doucin stocks may be grouped under the Doucin, the English Broad-leaved and the English Nonsouch. There is much confusion in the names of dwarf apple stock in nurseries and the grower will be fortunate if he gets what he calls for. Of these two classes, the Paradise stocks make the dwarfer plants and should be used for trees to be kept as true dwarfs and for all that are to be trained in fancy forms. The Douchin stocks are the better for free-growing trees.

Pears are dwarfed by growing on quince roots. Any quince may be used, but the Angers, upon which quinces are commonly propagated, is the best dwarfing stock for the pear. Comparatively few pears can be successfully worked on quince roots because stock and cion do not make a good union. This antipathy is obviated by budding the quince with a pear which unites readily; the next year the untractable variety is budded on the more amenable variety, the resulting tree being thus pear on quince, followed by pear on pear—the "double-working" of nurserymen.

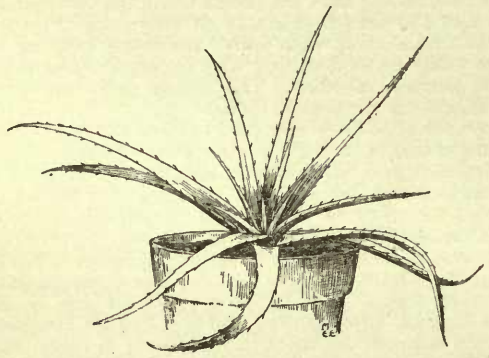
There is no question but that the Mahaleb is a dwarfing stock for the cherry, and in Europe, where it has long been used, it is always regarded as such. In America, where the Mahaleb in the last quarter century has all but superseded the Mazzard, a free-growing stock, it is not so commonly known that there is a difference in the size of trees on the two stocks. It must not be understood that the Mahaleb stock gives a true dwarf cherry, but it has a very decided dwarfing effect on either sweet or sour cherries.

Stocks for plums have not been well tested—a statement that holds for all stone fruits. It is very certain, however, that varieties of *Prunus insititia*, as the Damsons or the St. Julien, the latter one of the best of all plums for a stock, have a dwarfing effect on the varieties of the larger-growing trees of *P. domestica*, as do also several of our free-growing native species, among which *P. americana* may be recommended for cold climates. For true dwarf trees, however, the only stocks that give promise are the dwarf natives, of which *P. pumila* and *P. Besseyi* have been found to unite readily with several varieties each of either the Domestica or Triflora plums, and to make very good dwarfing stocks for them.

Peaches, apricots and nectarines are dwarfed by budding on *P. cerasifera*, *P. insititia* and *P. americana*. It is probable that all of these fruits, and the cherry as well, can be grown on *P. pumila* and *P. Besseyi* as true dwarfs, several experiments having demonstrated that good unions form between the peach, at least, and these dwarf sand cherries. As to whether the union

would be sufficiently permanent to make the trees so obtained worth while, remains to be seen.

The great advantage of a dwarf tree is its small size, which permits the planting of more varieties of a fruit in a small space. Dwarf fruits, then, deserve, in particular, the consideration of amateur fruit-growers and of those who want small-growing fillers for permanent orchards. Trees of small size are easier to prune, spray, and to care for in every way. Because of the low stature and compact head of the dwarfs, wind causes less injury to trees and crops.



1369. Dyckia rariflora.

Another very material advantage of the dwarfs is that they come into bearing earlier than the standards. The desirability of early bearing from several standpoints is obvious. Advocates of dwarf fruits very generally assert that the fruit from the dwarf trees is of higher quality, higher color and better flavor. As a generalization, this is not true, though it probably is true for a few varieties of each of the several fruits under consideration. Tests of many varieties of apples on dwarf and standard stocks on the grounds of the New York Agricultural Experiment Station show that more often the fruit from standard trees is the better. Pear-growers have found that comparatively few varieties of this fruit are improved in the qualities named by growing as dwarfs. Size, color and quality of fruit are as likely to be affected deleteriously as beneficially by dwarfing.

Dwarf stocks are much used to adapt varieties to soils. This is the chief value of most of the propagating plants named for the stone-fruits. The true purpose of such stocks must be clearly kept in mind —the dwarfing in this case is a disadvantage attendant upon the use of the stock for another purpose.

The disadvantages of dwarfing stocks, in America at least, are rather more pronounced than their advantages. They may be summed up as follows: Nearly all dwarf trees are shorter-lived than standards—the exceptions are very few. All dwarf trees, whether trained in fancy forms or free-growing, need more care than standard trees. The chief items needing extra care are pruning, tilling and fertilizing. It is more difficult to propagate dwarf trees and the cost of the plants is therefore greater, making the cost an acre, with the increased number of trees, much greater. Lastly, it is most difficult to secure trees, especially of apples, on dwarfing stocks that are known to be true to name.

In conclusion, it may be said that we have just passed through one of the recurring periods of interest in dwarf trees in America and that commercial fruit-growers are more than ever convinced that for the present, at least, dwarf trees are of little value to them. The place of these trees is in gardens of amateurs and on the estates of those who can afford to grow and train them for their beauty as well as for their fruit. There is, however, a possible future for dwarf fruits in commerical plantations, when the refinements of horticulture have been carried far enough to show the special adaptations of varieties of the several fruits to different stocks and when the care of dwarf trees is better understood.

U. P. Hedrick.

DÝCKIA (after Prince Salm-Dyck, German botanist, and author of a great work on succulent plants). *Bromeliàceæ*. Succulents, grown under glass and in the open far South.

Dyckias somewhat resemble century plants, but with smaller spines, as a rule, and flowering regularly. They are usually stemless, and the lvs. form dense rosettes. —About 60 species in S. Amer. For cult., see *Agave*. They are rarely cult. in Fla. and Calif., and in a few northern collections. Following have showy yellow fls.

A. *Infl. amply branched or panicled.*

altíssima, Lindl. (*D. princeps*, Lem.). Lvs. spiny at the margin: floral bracts small, all manifestly shorter than the fls. Brazil.

AA. *Infl. not branched, a raceme or spike.*

B. *Filaments forming a tube: fls. with scarcely any pedicel.*

rariflòra, Schult. Fig. 1369. Lvs. with small spines on the margin, shorter than in *D. altissima*: sepals not emarginate at the apex: upper sheaths of the scape shorter than internodes. Brazil. B.M. 3449. B.R. 1782.

BB. *Filaments not forming a tube all the way: fls. with a short but conspicuous pedicel.*

sulphùrea, C. Koch, not Baker. Lvs. with small spines at the margin: sheaths of the scape longer than the internodes, the higher ones entire: bracts lanceolate, the lowest conspicuously longer than the pedicelled fls.: blades of petals wide and longer than stamens. Brazil.

Wilhelm Miller.

DÝPSIS (obscure name). *Palmàceæ*, tribe *Arèceæ*. Madagascar palms that have been poorly described, are little known and of scarcely any horticultural significance. They are all small, unarmed palms, with reed-like sts.: lvs. terminal, entire, bifid at the apex or pinnatisect; segms. split at the apex or irregularly toothed, the apical one confluent; sheath short: spadices long, loosely fld.: fr. small, oblong or ovoid, straight or curved, oblique at base.—Perhaps half a dozen species.

No species of Dypsis are common in cultivation, as they possess but little beauty. They are among the easiest and quickest to germinate. All of them require a stove temperature. *D. madagascariénsis*, Nichols. is also known as *Areca madagascariénsis*, Mart., and is so treated here. *D. pinnatifròns*, Mart. (*A. grácilis*, Thouars), is one of several plants that have been known as *Areca gracilis*. It is a pretty palm, now grown in large quantities by some dealers. G.C. II. 24:394. The genus is closely related to Chamædorea.

N. Taylor.†

DYSCHORÍSTE (name refers to the scarcely divided or lobed stigma). Incl. *Calóphanes*. *Acanthàceæ*. Fifty or more annuals or perennials of the tropics of Amer., Afr., and Asia, allied to Ruellia and Strobilanthes. None of them is apparently in regular cult. They are plants with opposite mostly entire small lvs. and blue or pale fls. in short-stalked cymes. *D. nobilior*, C. B. Clarke (*D. Hildebrandtii*, Lind.), is a free-flowering shrub, with a penetrating odor, and hairy branches: lvs. elliptic, nearly 2 in. long, slightly crenulate: fls. purple-blue in many distant and dense axillary cymes; corolla less than ½in. long. Brit. Cent. Afr.; recently cult. at Kew.

E

EARTH-NUT, EARTH-PEA. Little-used names for the peanut, goober or pinder, *Arachis hypogæa.* The words earth-nut and ground-nut are used for many subterranean tubers, without much discrimination, and therefore they have small value as vernaculars. They may be applied to the underground tubers of *Apios tuberosa, Panax trifolium, Erigenia bulbosa, Cyperus esculentus,* and others. Earth-apple, earth-gall and similar variants are in use for various plants.

EATÒNIA: *Sphenopholis.*

ÉBENUS (Greek name for the ebony). *Leguminòsæ.* About 15 species of silky-hairy herbs or sub-shrubs, of the eastern Medit. region and eastward to Beluchistan, allied to Onobrychis, sometimes planted in borders but apparently not offered in this country. Fls. reddish or purplish, papilionaceous, in dense axillary long-peduncled spikes; standard obovate or obcordate, narrowed to base; wings short or minute; keel about equaling the standard, the apex obtuse and oblique; calyx-lobes subulate and plumose: pod obovate or oblong, compressed, included in the calyx-tube, indehiscent, 1- or 2-seeded: lvs. odd-pinnate or some of them somewhat digitately 3-foliolate or even simple. *E. crética,* Linn., is shrubby with lvs. usually of 5 (sometimes 3) lfts., and reddish purple fls. in ovate-cylindrical spikes. Crete. B.M. 1092 (as *Anthyllis cretica*). *E. Sibthorpii,* DC., is herbaceous, with more lfts., and purplish fls. in spherical spikes.

This genus has no relation to the ebony, which is of the genus Diospyros (particularly *D. Ebenum*).

EBONY: *Diospyros Ebenum.*

ECBÁLLIUM (Greek, *to throw out*). *Cucurbitàceæ.* Squirting Cucumber. A perennial trailing vine, easily grown as an annual in any garden, cultivated for its explosive fruits.

When ripe, the oblong prickly fr. squirts its seeds at the slightest touch, or sometimes at the mere vibration of the ground made by a person walking by. Some of the old herbalists called this plant *Cucumis asininus.* Another curious fact about the plant is that a powerful cathartic is made from the juice of the fr., which has been known for many centuries. A preparation of it is still sold in the drugstores as *Trituratio Elaterini.* The drug "elaterium" is derived from the juice of the fr. Ecballium has only 1 species, and is closely related to the important genera Cucumis and Citrullus. With them it differs from Momordica in lacking the 2 or 3 scales which close the bottom of the calyx. Other generic characters are: prostrate herb, fleshy, rough hairy: lvs. heart-shaped, more or less 3-lobed: tendrils wanting: fls. yellow, the staminate in racemes, pistillate usually from the same axils with the staminate fls.; calyx 5-cut. It is a native of the middle and eastern Medit. regions, especially in rich moist forests.

Elatèrium, A. Rich (*Elatèrium cordifòlium,* Moench. *Momórdica Elatèrium,* Linn.). Squirting Cucumber. Fig. 1370. Described above; grown in this country as a curiosity. B.M. 1914. Wilhelm Miller.

ECCREMOCÁRPUS (Greek, *pendent fruit*). *Bignoniàceæ.* An attractive half-hardy tendril-climber.

Shrubs, but grown as annuals in the N., tall climbing: lvs. opposite, 2-parted or -pinnate: fls. yellow, scarlet or orange, mostly racemose; calyx campanulate, 5-parted; corolla-tube elongated; limb more or less 2-lipped or in *E. scaber* small and nearly entire; stamens 4, didynamous, included; disk annular: fr. an ovate or elliptic loculicidal 1-celled caps.—Three or 4 species of tall somewhat woody plants from Peru and Chile, climbing by branched tendrils at the end of the twice-pinnate lvs., and having very distinct fls. of somewhat tubular shape, which are colored yellow, orange or scarlet.

Eccremocarpus has two sections, in one of which the corollas are cylindrical, but in the section Calampelis, to which *E. scaber* belongs, the corolla has a joint at a short distance beyond the calyx, then swells out on the under side, and suddenly constricts into a neck before it reaches the small circular mouth, surrounded by five very short rounded lobes.

scàber, Ruiz & Pav. (*Calámpelis scàber,* D. Don). About 10 ft. high: lvs. bipinnate; lfts. obliquely cordate, entire or serrate: fls. 1 in. long, orange, in racemes. July, Aug. Chile. B.R. 939. B.M. 6408. Var. **coccíneus,** Hort., has scarlet fls. Var. **aûreus,** Hort., has fls. bright golden yellow. Var. **carmíneus,** Hort., has fls. carmine-red.—*E. scaber* is hardy in the southern parts of the U. S., and makes a most attractive perennial woody subject. It is also satisfactory in the open in the N. if given a warm exposure, blooming readily from seed the first year. L. H. B.†



1370. Ecballium Elaterium. (×⅓)

ECHEVÈRIA (named for Atanasio Echeverria, an excellent Mexican botanical draughtsman). *Crassulàceæ.* Stemless or somewhat caulescent succulents.

Leaves fleshy, but usually broad and flat, commonly making dense rosettes: fls. borne in loose spikes or racemes or sometimes paniculate, but never in a flat cyme; calyx deeply 5-parted; sepals usually elongated and narrow, unequal, commonly spreading but sometimes erect; corolla 5-angled, usually strongly so, very broad at base; stigma-lobes united below, very thick and nerveless, erect but often spreading at tip; stamens 10, 5 attached near the middle of the petals, the other 5 either free or attached lower down on the corolla: carpels 5, erect; ovules and seeds many.—More than 60 species of this genus have been described. Most of them have been in cult. in Washington and at the New York Botanical Garden, although but few are in the trade. It is confined almost entirely to Mex., one species extending into the mountains of W. Texas, and one or two species extending into Cent. Amer. Many of the species are valuable for flat bedding on account of their compact rosettes and highly colored foliage. For cultural notes, see *Cotyledon* (with which it has been united by many authors).

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A. *Sepals orbicular, very small, obtuse.*

B. *Corolla twice as long as thick; sepals appressed.*

1. **amœna,** De Smet. Nearly stemless, with numerous offshoots: lvs. in small but dense rosettes: flowering branches slender, 4–8 in. long; fls. 1–8, in slender racemes; corolla red, 4–5 lines long. Native of Mex. —This species was intro. into cult. nearly 40 years ago.

BB. *Corolla little longer than thick; sepals not appressed.*

2. **microcàlyx,** Brit. & Rose (*E. Púrpusii*, Brit.). Shortly caulescent, sometimes 1 ft. high: corolla yellow-pink, 4 lines long. Native of Mex.

AA. *Sepals linear to ovate.*

B. *Fls. axillary, arranged in loose spikes or racemes.*

C. *The fls. in spikes.*

D. *Plant not caulescent, glabrous throughout.*

3. **mucronàta,** Schlecht. Caulescent, glabrous throughout: basal lvs. in a dense rosette 4–8 in. long: fls. sessile; corolla 1 in. or more long, reddish tinged with yellow. E. Mex.

DD. *Plant caulescent, pubescent throughout.*

4. **coccínea,** DC. (*Cotylèdon coccínea*, Cav.). St. 1–2 ft. high, finely grayish pubescent: lvs. oblanceolate, largest 8–9 in. long: infl. a spike of 15–25 fls. Common in Cent. Mex. Page 870.

5. **pubéscens,** Schlecht. (*Cotylèdon pubéscens*, Baker). A similar species is sometimes cult., with obovate-spatulate lvs.

CC. *The fls. in racemes.*

D. *Species caulescent.*

E. *Infl. compound below; corolla pale.*

6. **linguæfòlia,** Lem. Sts. 1 ft. or more high, very leafy: lvs. thick, fleshy, green, nearly terete at base: flowering branches long and drooping, each consisting of a simple raceme: fls. cream-colored. Mex.—This species has long been in cult., and has not been collected wild in recent years. It is so very different from the other echeverias of Mex. that we are led to suspect that it may be of hybrid origin.

EE. *Infl. simple throughout; corolla bright-colored.*

F. *Plant pubescent throughout.*

7. **pulvinàta,** Rose (*Cotylèdon pulvinàta*, Hook.). Sts. 4–6 in. high, somewhat branching, becoming naked below: young branches, lvs. and sepals covered with a velvety pubescence: lvs. clustered in rosettes at the top branches, about 1 in. long, very thick: fls. in a leafy raceme; corolla scarlet, sharply 5-angled. Mex.—This is a very distinct echeveria, with a remarkable pubescence.

8. **Prínglei,** Rose (*Cotylèdon Prínglei*, Wats.). This is perhaps nearest *E. pulvinata*, although not so pubescent nor so attractive a plant.

FF. *Plant glabrous throughout.*

9. **atropurpùrea,** Baker (*Cotylèdon atropurpùrea*, Baker. *E. sanguínea*, Morr.). Sts. 4–8 in. high, glabrous throughout: lvs. aggregated at the top of the st. in a dense rosette, usually dark purple above, somewhat glaucous: flowering branches elongated; sepals somewhat unequal; corolla bright red, strongly angled. Probably native of Mex., but known only from cult. specimens. Page 870.

DD. *Species not caulescent.*

10. **lùrida,** Haw. (*Cotylèdon lùrida*, Baker). Plants stemless, glabrous and glaucous throughout: lvs. forming a flat, rather open rosette, narrowly oblong, 2–4 in. long, acute, tinged with purple, especially when old: flowering branches 12–32-fld.; sepals thick, spreading or even reflexed; corolla bright red. Known only from garden material, but undoubtedly from Mex. B.R. 27:1.

11. **racemòsa,** Schlecht. & Cham. This is similar to *E. lurida*, and was considered by Baker to be a synonym; but they are here kept distinct. The material of *E. racemosa* now in cult. was secured at the type locality of the species, Jalapa, Mex.

12. **carnícolor,** Morr. (*Cotylèdon carnícolor*, Baker). Another somewhat similar species, but with only 6–8 fls. It is known only from garden specimens.

13. **maculàta,** Rose. This belongs also to this alliance, but grows at higher localities in Mex., and has brighter green lvs. It ought to live throughout the year in our southern gardens.

BB *Fls. terminal, arranged in secund spikes or racemes, either simple or compound.*

C. *Infl. a simple raceme.*

D. *Plant hairy throughout.*

14. **setòsa,** Rose & Purpus. Plants stemless, giving out offsets from the base: lvs. often 100 or more, forming a dense, almost globular, rosette, thickish but flattened, about 2 in. long, covered on both sides with setiform hairs: infl. usually a simple secund raceme with 8–10 fls.; petals red at base, yellow at tip, setose without. Contr. Nat. Herb. 13: pl. 10.—A very peculiar species, recently collected by C. A. Purpus in Puebla, Mex.

DD. *Plant glabrous throughout.*

E. *The fls. sessile.*

15. **Pèacockii,** Croucher (*Cotylèdon Pèacockii*, Baker). Stemless: lvs. about 50 in a close rosette, obovate, spatulate, white-glaucous, slightly red toward the tip, faintly keeled on the back: flowering branches forming a scorpioid spike; corolla bright red, 6 lines long. It is doubtless of Mexican origin, although often reported as from New Mex. or Calif. Page 870.

EE. *The fls. pedicelled.*

F. *Lower pedicels short.*

16. **subséssilis,** Rose. This is very similar to *E. Peacockii*, but has shortly pedicelled fls. It is a very beautiful species, well suited for flat bedding. Native of Cent. Mex.

FF. *Lower pedicels elongated.*

G. *Lvs. very turgid.*

17. **élegans,** Rose. Stemless: lvs. numerous, sometimes 80–100 in cult. specimens, forming very compact rosettes, very glaucous, pale bluish green, very turgid, with translucent margins, these sometimes reddish: flowering branches pinkish, with 8–12 lvs.; fls. in a succulent raceme; corolla 5 lines long, its segms. distinct nearly to the base, pinkish with yellow spreading tips.—Known only from material collected near Pachuca, Mex., by J. N. Rose. This is one of the most beautiful species of the genus, and is well suited for rockeries or for use in flat bedding. This is not to be confused with *Cotyledon elegans*, N. E. Br., which is *Oliveranthus elegans*.

18. **símulans,** Rose. A similar species with somewhat different habit and lvs., and with slightly different corolla; sepals appressed rather than spreading.

GG. *Lvs. not turgid.*

H. *The lvs. glaucous green.*

19. **glaùca,** Baker (*Cotylèdon glaùca*, Baker). Stemless: lvs. in small but dense rosettes, nearly orbicular,

broadened just above the apex, almost truncate, but with a decidedly purple mucro, very pale, slightly glaucous: fls. 15–20 in a small secund raceme. Cent. Mex.—Often confused with *E. secunda*, but apparently specifically distinct. Page 870.

HH. *The lvs. with reddish margins.*

20. **secúnda,** Booth (*Cotylèdon secúnda*, Baker). Fig. 1083. Stemless, glabrous: lvs. numerous, inclined to be erect, forming a dense rosette, bluish green, ovate-cuneate, broad at margin and more or less reddish: fls. 12–15 in a secund raceme. Mex. Page 870.

CC. *Infl. a compound raceme.*

D. *Plants acaulescent.*

E. *Sepals widely spreading.*

21. **rubromarginàta,** Rose. Stemless or sometimes with a short st.: lvs. comparatively few, stiff, ascending, glabrous, glaucous, with a somewhat crenulate, red margin: flowering sts. sometimes a foot high, more or less paniculate. Mex.

EE. *Sepals erect and closely appressed to the corolla.*

22. **subrígida,** Rose (*Cotylèdon subrígida*, Rob. & Seaton). Stemless, glaucous throughout: lvs. in a dense rosette, flat, acute, very glaucous, bluish green, tinged with purple, the margins of young ones bright scarlet. Mex.—This is one of the most beautiful of all the echeverias. It is especially suitable for growing in clusters.

DD. *Plants caulescent.*

E. *Shape of lvs. acute.*

F. *Lvs. tapering into a long narrow stalk.*

23. **Scheèrii,** Lindl. (*Cotylèdon Scheèrii*, Baker). Sts. sometimes 2 ft. tall, or more often branched, glabrous, and somewhat glaucous: infl. a few-branched panicle; petals red or tinged with yellow, thick, erect or spreading at tip. Undoubtedly Mex., but known only from cult. material. B.R. 31:27. Page 870.

FF. *Lvs. somewhat narrowed downward, but with a broad base.*

24. **fúlgens,** Lem. (*Cotylèdon fúlgens*, Baker). Sts. usually 4–8 in. high, glabrous throughout: lvs. few in each rosette: infl. paniculate; corolla strongly 5-angled, coral-red without, yellowish within. Mex. Page 870.

EE. *Shape of lvs. obtuse.*

F. *Lvs. rounded on the face.*

25. **campanulàta,** Kunze. Short, caulescent, the branches crowned by rosettes of large lvs.: lvs. spatulate, tapering into thick petioles, very glaucous, obtuse at apex: petals thick, reddish without, yellowish within, somewhat spreading at tip. Mex. B.R. 1247 (as *E. gibbiflora*).—It is said to be near *E. gibbiflora*, but it certainly has very different foliage.

FF. *Lvs. concave or flat on the face.*

26. **gibbiflòra,** DC. Sts. often tall, 2 ft. or more high, glabrous throughout: lvs. 12–20 in a close rosette, obovate-spatulate, often highly colored: infl. a lax panicle. Mex. Var. **metállica.** A very common and popular greenhouse plant. It is very similar to the type, but has more highly colored lvs. Page 870.

E. argéntea, Lem., I.H. 10:Misc. 78, 1863=Dudleya pulverulenta.—*E. Bernhardyàna*, Foerst., is a garden species or form from an unknown source.—*E. bracteòsa*, Lindl. & Paxt.=Pachyphytum sp.—*E. cinèrea* is listed in Johnson's Gardener's Dict., p. 264, 1894, as a hybrid.—*E. clavifólia*, Deleuil, is a hybrid of Pachyphytum bracteolosum and Courantia rosea.—*E. Clèvelandii* is a hybrid in cult. at the White House, Washington.—*E. cyánea*, Johnson Gard. Dict., is a garden hybrid.—*E. dealbàta*, Johnson Gard. Dict. garden hybrid.—*E. Desmetriàna*, L. De Smet = E. Peacockii.—*E. erécta*, Deleuil, is said to be a hybrid of E. coccinea and E. atropurpurea.—*E. férrea*, Deleuil, said to be a hybrid of E. Scheerii and E. Calophana.—*E. globòsa*, Hort. ex. E. Morr. in B.H. 24:161. (1874.) Caulescent or nearly so: lvs. numerous, forming a dense rosette, spatulate, pale and somewhat glaucous, about 3 in. long, broadest near the top and there ½–1 in. broad, mucronate at tip, rather flat: flowering branches weak and spreading, bearing a few linear bracts, branched at top into 2 secund racemes; sepals linear, very unequal, somewhat ascending; corolla both before and after flowering strongly 5-angled, reddish below, yellowish above and within; petals free nearly, if not quite, to the base; stamens opposite the petals borne on the lower third of the corresponding petals; the 5 alternate stamens free nearly to the base: carpels free, erect. This description is drawn from a plant in the Washington Botanical Garden of unknown origin. It resembles somewhat E. secunda.—*E. grandiflòra*, E. Morr., is evidently a typographical error for E. grandifolia, Haw.—*E. grándis*, E. Morr.=E. gibbiflora(?).—*E. grandisèpala*, Deleuil, is said to be hybrid of E. metallica and a Courantia.—*E. herbàcea*, Johnson Gard. Dict., is a garden hybrid.—*E. imbricàta*, Deleuil, Cat. 1874; Deleuil in E. Morr. B.H. 24:329. (1874.) Deleuil in A. De Smet. R..B. 3:147. (1677.) This is cult. in the Washington Botanical Garden, and in the White House grounds. This species seems to be a favorite as a border plant in Washington City parks. It is said to be a cross between E. glauca and E. metallica. The infl., while secund as in E. glauca, is generally, although not always, 2-branched, while the lvs. are larger than in the true E. glauca.—*E. metállica decòra*, Rodgers, I.H. 30:505, is a variegated form of C. metallica.—*E. mirábilis*, Deleuil, is a hybrid.—*E. mutábilis*, Deleuil, is said to be a hybrid of E. Scheerii and E. lingulæfolia.—*E. ovàta*, Deleuil, is said to be a hybrid of E. Scheerii and E. metallica.—*E. pachyphytioides*, L. De Smet, is a cross of Pachyphytum bracteosum and E. metallica.—*E. pruinòsa*, Deleuil, is said to be a hybrid between E. lingulæfolia and E. coccinea.—*E. pulverulènta*, Nutt. =Dudleya.—*E. Púrpusii*, Schum.= Dudleya.—*E. rosàcea*, Lind. & André. I.H. 20:124, said to be close to E. secunda; locality not given.—*E. ròsea*, Lindl.=Courantia.—*E. scaphýlla*, Deleuil, is a hybrid of Urbinia agavoides and E. lingulæfolia.—*E. securifera*, Deleuil, is a hybrid.—*E. spathulàta*, Deleuil, is a hybrid.—*E. spiràlis*, Deleuil, hybrid.—*E. stellàta*, Deleuil, hybrid.

J. N. Rose.

ECHIDNÓPSIS (*viper-like*, alluding to the serpent-like sts.). *Asclepiadàceæ.* A few species of leafless succulents of Trop. Afr. and Arabia, not sufficiently distinguished from Caralluma; allied to Stapelia, which see for cult. None of the species seems to be in the trade. The sts. are many-angled and tessellate, bearing small mostly fascicled fls. in the grooves: corolla rotate or approaching campanulate, 5-lobed, fleshy, yellow or purple-brown; staminal column very short and arising from the base of the corolla, and bearing the corona. The following species have recently been mentioned in garden literature: *E. cereifórmis*, Hook. f. is 6 in. high, with elongated cylindrical serpentine or pendulous sts. and bright yellow fls. in fascicles. B.M. 5930. *E. Dammanniàna*, Spreng. not Schweinf., is similar but has dark brown-purple fls. Nile Land. *E. Béntii*, N. E. Br., has 7–8-ribbed sts. ¾in. or less diam. and vinous-purple fls. in pairs toward the tips of the branches. S. Arabia. B.M. 7760. *E. somalénsis*, N. E. Br., has columnar cereus-like shrubby cylindrical 6–8-furrowed branches, and nearly sessile dark purple yellow-spotted fls. solitary or in 2's or 3's. Somaliland. B.M. 7929.

ECHINÀCEA (Greek, *echinos*, hedgehog; alluding to the sharp-pointed bracts of the receptacle). *Compósitæ.* Purple Cone-Flower. Perennial stout herbs, more or less grown in the border or wild garden.

Closely related to Rudbeckia, but rays ranging from flesh-color, through rose, to purple and crimson (one species, not in the trade, has fls. yellow to red), while those of Rudbeckia are yellow or partly (rarely wholly) brown-purple: the high disk and the downward angle at which the rays are pointed are features of echinaceas; the disk is only convex at first, but becomes egg-shaped, and the receptacle conical, while Rudbeckia has a greater range, the disk from globose to columnar, and the receptacle from conical to cylindrical; heads many-fld., mostly large; disk-fls. fertile, rays pistillate but sterile; pappus a small-toothed border or crown: sts. long and strong, nearly leafless above, terminated by a single head.—Five species in N. Amer., 2 of them from Mex., the others native to the U. S. By some treated as a section of Rudbeckia; by others now called Brauneria, which is an older name.

Echinaceas and rudbeckias are stout, and perhaps a little coarse in appearance, but their flower-heads, sometimes 6 inches across, are very attractive, and borne in succession for two months or more of late summer.

With the growing appreciation of hardy borders and of native plants, it should be possible to procure four or five distinct colors in the flower, associated with low, medium and tall-growing habits. They do well in ordinary soils, and may be used to help cover unusually dry and exposed spots.

They respond well to rich soil, especially sandy loam, and prefer warm and sunny sites. They are perennials of easy culture. Propagated by division, though not too frequently; sometimes by seeds. The roots of *E. angustifolia* are black, pungent-tasted, and are included in the United States pharmacopœa as the source of an oleo-resin.

purpûrea, Moench. (*Braunèria purpùrea,* Brit.). Commonly not hairy, typically taller than *E. angustifolia,* 2 ft. or more high: lvs. ovate-lanceolate, or the lower ones broadly ovate, often 5-nerved, commonly denticulate or sharply serrate, most of them abruptly contracted into a margined petiole; upper lvs. lanceolate and 3-nerved: rays at first an inch long and broadish, later often 2 in. long or more, with the same color-range as *E. angustifolia,* but rarely almost white. Rich or deep soil. Va. and Ohio to Ill. and La. G.L. 19:28. G.M. 22: suppl. Nov. 11; 31:374. Gng. 5:41. Var. **serótina,** Bailey (*Rudbéckia purpùrea* var. *serótina,* Nutt. *R. serótina,* Sweet). The varietal name means late-flowering, but the chief point is the hairy or bristly character of the plant. L.B.C. 16:1539. P.M. 15:79 (as *E. intérmedia*).—Perhaps the best form for garden purposes, the rays said to be much brighter colored, broader and not rolling at the edges.

angustifòlia, DC. (*B. angustifòlia,* Brit.). Bristly, either sparsely or densely: lvs. narrower than in *E. purpurea,* from broadly lanceolate to nearly linear, entire, 3-nerved, all narrowed gradually to the base, the lower into slender petioles: fl.-heads nearly as large as in *E. purpurea,* but sometimes much smaller. Prairies and barrens, Sask. and Neb. to Texas, east to Ill., Tenn. and Ala. B.M. 5281. G.W. 4:164.—This species has several forms, which approach and run into *E. purpurea.*

A dealer advertises (1912) a "red sunflower" obtained by crossing a species of Echinacea with Helianthus multiflorus. It is described as 5–6 ft. high, with fls. 4–7 in. diam., red. See *Helianthus.*

N. Taylor.†

ECHINOCÁCTUS (Greek, *spine* and *cactus*). *Cactàceæ.* A very large group of globular, strongly ribbed, and strongly spiny cacti, growing from the United States to South America, particularly abundant in Mexico.

Sometimes these cacti become very short-cylindrical; occasionally the ribs are broken up into tubercles which resemble those of Mammillaria; and rarely spines are entirely wanting: the fls. usually appear just above the young spine-bearing areas, but sometimes they are farther removed, and occasionally they are in the axil of a tubercle; the ovary bears scales which are naked or woolly in the axils, and the fr. is either succulent or dry. —The genus is well developed within the U. S., about 40 species having been recognized, but its extreme northern limit is the southern borders of Colo., Utah, and Nev., apparently having spread from the great arid plateau regions of Mex. proper and Low. Calif. The genus extends throughout Mex. but is not found in Cent. Amer. It is well represented, however, in the drier regions of S. Amer. Echinocactus and Mammillaria are distinguished chiefly by the way in which the fls. are borne,—terminal on the tubercles in the former, and axillary to tubercles in the latter. In external appearance they are very similar. The genus Astrophytum is here included, although it seems to be very different from the typical forms of Echinocactus and should doubtless be kept distinct. It is impossible to identify with certainty all of the specific names found in trade catalogues, but the following synopsis contains the greater part of them. In all cases the original descriptions have been consulted, and in some cases it is certain that a name originally applied to one form has been shifted to another. The following synopsis may be useful, therefore, in checking up the proper application of names, but it may thus leave some of the common species of the trade unaccounted for. No attempt is made to group the species according to relationships, but a more easily handled artificial arrangement, chiefly based upon spine characters, is used. It must be remembered that the species are exceedingly variable, especially under cult., and large allowance must be made for the characters given in the key and in the specific descriptions.

Unlike most globular forms of cacti, echinocacti do not readily produce offsets; consequently they must be propagated by seeds if one wishes to increase these plants in quantity. Seeds of echinocactus, and, in fact, most cacti, will germinate as freely as seeds of other plants, provided they have been allowed to ripen properly before gathering and carefully dried afterward. The months of May and June have been found to be by far the most favorable for germination. Seeds of echinocactus will then germinate in five or six days, while during the winter months it takes almost as many weeks. Opuntias will germinate in even less than six days; they germinate most readily of all the Cactaceæ, and grow the fastest afterward, while mammillarias are the slowest to germinate and grow the slowest afterward.—The seeds should be sown in well-drained 4-inch pots in a finely sifted mixture of one part leaf-mold, one part loam and one part charcoal dust and silver sand. The surface should be made very smooth, and the seeds pressed lightly into the soil with the bottom of a flower-pot and then covered with about ⅜ inch of fine silver sand. This allows the seedlings to push through readily and prevents the soil from crusting on the surface of the pots, as they usually have to stay in their seedling pots at least one year. The pots should be placed in a greenhouse where they will receive plenty of light but not the direct sunlight, for, although cacti are natives of desert regions, the seedlings will roast if exposed to full sunlight under glass. For the first winter, at least, the seedlings should be kept in a temperature of not less than 60° and carefully looked over every day to ascertain the condition of the soil, for, although they should be kept on the dry side, they must never be allowed to become quite dry during the seedling stage. When about a year old they may be transplanted to shallow pans not more than 6 inches in diameter, and prepared with the same mixture as for seedling pots. These pans will be found better than small pots, because the soil may be kept more evenly moist and the seedlings do better in consequence. When grown from 2 to 3 inches in diameter, seedling echinocacti may be transferred to pots, using only sizes just large enough to accommodate them, as they make but few roots. Pot them in a mixture of two parts fibrous loam, one part leaf-mold and one part pounded brick and silver sand. During the spring and summer months, established plants may be given a liberal supply of water, but must be studiously watered during the fall and winter months.—During the winter they should be given a light position in a dry greenhouse, with a night temperature of 45° to 50°, and a rise of 10° by day. For the summer, they may be either kept in an airy greenhouse or placed in some convenient position outside, plunging the pots in the soil or in some light non-conducting material. Some of the species will begin to blossom in May and others at intervals during the summer. The flowers vary considerably in size, and embrace a good range of color, from white to deep yellow, and from faintest purple to deep rose. They do not readily produce seed (in New England, at least) unless artificially pollinated.—Like most of the cactus family, the more cylindrical species

will readily unite when grafted upon other kinds, not only in the same genus, but in other genera of Cactaceæ, and for weak-growing species it may often be an advantage to graft upon some stronger-growing species. *Cleistocactus Baumannii* (or *C. colubrinus*) makes an excellent stock to graft upon, choosing stock plants of reasonable size and height. The system known as "wedge-grafting" is perhaps best for the purpose, and the early spring months, or just as the growing season is about to begin, is the best time for grafting.—If plants of echinocactus can be kept in a healthy condition, they are not much troubled with insect pests; mealy-bug is their worst enemy and should be removed at once with a clean mucilage brush.—The following varieties have been found to be among the most easily grown: *E. capricornis, E. coptonogonus, E. cornigerus, E. Grusonii, E. horizonthalonius, E. longihamatus, E. myriostigma, E. setispinus, E. texensis,* and *E. Wislizenii.* (E. J. Canning.)

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A. *Spines, or some of them, hooked (Nos. I–10).*

B. *Central spine solitary.*

1. **Wrightii,** Coulter (*E. uncinàtus* var. *Wrightii*, Engelm.). Oval, 3–6 in. high, 2–3½ in. diam.: radial spines 8, arranged as in *E. uncinatus;* central spine solitary, angled, flexuous and hooked, elongated (2–6 in.), erect, straw-color, with dark tip: fls. 1–1½ in. long, dark purple. Texas and N. Mex.

BB. *Central spines 4.*

C. *Some or all of the spines annulate.*

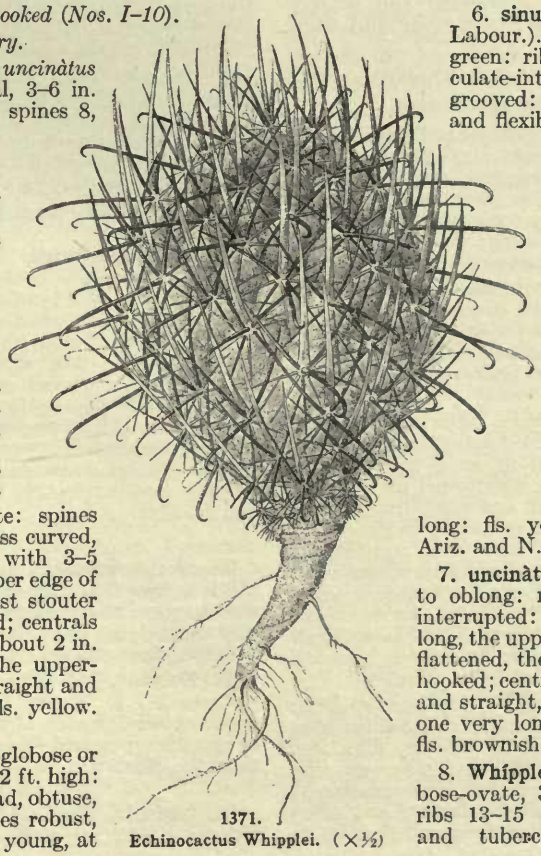
2. **cylindràceus,** Engelm. Globose to ovate or ovate-cylindrical, simple or branching at base, becoming as much as 3 ft. high and 1 ft. diam.: ribs 13 in younger specimens, 20–27 in older ones, obtuse and tuberculate: spines stout, compressed, more or less curved, reddish; radials about 12, with 3–5 additional slender ones at upper edge of areole, 1–2 in. long, the lowest stouter and shorter and much hooked; centrals 4, very stout and 4-angled, about 2 in. long and $\frac{1}{12}$–$\frac{1}{6}$in. broad, the uppermost broadest and almost straight and erect, the lowest decurved: fls. yellow. S. W. U. S. and Low. Calif.

3. **longihamàtus,** Gal. Subglobose or at length ovate, becoming 1–2 ft. high: ribs 13–17, often oblique, broad, obtuse, tuberculate-interrupted: spines robust, purplish or variegated when young, at length ashy; radials 8–11, spreading, straight or curved or flexuous, the upper and lower ones 1–3 in. long, the laterals 2–4 in.; centrals 4, angled, the upper ones turned upward, straight or curved or twisted, the lower one stouter, elongated (3–8 in.), flexuous and more or less hooked: fls. yellow, tinged with red, 2½–3½ in. long. Texas and Mex.

4. **Wislizènii,** Engelm. At first globose, then ovate to cylindrical, 1⅔–4 ft. high: ribs 21–25 (13 in small specimens), acute and oblique, more or less tuberculate: radial spines ⅗–2 in. long, the 3 upper and 3–5 lower ones stiff, straight or curved, annulate, red (in old specimens the 3 stout upper radials move toward the center and become surrounded by the upper bristly ones), the 12–20 laterals (sometimes additional shorter ones above) bristly, elongated, flexuous, horizontally spreading, yellowish white; centrals 4, stout, angled, and red, 1⅗–3⅕ in. long, the 3 upper straight, the lower one longest (sometimes as much as 4–5 in.), very robust (flat and channeled above), hooked downward: fls. yellow or sometimes red, 2–2⅗ in. long. From S. Utah to N. Mex. and Low. Calif.

CC. *None of the spines annulate.*

5. **brevihamàtus,** Engelm. Globose-ovate, very dark green: ribs 13, deeply tuberculate-interrupted, the tubercles with a woolly groove extending to the base: radial spines mostly 12, terete, straight, white or yellowish, with dusky tips, ½–1 in. long, the upper longer; central spines 4 (rarely 1 or 2 additional ones), flattened, white with black tips, the 2 lateral ones divergent upward, straight or a little recurved, 1–2 in. long, the uppermost one weaker, the lower stoutest and darkest, porrect or deflexed, hooked downward, ¾–1 in. long: fls. funnelform, rose-color, 1–1½ in. long. S. W. Texas and New Mex.



1371.
Echinocactus Whipplei. (×½)

6. **sinuàtus,** Dietr. (*E. Treculiànus,* Labour.). Globose, 4–8 in. diam., bright green: ribs 13, oblique, acute, tuberculate-interrupted, the tubercles short-grooved: radial spines 8–12, setiform and flexible, the 3 upper and 3 lower purplish brown and straightish (the lower ones sometimes more or less hooked), ⅘–1 in. long, the 2–6 laterals more slender, longer (1–1⅗ in.), often flattened, puberulent and whitish, sometimes flexuous or hooked; central spines 4, puberulent, yellowish (or purplish variegated), the 3 upper ones slender, flattened or subangled, erect and generally straight (rarely hooked), 1⅗–2 in. long, the lowest one much stouter, flattened or even channeled, straw-color, flexuous, more or less hooked (sometimes straight), 2–4 in. long: fls. yellow, 2–3 in. long. Texas, Ariz. and N. Mex.

7. **uncinàtus,** Gal. Glaucescent, globose to oblong: ribs 13, obtuse, tuberculate-interrupted: radial spines 7 or 8, 1–2 in. long, the upper 4 or 5 straw-color, straight, flattened, the lower 3 purplish, terete and hooked; centrals 4, the upper 3 rather stout and straight, about 1 in. long, the lowest one very long, flattened, hooked at apex: fls. brownish purple. N. Mex.

8. **Whipplei,** Engelm. Fig. 1371. Globose-ovate, 3–5 in. high, 2–4 in. diam.: ribs 13–15 (often oblique), compressed and tuberculately interrupted: radial

spines usually 7, compressed, straight or slightly recurved, ½–⅗ in. long, lower ones shorter than the others, all white excepting the two darker lowest laterals; central spines 4, widely divergent, the uppermost one flattened, straight and white, 1–1⅗ in. long, turned upward in the plane of the radials (completing the circle of radials), the others a little shorter, quadrangular-compressed, dark brown or black, becoming reddish and finally ashy, the 2 laterals straight, the lowest one stouter and sharply hooked downward: fl. greenish red. N. Ariz. Fig. 1371 is adapted from the Pacific Railroad Report.

BBB. *Central spines 5 to 8.*

9. **cornígerus,** DC. Globose or depressed-globose, 10–16 in. diam.: ribs about 21, very acute and wavy (not tuberculately interrupted): radial spines 6–10, white and comparatively slender, or wanting; centrals red and very robust, angular-compressed, with long, sharp, horny tips, the upper 3 erect-spreading, 1–1½ in. long, the lower 2 weaker and declined, the central one longer, more rigid and keeled, very broad (½–⅔in.) and hooked downward: fls. purple, 1–1½ in. long. Mex.

10. **polyancístrus,** Engelm. & Bigel. Ovate or at length subcylindric, becoming 4–10 in. high and 3–4 in. diam.: ribs 13–17, obtuse, tuberculately interrupted: radial spines 20 or more, compressed and white, the uppermost wanting, the 4 upper ones broader and longer (1–2 in.) and dusky-tipped, the laterals shorter (⅘–1 in.), the lowest very short (½in.) and subsetaceous; central spines of several forms, the uppermost one (rarely a second similar but smaller one above or beside it) compressed-quadrangular, elongated (3–5 in.), white with dusky tip, curved upward, the other 5–10 teretish or subangled, bright purple-brown; upper ones long (2–4 in.) and mostly straight, the others gradually shortening (to about 1 in.) downward and sharply hooked: fls. red or yellow, 2–2⅗ in. long and wide. Nev. and S. E. Calif.

AA. *Spines not hooked (Nos. 11–48).*

B. *Central spines none or indistinct.*

11. **Monvíllii,** Lem. Stout, globose and bright green: ribs 13–17, tuberculate, broadest toward the base, undulate; tubercles somewhat hexagonal, strongly dilated below: radial spines 9–12, the lower ones somewhat longer, very stout, spreading, yellowish translucent, reddish at base; central wanting: fls. varying from white to yellow and red. Paraguay.

12. **Pfeífferi,** Zucc. Oblong-globose, becoming 1–2 ft. high and 1 ft. diam.: ribs 11–13, compressed and somewhat acute: spines 6, about equal, rigid, straight, divergent or erect, pale transparent yellow with a brownish base; very rarely a solitary central spine. Mex.

13. **coptonogònus,** Lem., var. **màjor,** Salm-Dyck. Depressed, from a large indurated naked napiform base, 2–4 in. across the top: ribs 10–15, acute from a broad base, more or less transversely interrupted and sinuous: spines 3, annulate, very stout and erect from deeply sunken areoles, reddish when young, becoming ashy gray; upper spine stoutest, erect and straight, or slightly curved upward, flattened and keeled, and occasionally twisted, 1½–2¼ in. long; the 2 laterals erect-divergent, straight or slightly curved, terete above and somewhat quadrangular below, 1–1½ in. long; all from an abruptly enlarged base: fls. said to be small and white, with purplish median lines. Mex.

14. **multicostàtus,** Hildmann. Depressed-globose: ribs very numerous, 90–120, compressed into thin plates which run vertically or are twisted in every direction: spines exceedingly variable, in some cases wanting entirely, in others 3 or 4, short, rigid, and translucent yellow; in others more numerous, larger, and often flattish; in still other cases very long and flat, interlacing all over the plant; no centrals: fls. white, with a broad purple stripe. Mex.

15. **capricórnis,** A. Dietr. Globose: ribs about 11, broad, spotted all over with white dots: clusters of spines distant, usually seen only near the apex; spines 5–10, long and flexuous; centrals not distinct: fls. large, yellow. Mex.

16. **rinconénsis,** Poselg. Cylindrical, covered with ivory-white spines which are tipped with crimson: spines 3, with no centrals: fls. large, purple-crimson, darker at base. N. Mex.

17. **phyllacánthus,** Mart. From globose to cylindrical, with depressed vertex, simple or proliferous, 2⅓–3⅗ in. broad: ribs 40–55 (sometimes as few as 30), very much crowded and compressed, thin, acute, very wavy, continuous or somewhat interrupted: radial spines 5 (sometimes 6 or 7), straight and spreading, the 2 lowest ones white, rigid, ⅛–¼in. long, half as long as the 2 darker, angled, larger laterals, the uppermost spine thin and broad, channeled above, faintly annulate, flexible, grayish pink, ⅜–1 in. long; central spines none: fls. small, dirty white. Mex.

BB. *Central spine solitary (sometimes 2–4 in E. crispatus, E. helophorus, and E. setispinus, or wanting in E. lophothele).*

C. *Sts. with less than 13 ribs.*

18. **leucacánthus,** Zucc. Somewhat clavate-cylindrical, pale: ribs 8–10, thick, obtuse, strongly tuberculate, the areoles with strong wool: radial spines 7 or 8, similar, straight, finely pubescent, at first yellowish, at length white; central spine solitary, more or less erect, rarely wanting: fls. light yellow. Mex.

19. **ornàtus,** DC. (*E. Mirbéllii,* Lem.). Subglobose: ribs 8, broad, compressed, vertical, thickly covered with close-set white woolly spots, making the whole plant almost white: radial spines 7, straight, stout, yellowish or becoming gray; central spine solitary. Mex.

20. **íngens,** Zucc. (*E. Visnàga,* Hook.). Very large (sometimes as much as 10 ft. high and as much in circumference), globose or oblong, purplish toward the top: ribs 8, obtuse, tuberculate: areoles large, distant, with very copious yellowish wool: radial spines 8 or more; central spine solitary; all the spines shaded yellow and red or brownish, straight, rigid, and interwoven: fls. bright yellow, about 3 in. broad. Mex.

21. **horizonthalònius,** Lem. Glaucous, depressed-globose or at length ovate or even cylindric with age, 2–8 in. high, 2½–4 in. diam.: ribs 8–10 (fewer in very young specimens), often spirally arranged, the tubercles scarcely distinct by inconspicuous transverse grooves: spines 6–9, stout, compressed, reddish (at length ashy), recurved or sometimes almost straight, nearly equal, ⅘–1½ in. long (sometimes long and slender and almost terete, sometimes short, stout and broad); radials 5–8, upper ones weaker, lowest wanting; a single stouter decurved central (sometimes wanting): fls. pale rose-purple, 2½ in. long or more. New Mex. and N. Mex.

CC. *Sts. with 13–27 ribs.*

22. **electracánthus,** Lem. Globose or thick cylindrical, becoming 2 ft. high and 1 ft. diam.: ribs about 15: radial spines about 8, equal, rigid, spreading, yellowish, about 1 in. long; the central one solitary, red at base: fls. clear yellow. Mex.

23. **Echídne,** DC. (*E. Vanderæyi,* Lem.). Depressed-globose, 5–7 in. diam., 3–4 in. high: ribs 13, acute: radial spines 7, broad, rigid, spreading, yellowish, 1 in. or more long; central spine solitary and scarcely longer than the others: fls. bright yellow, 1 in. or more long. Mex.

24. **texénsis,** Hopf. Mostly depressed (sometimes globose), 8–12 in. diam., 4–6 in. high, simple: ribs

mostly 21 (sometimes 27, and in smaller specimens 13 or 14) and undulate: spines stout and fasciculate, reddish, compressed; the exterior 6 or 7 radiant, straightish or curved, unequal, ½–⅘in. long in some cases, 1⅘–2 in. in others, much shorter than the solitary and stout recurved central, which is sometimes ⅙–¼in. broad: fls. about ⅘in. long, parti-colored (scarlet and orange below to white above). Texas and N. E. Mex.

25. **rectispìnus,** Brit. & Rose. Fig. 1372. Globose, at length cylindrical: ribs 13–21, obtuse and strongly tuberculate: radial spines 7–9, very unequal, the 3 upper ones 4–5 in. long, the lower 1½–3 in. long and paler; the central very long (12–13 in.), straight or slightly decurved: fls. about 1⅘in. long, pinkish; ovary bearing a few ovate, scarious, naked scales. Low. Calif.

26. **Émoryi,** Engelm. Becoming large, globular to cylindrical plants, 1–4 ft. high: ribs 13–21, obtuse: radial spines 7–9, nearly equal, stout, 1–2 in. long; central spine single, porrect, hooked: fls. red, tipped with yellow: fr. 1–2 in. long, covered with thin bracts. S. Ariz. and N. Sonora.



1372. Echinocactus rectispinus. No. 25.

27. **recúrvus,** Link & Otto. Subglobose and very stout: ribs about 15, covered with broad, dark red spines, the radials spreading, the central one recurved and very stout. Mex.

28. **setispìnus,** Engelm. Subglobose, 2–3⅘ in. diam.: ribs 13, more or less oblique, often undulate or somewhat interrupted: radial spines 14–16, setiform and flexible, ⅖–⅘in. long, the uppermost (the longest) and lowest ones yellowish brown, the laterals white; central spines 1–3, setiform and flexuous, dark, 1–1⅘ in. long: fls. funnelform, 1⅗–3 in. long, yellow, scarlet within. Texas and N. Mex.

29. **helóphorus,** Lem. Depressed globose, light green with purple-red veins: ribs about 20, compressed, obtuse: radial spines 9–12, very stout and porrect; central spines 1–4, stronger and annulate; all the spines pearl-gray. Mex.

ccc. *Sts. with 30 or more ribs.*

30. **obvallàtus,** DC. Obovate-globose, depressed: ribs very numerous, vertical: spines most abundant towards the apex, unequal, spreading, stout, whitish; the 3 upper radials and solitary central strong, the others (especially the lowest) small: fls. purple, with whitish margin. Mex.—The name was suggested by the appearance of the terminal cluster of fls. surrounded by a fortification of strong spines.

31. **crispàtus,** DC. (*E. árrigens,* Link) Globose, 5 in. or more high: ribs 30–60, compressed and sharp, more or less undulate-crisped: spines 7–11, widely spreading, more or less flattened, the upper larger and brown at tip, the lower shorter and white, or all of them brown: fls. purple, or white with purple stripes. Mex.

cccc. *Sts. tuberculate, as in Mammillaria.*

32. **hexædróphorus,** Lem. More or less globular, dark gray: ribs deeply tuberculate, giving the appearance of a mammillaria, with hexagonal tubercles: radial spines 6 or 7, radiating like a star; central spine solitary, erect, longer; all the spines annulate, reddish brown: fls. white, tinted with rose. Mex.

33. **lopothèle,** Salm-Dyck. Globose, strongly tuberculate, after the manner of Mammillaria: tubercles quadrangular, bearing clusters of 5–10, more or less porrect, long, rigid, and equal spines; central solitary or wanting: fls. white or yellowish. Mex.

BBB. *Central spines 4 (2 or 3 in E. Sileri and sometimes 3 in E. Scopa).*

c. *Ribs less than 13.*

34. **robústus,** Otto. Clavate and stout: ribs about 8, compressed, vertical: radial spines about 14, the upper ones slender, the lowest 3 stronger; central spines 4, 4-angled at base, transversely striate, the lowest one largest; all the spines purple-red, 1½–3 in. long: fls. golden yellow. Mex.

35. **Ottònis,** Link & Otto. Depressed-globose or ovate, 3–4 in. high: ribs 10–12, obtuse: radial spines 10–18, slender, yellowish, more or less straight and spreading, about ½in. long; central spines 4, dusky red, stronger, the uppermost very short, the 2 laterals horizontal, the lowest longest (1 in.) and deflexed: fls. lemon-yellow, becoming 2–3 in. diam. Mex.

36. **bícolor,** Gal. Globose-ovate, stout, 1½–4 in. diam., sometimes becoming 8 in. high: ribs 8, oblique and obtuse, compressed, tuberculate-interrupted: lower radials and centrals variegated red and white; radials 9–17, spreading and recurved, slender and rather rigid, the lowest one ½–1 in. long, the laterals 1–2 in. long and about equaling the 2–4 flat flexuous ashy upper ones; centrals 4, flat and flexuous, 1½–3 in. long, the uppermost thin and not longer than the erect and rigid laterals, the lowest very stout, porrect and very long: fls. funnelform, bright purple, 2–3 in. long. N. Mex.

cc. *Ribs 13–27.*

37. **orthacánthus,** Link & Otto (*E. flavovìrens,* Scheidw.). Globose, yellowish green: ribs 12 or 13, vertical, acute: radial spines 14, unequal, straight and spreading; central spines 4, stronger, the lowest the largest; all the spines rigid, annulate, and grayish white. Mex.

38. **intertéxtus,** Engelm. Ovate-globose, 1–4 in. high: ribs 13, acute, somewhat oblique, tuberculate-interrupted, the tubercles with a woolly groove: spines short and rigid, reddish from a whitish base and with dusky tips; radial 16–25, closely appressed and interwoven, the upper 5–9 setaceous and white, straight ⅕–½in. long, the laterals more rigid and a little longer, the lowest stout and short, a little recurved; centrals 4, the 3 upper ones turned upward and exceeding the radials and interwoven with them, the lower one very short, stout and porrect: fls. about 1 in. long and wide, purplish. Texas and N. Mex.

39. **Órcuttii,** Engelm. Cylindrical, 2–3½ ft. high, 1 ft. diam., single or in clusters up to 18 or more, not rarely decumbent: ribs 18–22, often oblique: spines extremely variable, angled to flat, ¼–3 in. wide; radials 11–13, unequal, lowest and several laterals thinnest; centrals 4: fls. about 2 in. long, deep crimson in center, bordered by light greenish yellow. Low. Calif.

40. **Jóhnsonii,** Parry. Oval, 4–6 in. high: ribs 17–21, low, rounded, tuberculately interrupted, close set, often oblique, densely covered with stoutish reddish gray spines: radial spines 10–14, ⅜–1⅓ in. long, the upper longest; centrals 4, stouter, recurved, about 1½ in. long: fls. 2–2⅗ in. long and wide, from deep red to pink. Utah, Nev., Calif.

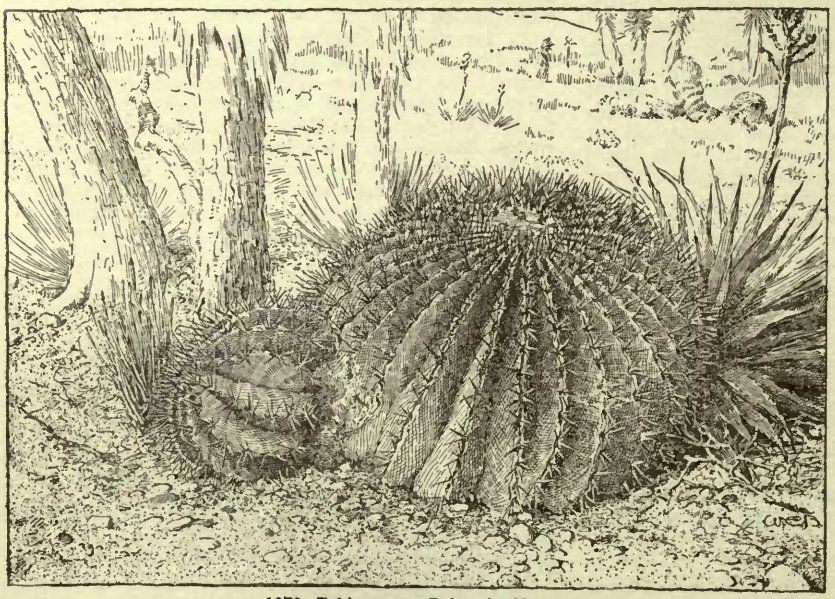
41. **polycéphalus,** Engelm. & Bigel. Globose (6–10 in. diam.) to ovate (10–16 in. high, 5–10 in. diam.) and cylindrical (reaching 24–28 in. high and about 10 in. diam.), profusely branched at base: ribs 13–21 (occasionally 10): spines 8–15, very stout and compressed, more or less recurved and reddish; radials 4–11, comparatively slender (the uppermost the most slender), 1–2 in. long; the 4 centrals much stouter and longer (1½–2⅘ in.), very unequal, the uppermost one usually broadest and curved upward, the lowest one usually the longest and decurved: fls. yellow. Utah to Calif.

42. **viridéscens,** Nutt. Globose or depressed, simple or branching at base, 4–12 in. high, 6–10 in. diam.: ribs 13–21 (fewer when young), compressed and scarcely tuberculate: spines more or less curved and sometimes twisted, reddish below, shading into greenish or yellowish above; radials 9–20, ⅖–⅘in. long, the lowest shortest, robust, and decurved; centrals 4, cruciate, much stouter, compressed and 4-angled, ⅘–1⅖ in. long, the lowest broadest, longest and straightest: fls. yellowish green, about 1⅗in. long. S. Calif.—*E. limitus,* Engelm., is closely related to this species and is thought by some to be identical with it.

43. **Lecóntei,** Engelm. Resembles *E. Wislizenii,* but often somewhat taller (sometimes becoming 8 ft. high and 2 ft. diam.), usually more slender, and at last clavate from a slender base: ribs somewhat more interrupted and more obtuse: lower central spine more flattened and broader, curved (rather than hooked) or twisted, usually not at all hooked, sometimes as much as 6 in. long: fls. rather smaller. From the Great Basin to Mex. and Low. Calif.

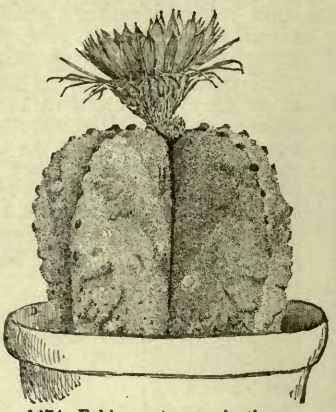
44. **Sìleri,** Engelm. Globose: ribs 13, prominent, densely crowded, with short rhombic-angled tubercles: radial spines 11–13, white; centrals 3, black, with pale base, ⅗in. long, the upper one slightly longer: fls. scarcely 1 in. long, straw-colored. Utah.

45. **Grùsonii,** Hildmann. Globose, completely covered by a mass of almost transparent golden spines, which give the plant the appearance of a ball of gold: centrals 4, curved: fls. red and yellow. Mountains of Mex.—From illustrations it is evident that the radial spines are somewhat numerous and widely spreading, and that the centrals are prominent and more or less deflexed.



1373. Echinocactus Palmeri. No. 46.

46. **Pálmeri,** Rose (*E. saltillénsis,* Poselg.). Fig. 1373. Very stout, globose: ribs 15–19, compressed, dark green: spines very prominent, 5–7 in a cluster, stout and porrect, sometimes becoming 5 in. long; centrals 4. Mex.—Schumann makes this a variety of *E. ingens.*



1374. Echinocactus myriostigma. No. 50.

CCC. *Ribs 30 or more.*

47. **Scòpa,** Link & Otto. More or less cylindrical, 1 ft. or more high, 2–4 in. diam., at length branching above: ribs 30–36, nearly vertical, tuberculate: radial spines 30–40, setaceous, white; central spines 3 or 4, purple, erect; sometimes all the spines are white: fls. yellow. Brazil. —The species is exceedingly plastic in form, branching variously or passing into the cristate condition.

BBBB. *Central spines 5–10.*

48. **pilòsus,** Gal. Globose, 6–18 in. high: ribs 13–18, compressed, little if at all interrupted: radial spines represented by 3 slender ones at the lowest part of the pulvillus or wanting; centrals 6, very stout, at first purplish, becoming pale yellow, the 3 upper ones erect, the 3 lower recurved-spreading: fls. unknown. N. Mex.

AAA. *Spines entirely wanting.*

49. **turbiniformis,** Pfeiff. Depressed-globose, grayish green, with 12–14 spirally ascending ribs, cut into regular rhomboidal tubercles; tubercles flat, with a depressed pulvillus, entirely naked excepting a few small setaceous spines upon the younger ones: fls. white, with a purplish base. Mex.—The depressed and spineless body, with its surface regularly cut in spiral series of low, flat tubercles, gives the plant a very characteristic appearance.

50. **myriostígma,** Salm-Dyck (*Astróphytum myriostígma,* Lem.). Fig. 1374. Depressed-globose, 5 in. diam.: ribs 5 or 6, very broad, covered with numerous somewhat pilose white spots, and with deep obtuse sinuses: spines none: fls. large, pale yellow. Mex.

E. chrysánthus (E. chrysacanthus)=(?).—*E. Drægeànus*=(?). —*E. Lewínii*=Lophophora.—*E. micromèris* = Mammillaria.—*E. Poselgeriànus,* A. Dietz.=Mammillaria Scheerii.—*E. Símpsonii*=Pediocactus.—*E. trifurcàtus*=(?). —*E. Williamsii*=Lophophora.

JOHN M. COULTER.
J. N. ROSE.†

ECHINOCÈREUS (*spiny Cereus*). *Cactàceæ.* Condensed globular, cylindrical or prostrate cacti of the United States and Mexico.

Stems single or cespitose, sometimes forming large clusters of 200–300 sts., distinctly ribbed, usually low in stature, or, if elongated, sprawling or creeping, generally very spiny: fls. yellow, purplish or scarlet, with rather a short funnel-

shaped tube; fl.-tube and ovary covered with clusters of spines; stigma-lobes always green. This genus has commonly been merged into Cereus, although it seems to be quite distinct.

Most of the species of Echinocereus are unsuited for greenhouse purposes, for when brought under glass they survive only for a few years. The very large flowers of some species make them very attractive while in bloom.

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A. *Sts. covered with long weak bristles or hairs, and resembling a small plant of Cephalocereus senilis.*

1. **De Lætii,** Gürke. Low and cespitose, 6–10 in. high: ribs 17–20: radial spines numerous; central spines 4 or 5, intermixed with long, hair-like bristles entirely hiding the plant: fls. small, rose-colored. Mex.—This species has been secured in great quantities by European dealers. It closely simulates a small *Cephalocereus senilis*, but has very different fls. and fr.

AA. *Sts. variously covered with spines, but not like the above (Nos. 2–27).*

B. *The sts. weak and trailing, at least becoming prostrate.*

C. *Ribs nearly continuous.*

2. **Scheèri,** Lem. (*Cèreus Scheèri*, Salm-Dyck). Branching freely from the base of the st. and forming dense clusters: branches upright or ascending, about 8 in. long by 1 in. diam., slightly tapering toward the apex, dark green: ribs 8–9, straight or sometimes inclined to spiral, separated above by sharp grooves which become flattened toward the base, low arched: areoles little more than ¼in. apart, round, yellowish white: radial spines 7–9, spreading, needle-like, the under pair the longest, about ¼– ⅜in. long, white with yellowish bases; centrals 3, the lower the longest, about ⅜in., red with brown bases; later all the spines become gray: fls. red, from the upper part of the st., about 5 in. long; ovary and tube bracteate and furnished with abundance of wool and spines. Mex.

CC. *Ribs divided into tubercles.*

D. *Central spines, when present, short: flowering areoles bearing cobwebby wool.*

3. **procúmbens,** Lem. (*Cèreus procúmbens*, Engelm.). Branching from the lower part of the st. and so forming clusters: branches procumbent or ascending, angled, at the base tapering into cylindrical, 1½–5 in. long by ½–¾ in. diam.: ribs mostly 5, rarely 4, straight or spiral, on the upper portion of the branch almost divided into tubercles: areoles ¼–½in. apart, round, sparingly white curly-woolly, soon naked: radial spines 4–6, subulate, stiff, straight, sharp, in young growth brownish, then white, at the base often yellowish and the tip brownish, horizontally spreading, the upper the longest, reaching ¼in. length; central solitary or absent on the lower areoles, somewhat stronger, ⅜–⅝ in. long, darker: fls. lateral, from just below the crown, 3–4 in long, carmine-red to violet, with white or yellowish throat: fr. ellipsoidal, green, ⅝in. long. Mex.

DD. *Central spines slender: flowering areoles with short wool.*

E. *Length of central spine ¾in.*

4. **Berlandièri,** Lem. (*Cèreus Berlandièri*, Engelm.). Sts. prostrate, richly branching, forming dense clusters, the branches upright or ascending, 2–3 in. long or longer, by ½–¾ in. diam., light or dark green, and in young growth often purplish: ribs 5–6, broken up into as many straight or spiral rows of tubercles; tubercles conical, pointed: areoles ⅜–⅝ in. apart, round, white-woolly, soon naked: radial spines 6–8, stiff bristle-form, thin, horizontally spreading, white, about ⅜in. long, the upper one sometimes light brown and somewhat stronger; central solitary, yellowish brown, sometimes reaching ¾in. length: fls. from the upper lateral areoles, 2–3 in. long, red to light pink: fr. ovoid, green, bristly. S. Texas and N. Mex.

EE. *Length of central spine 1 in. or more.*

5. **Blánkii,** Palmer (*Cèreus Blánkii*, Poselg.). Branching freely from the base and thus forming clusters: sts. columnar, tapering above, about 6 in. long by 1 in. diam., dark green: ribs 5–6 (rarely 7), straight, almost divided into tubercles: areoles about ⅜in. apart, round, white curly-woolly, later naked: radial spines mostly 8, horizontally spreading, the under pair the longest, reaching about ⅜in. length, all stiff, straight, thin, white or the upper ones carmine-red when young, later reddish brown; central solitary, porrect, later deflexed, 1–1¼ in. long, white or brownish, black when young: fls. from near the crown, 2½–3 in. long, purple-red to violet. Mex. R.H. 1865:90.

BB. *The sts. usually short and stout, usually erect.*

C. *Fls. rather small, scarlet.*

D. *Ribs 5–7.*

E. *Spines terete.*

6. **paucispìnus,** Rümpl. (*Cèreus paucispìnus*, Engelm.). Clustered in irregular bunches: sts. cylindrical to ovoid, 4–7 in. high by 1¾–3 in. diam.: ribs 5–7, undulate: areoles ⅜–⅝in. apart, round, white-woolly, later naked: radial spines 3–6, spreading, subulate, straight or curved, round, bulbose at the base, the lowest one longest, reaching ¾in., light-colored, the upper ones reaching to about ½in., reddish or brownish; central solitary or none, reaching about 1½ in. length, somewhat angled, brown-black, porrect or upright; later all the spines blackish: fls. 2 in. or more long, dark scarlet to yellowish. Texas and Colo.

Var. **gonacánthus,** K. Sch. (*E. gonacánthus*, Lem. *Cèreus gonacánthus*, Engelm. & Bigel.). Radial spines 8, very large, angled and sometimes twisted, the upper strongest, reaching nearly 3 in. length, light or dark yellow with brown tips; central always present, deeply grooved, often flattened, 3 in. or more long. Colo.

EE. *Spines angled.*

7. **triglochidiàtus,** K. Sch. (*E. triglochidiàtus*, Engelm. *Cèreus triglochidiàtus*, Engelm.). Radial spines usually 3, sometimes as many as 6, strong, angled, base bulbose, straight or curved, about 1 in. long, soon ash-gray. Texas and New Mex.

DD. *Ribs 9–11.*

E. *Axils of fl.-bracts filled with long cobwebby hairs.*

8. **polyacánthus,** Engelm. (*Cèreus polyacánthus*, Engelm.). Sts. clustered, forming thick masses, cylindrical to ellipsoidal: ribs 9–13: radial spines 8–12, robust, subulate, stiff and sharp, under one the longest, nearly 1 in., upper ones scarcely ½in., white to reddish gray with dark tips; centrals 3–4, bulbose base, stronger, about the length of the radials or the lowest sometimes reaching 2 in., horn-colored; later all the spines become gray: fls. lateral, about 1¾–2¼ in. long, dark scarlet to blood-red: fr. spherical, about 1 in. long, greenish red, spiny. Texas to N. Mex.

EE. *Axils of fl.-bracts bearing short wool.*

F. *Central spines always solitary: sts. 6–8 in. high. Mex.*

9. **ácifer,** Lem. (*Cèreus ácifer*, Otto). Sts. thickly clustered, 6–8 in. high by 1½–2 in. diam., becoming

gray and corky with age: ribs 9–11, usually 10: radial spines usually 9, spreading, under pair longest, about ½in., in young growth white, later horn-colored to gray, the upper ones brownish; central solitary, straight, porrect, at first ruby-red, later brown, 1 in. long: fls. lateral, 2 in. and more long, clear scarlet-red, with a yellow throat and sometimes a carmine border. N. Mex.

FF. *Central spines 1–4: sts. 2–4 in. high. New Mex. and Colo.*

10. **coccíneus,** Engelm. (*E. phœníceus,* Lem. *Cèreus phœníceus,* Engelm.). Sts. irregularly clustered, ellipsoidal to short-cylindrical, 2–4 in. high by 1½–2¼ in. diam.: ribs 8–11, straight: spines bristle-form, straight, round; radials 8–12, white, ¼–½ in. long, upper ones shortest; centrals 1–4, stouter, white to yellow or brown, with bulbose base: fls. from upper lateral areoles scarlet-red, with the corolla-throat yellow. Colo. to Ariz.

Var. **conoídeus,** Engelm. (*E. conoídeus,* Rümpl. *Cèreus conoídeus,* Engelm.). Central spine long and robust: fls. large, red. S. Calif. and N. W. Mex.

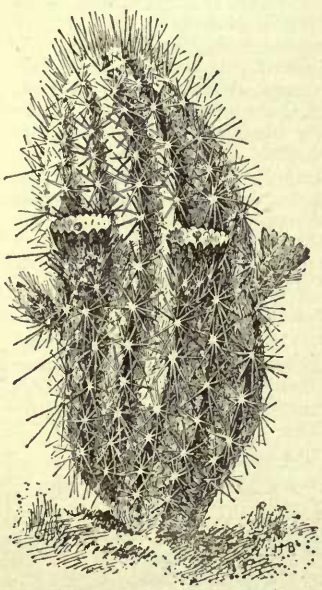
CC. *Fls. never scarlet, usually crimson or purplish, sometimes yellow.*

D. *Spines more or less pectinate: ribs 12 or more.*

E. *Areoles short, nearly orbicular.*

F. *Color of spines white.*

11. **longisètus,** Lem. (*Cèreus longisètus,* Engelm.). Sts. clustered, cylindrical, covered with long, dirty white spines, about 8 in. high by 2 in. diam., light green: ribs 11–14, straight, undulate: radial spines 18–20, straight, compressed, base thickened, subulate, flexuose, usually horizontally spreading, interlocking with adjacent clusters, the lower laterals the longest, reaching ⅜in. long, the upper more bristle-like and the shortest, all white; centrals 5–7, longer, reaching 2½ in., stronger, the upper ones scarcely longer than the longest radials; all are bulbose at the base; the 3 lower ones the longest and deflexed, spreading and sometimes curved: fls. red. Mex.



1375. Echinocereus chloranthus.

FF. *Color of spines white and brown.*

12. **chlorânthus,** Rümpl. (*Cèreus chlorânthus,* Engelm.) Fig. 1375. Sts. in small clusters, cylindrical, slightly tapering above, 4–9 in. high by 2–2½ in. diam.: ribs 13–18, straight or rarely spiral: radial spines 12–20, horizontally spreading and appressed, sharp, the shortest one about ⅜in. long and white, the lower laterals a little longer and have purple tips; centrals 3–5, or in young plants absent, bulbose at the base, the upper ones shortest, about the length of the radials, and darker colored, with purplish tips, the lower ones stouter, about 1 in. long, deflexed, white; frequently all the spines are white: fls. lateral, little more than 1 in. long; ovary and tube white bristly; petals green: fr. ellipsoidal, about ½in. long, spiny. Texas and New Mex.

EE. *Areoles more or less elongated.*

F. *Color of fls. greenish or yellow.*

G. *Fls. greenish.*

13. **viridiflòrus,** Engelm. (*Cèreus viridiflòrus,* Engelm.). Sts. solitary or only in age forming small, loose clusters, cylindrical or elongated, ellipsoidal, 3–7 in. high by 1–2 in. diam: ribs 13: radial spines 12–18, horizontally radiate, pectinate, straight or somewhat curved, subulate, the lower laterals the longest, about ½in., translucent ruby-red, the others white; centrals usually absent, rarely 1, strong, about ¾in. long, curved upward, red with brown point: fls. lateral, from just below the crown, broad funnelform, little more than 1 in. long; ovary and tube spiny; corolla green, with a broad darker olive-green to pink stripe down the middle of each petal: fr. ellipsoidal, about ½in. long, greenish. Wyo. and Kans. to Texas and New Mex.

GG. *Fls. yellow.*

H. *Ribs 15–21: central spines unequal.*

14. **dasyacânthus,** Engelm. (*Cèreus dasyacánthus,* Engelm.). Sts. solitary or sometimes forming open clusters, ellipsoidal to short-cylindrical ribs 15–21, straight or sometimes slightly spiral, obtuse: radial spines 20–30, straight or sometimes slightly curved, subulate, stiff, sharp, pectinate, white with red or brown tips, later gray, the laterals longest, ½–1 in., the upper ones shortest, about ⅜in., those of one cluster interlocking with those of the adjacent clusters; centrals 3–8, the lower one longest, white with colored tips, mostly with bulbose bases: fls. from near the crown of the st. large, 2½–3 in. long; ovary and short tube covered with white, reddish tipped stiff bristles; corolla yellow: fr. 1–1½ in. long, ellipsoidal, spiny, green to reddish. Texas.

HH. *Ribs 15 or 16: central spines very short, equal.*

15. **ctenoìdes,** Lem. (*Cèreus ctenoìdes,* Engelm.). Sts. solitary or rarely branching, cylindrical to elongated ovoid, reaching a height of 6 in. and a diam. of 2½ in.: ribs 15–16, usually straight: radial spines 13–22, horizontally radiate, pectinate, subulate, bases bulbose and laterally compressed, stiff, straight or often slightly curved, the laterals longest and about ⅜in., the upper ones very short, white or sometimes with brownish tips; centrals 2–3 or rarely 4, superposed, coarser, bulbose at the base, short and conical to ¼in. long, reddish; later all the spines are gray: fls. lateral, from near the crown, 2½–3 in. long; ovary and short tube white bristly; corolla yellow, with greenish throat. Texas. and N. Mex.–This species is very rare in cult.

FF. *Color of fls. purple.*

G. *The spines irregularly pectinate.*

16. **Rœtteri,** Rümpl. (*Cèreus Rœtteri,* Engelm.). Loosely open clustered: sts. upright, 4–6 in. high, 2–3 in. diam., cylindrical or ovoid: ribs 10–13, straight: radial spines 8–15, subulate, thickened at the base, stiff, sharp, straight or slightly curved, the laterals longest, about ½in., the upper ones shortest, reddish with darker tips; centrals 2–5, stouter, bulbose at base, ¼–⅜in. long, the lower ones the longest; later all the spines are gray: fls. lateral, from near the crown, 2½–3 in. long, purple-red to violet: fr. short ellipsoidal, spiny, green, ¾in. long. Texas to Ariz. and N. Mex.

GG. *The spines regularly pectinate.*

H. *Tube of fl. and spines of ovary slender and weak, the surrounding hairs long and cobwebby.*

17. **cæspitòsus,** K. Sch. (*Cèreus cæspitòsus,* Engelm.). Radials 20–30, curved, clear white or with rose-red tips; centrals absent, or 1–2 very short ones. Okla., Texas and Mex.

HH. *Tube of fl. and spines of ovary short and stout, the surrounding hairs short.*

I. *Central spines several.*

18. **pectinàtus,** Engelm. (*Cèreus pectinàtus,* Engelm.). Clustered sts. cylindrical or ovoid, reaching a height of 10 in. by 3 in. diam.: ribs 13–23, straight: radial spines 16–30, pectinate, horizontally spreading and appressed, straight or curved, the laterals longest, round, hardly ⅜in. long; central usually absent, or as many as 5, which are short, conical and superposed, white, with tips and bases variously colored with pink, yellow or brown; later all become gray: fls. lateral, from near the crown, 2½–4 in. long; ovary tuberculate and spiny, light to dark rose-red or rarely white: fr. globose, spiny, green to reddish green. Mex.

Var. **adústus,** K. Sch. (*Cèreus adústus,* Engelm.). Like the type, but with black-brown to chestnut-brown spines. Mex.

Var. **rufispìnus,** K. Sch. Of more robust growth: radial spines curved, red. Mex.

II. *Central spines none.*

19. **rigidíssimus,** Engelm. (*Cèreus cándicans,* Hort. *C. rigidíssimus,* Hort.). Rainbow Cactus. Fig. 1376. Sts. comparatively shorter and thicker: radial spines 16–20, coarser and stiffer, straight or very little curved; base thickened, white, yellow or red to brown, these colors commonly arranged in alternating bands around the plant, the spines of adjacent clusters interlocking; centrals absent. Ariz. and N. Mex.

DD. *Spines not pectinate.*

E. *Ribs 10 or fewer.*

F. *Fls. crimson.*

20. **mojavénsis,** Rümpl. (*Cèreus mojavénsis,* Engelm. & Bigel.). Sts. clustered, ovoid, reaching 3 in. height by 2 in. diam.: ribs 8–12, conspicuously undulate: radial spines 5–8, the lowest pair the longest, reaching about 2¼ in. long; all are white with brown tips, subulate, straight or curved, strongly bulbose at the base; central solitary, or sometimes absent, stronger and somewhat longer and darker colored; later all the spines become gray: fls. 2–3 in. long, deep carmine: fr. ellipsoidal, about 1 in. long. Deserts of Ariz., Nev. and Calif.

FF. *Fls. purple-violet.*

G. *The spines dark, often of several colors.*

H. *Central spine 1.*

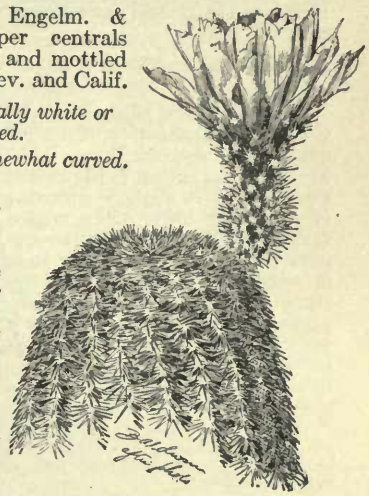
21. **Féndleri,** Rümpl. (*Cèreus Féndleri,* Engelm.). Irregularly clustered: st. cylindrical or rarely ovoid or even globose, sparingly branching, 3–7 in. high by 1¾–2½ in. diam.: ribs 9–12, straight or slightly spiral, undulate: radial spines 7–10, subulate, straight or curved, the lowest or the 2 lower laterals the longest, about 1 in., stronger, quadrangular, white; the 2 next higher brownish; the upper ones round, white and much shorter; all are bulbose at the base; central solitary (or in old plants 3–4), very strongly thickened at the base, round, black, sometimes with a lighter colored tip, curved upward, reaching a length of 1¾ in.: fls. lateral, from near the crown, 2–3½ in. long, dark carmine-red to purple and violet: fr. ellipsoidal, spiny, green to purple-red, about 1 in. long. Colo., Utah and south to N. Mex. B.M. 6533.

HH. *Central spines several.*

22. **Éngelmannii,** Lem. (*Cèreus Éngelmannii,* Parry). Sts. clustered, cylindrical to ovoid, 4–10 in. high, 1¾–2½ in. diam., light green: ribs 11–13, undulate: radial spines 11–13, somewhat angled, stiff, sharp, straight or somewhat curved, horizontally spreading, the lowest or lower laterals the longest, about ½in., the upper ones the shortest, whitish with brown tips; centrals 4, stiff, straight, angled, stout, the lowest one deflexed, white to dark-colored, reaching a length of 2½ in., the upper ones about half as long, spreading, brown: fls. lateral, from just below the crown, 1¾–2½in. long, purple-red: fr. ovoid, green to purple-red, spiny, later naked, about 1 in. diam.; pulp purple-red. Calif. to Utah and south into Mex.

Var. **chrysocéntrus,** Engelm. & Bigel. The 3 upper centrals golden yellow, the lowest white. Mojave Desert, Calif.

Var. **variegàtus,** Engelm. & Bigel. The 3 upper centrals curved, horn-colored and mottled with black. Utah, Nev. and Calif.



1376. Echinocereus rigidissimus.

GG. *The spines usually white or straw-colored.*

H. *Central spines somewhat curved.*

23. **dùbius,** Rümpl. (*Cèreus dùbius,* Engelm.). Tolerably thickly clustered: sts. branching at the base, cylindrical or elongated ellipsoidal, 4½–7 in. high by 1½–2¼ in. diam.: ribs 7–9, undulate: areoles ⅜–⅝ in. apart, round, covered with short curly white wool, later naked: radials 5–8, subulate, horizontally spreading, stiff, round or faintly angled, the lower ones usually the longest, about 1 in. long, the upper ones about half as long, or sometimes absent, transparent white; centrals 1–4, stronger and longer, bulbose at the base, straight or curved, reaches 2½ in. length, the lowest one longest, straight, porrect or deflexed, the upper ones spreading: fls. lateral, 2 in. long, rose-red to violet: fr. spherical, greenish to purple-red, covered with bundles of deciduous spines. Texas and N. Mex.

HH. *Central spines straight.*

I. *Sts. erect, with the spines pale at base.*

24. **enneacánthus,** Engelm. (*Cèreus enneacánthus,* Engelm.). Freely branching at the base of the st. and thus forming thick, irregular clusters: branches ascending, usually 3–5 in. long by 1½–2 in. diam., green or sometimes reddish: ribs 8–10, straight, often divided by transverse grooves into more or less conspicuous tubercles: areoles ⅜–⅝in. apart, round, white curly-woolly, soon naked: radial spines 7–12 (mostly 8), horizontally spreading, needle-form, straight, stiff, translucent white, base bulbose, the under one longest, reaching about ½in., the upper one very short; central solitary, or seldom with 2 additional upper ones, straight, porrect or deflexed, round or angled, whitish to straw-yellow or darker, ⅜–1½ in. long; later all the spines are gray: fls. lateral, from near the crown or lower, 1¾–2½ in. long, red to purplish: fr. spherical, green to red, spiny, ¾–1 in. long. Texas and N. Mex.

II. *Sts. spreading and flabby, with the spines red at base.*

25. **Mérkeri,** Hildmann. Sts. at first upright, columnar, later reclining and by branching at the base forming clusters, in new growth bright green, later gray to gray-brown and corky: ribs 5–9, undulate to more or less tuberculate: areoles ¾in. and more apart, round, white velvety, later naked: radial spines 6–9, the upper ones the longest, reaching 1¼ in. length, somewhat confluent with the centrals, subulate, spreading, straight; centrals 1–2, stronger, reaching a length of 2 in.; all the spines are white, nearly transparent, with red-tinted bulbose base. N. Mex.

EE. *Ribs 11 or 13.*

F. *Plants in small clusters: central spines sometimes solitary.*

26. **conglomerâtus,** Forst. Sts. clustered, columnar, somewhat tapering above, reaching a height of 1 ft. and 2 in. diam., light green: ribs 12–13, strongly undulate, tubercled above: radial spines 9–10, glossy, spreading, the lower pair the longest, base yellow; centrals 1–4, the lowest straight, porrect, reaching a length of 1½ in. and more, somewhat stronger than the rest. N. Mex.

FF. *Plants often 200 in a single mound: centrals never single.*

27. **stramíneus,** Rümpl. (*Cèreus stramíneus,* Engelm). Clustered in thick, irregular bunches: sts. ovoid to cylindrical, 4–8 in. long, 1½–2½ in. diam.: ribs 11–13: radial spines 7–10 (usually 8), horizontally radiate, straight or slightly curved, subulate, sharp, round or the long lower ones angled, transparent white, tolerably equal in length, about ½–¾in. or the lower ones sometimes longer and reaching a length of 1½ in.; centrals 3–4, much longer, stronger, twisted, angled, straw-yellow to brownish, when young reddish transparent, the upper ones shortest and spreading upward, the lower ones porrect or depressed: fls. lateral, 2½–3½ in. long, bright purple-red or deep dark red, to scarlet: fr. ellipsoidal, about 1½ in. long, covered with numerous spines, purple-red. Texas to Ariz. and N. Mex.

Horticultural names are: *E. paucispìna,* no doubt a mutilation of paucispinus.—*E. polycéphalus.*—*E. sanguíneus.*—*E. Schlénii*=E. Scheeri (?).—*E. tuberòsus,* Rümpl.=Wilcoxia.—*E. Uèhri.*—*E. Uspéndkii.*

C. H. Thompson.
J. N. Rose.†

ECHINÓCHLOA (Greek, *echinos,* a hedgehog, *chloa,* grass). *Gramíneæ.* Annual grasses with narrow inflorescence of several thick spikes. Sometimes grown for grain and forage, but scarcely horticultural subjects.

Spikelets as in Panicum; glumes hispid-spiny, mucronate, the sterile lemma more or less awned.—Species about 12, in the warm regions of both hemispheres. Regarded by many botanists as a section of Panicum. *E. Crùsgalli,* Beauv., barnyard grass, is a common weed in cult. soil. The spikelets are usually long-awned, the panicle 4–10 in. long, green or purple. Dept. Agric., Div. Agrost. 7:82.

frumentàcea, Link (*Pánicum frumentàceum,* Roxbg.). Japanese Barnyard Millet. Closely allied to *E. Crùsgalli,* but differing in the compact, somewhat incurved, appressed spikes, of nearly awnless spikelets: culms 1–4 ft., erect.—Cult. in S. E. Asia for the seed which is used for food. Occasionally cult. in U. S. for forage. Sometimes known as "billion-dollar grass."

A. S. Hitchcock.

ECHINOCÝSTIS (Greek, *hedgehog* and *bladder;* from the prickly fruit). Syn. *Micrámpelis. Curcurbitàceæ.* Wild Cucumber. Wild Balsam-Apple. A profuse native annual vine which is a favorite for home arbors; the other species not generally cultivated, except perhaps the perennial-rooted megarrhizas.

Most of the species are annual herbs, with branched tendrils and palmately lobed or angled lvs.: fls. small, white or greenish, dicœcious, the campanulate calyx 5–6-lobed and the corolla deeply 5–6-parted; stamens in staminate fls. 3; ovary 2-celled, with 2 ovules in each: fr. fleshy or dry, more or less inflated and papery, opening at the summit; seeds flattened, more or less rough.—The species are about 25, in the warmer parts of the western hemisphere, about 10 of them in the W. U. S., and 1 in the eastern states. The eastern species (*E. lobata*) is one of the quickest-growing of all vines, and is therefore useful in hiding unsightly objects while the slower-growing shrubbery is getting a start. Cogniaux, in DC. Mon. Phan. vol. 3, 1881, makes three sections of this genus, and this plant the sole representative of the second section, or true Echinocystis, because its juicy fr. bursts irregularly at the top, and contains 2 cells, each with 2 flattish seeds. The Megarrhiza group (kept distinct by some) is distinguished by its thick perennial root, large turgid seeds and hypogeal germination.

lobàta, Torr. & Gray. Lvs. wider than long, deeply 5-lobed, slightly emarginate at the base: tendrils 3–4-branched: staminate fls. small, in many-fld. panicles longer than the lvs.; calyx glabrous: fr. egg-shaped, sparsely covered with prickles. New Bruns. and Ont. to Mont. and Texas, growing in rich soil along rivers and in low places. A.G. 14:161. R.H. 1895, p. 9. G.C. III. 22:271. G.W. 10, p. 499.—Sometimes becomes a weed.

fabàcea, Naudin (*Megarrhìza califórnica,* Torr.), is sometimes grown in fine collections and botanic gardens. It is a tendril-climber, reaching 20–30 ft. in its native haunts: lvs. deeply 5–7-lobed: fls. monœcious, greenish white, the corolla rotate: fr. densely spinose, globose or ovoid, 2 in. long; seed obovoid, nearly or about 1 in. long and half or more as broad, margined by a narrow groove or dark line. S. Calif.—Odd in germination (see Gray, Amer. Journ. Sci. 1877, and Structural Botany, p. 21).

L. H. B.†

ECHINÓPANAX (Greek, *hedgehog* and *panax,* referring to the prickly nature of the plant). *Araliàceæ.* Ornamental shrub, but rarely grown; very handsome on account of the large foliage and scarlet fruits.

Deciduous, prickly throughout: lvs. alternate, long-petioled, palmately 5–7-lobed, with serrate lobes, without stipules: fls. greenish white, in umbels forming terminal panicles; calyx-teeth indistinct; petals 5, valvate; stamens 5, with filiform filaments; styles 2, connate at the base: fr. a compressed drupe.—One species, Pacific N. Amer., Alaska to Calif., and Japan.

This is a strikingly handsome shrub with its large bright green palmately lobed leaves and scarlet fruits late in summer. Little known in cultivation; it will succeed best in moist and cool places and in partial shade. Propagation is by seeds and by suckers and probably also by root-cuttings.

hôrridum, Decne. & Planch. (*Fátsia hórridum,* Benth. & Hook. *Pànax hórridum,* Smith). Shrub, to 12 ft.: sts. densely prickly: lvs. roundish-cordate, prickly on both sides, pubescent below, 5–7-lobed, lobes incisely lobulate and sharply serrate, 6–12 in. long: infl. tomentose: fr. scarlet, ⅓in. long. July, Aug.; fr. Aug., Sept.

Alfred Rehder.

ECHÌNOPS (Greek, *like a hedgehog;* alluding to the spiny involucral scales). *Compósitæ.* Globe Thistle. Coarse thistle-like plants, with blue or whitish flowers in globose masses, sometimes used in the wild garden.

More or less white-woolly herbs: lvs. alternate, sometimes entire, usually pinnate-dentate or twice or thrice pinnatisect, the lobes and teeth prickly: fls. in globes; the structure of one of the globes is very odd; each fl. in the globe has a little involucre of its own, and the whole globe has one all-embracing involucre; fls. perfect and fertile (or sterile by abortion), corolla regular and no ray-fls.; pappus of many short scales forming a crown: achene elongate, 4-angled or nearly terete, usually villous.—About 60 species, from Spain and Portugal to India and Abyssinia.

Globe thistles are coarse-growing plants of the easiest culture, and are suitable for naturalizing in wild gardens and shrubberies. An English gardener with an eye for the picturesque (W. Goldring) recommends massing them against a background of *Bocconia cordata,* or with such boldly contrasting yellow- or white-flowered plants as *Helianthus rigidum* or *Helianthus multiflorus.* The best species is *E. ruthenicus* (form of *E. Ritro*). A few scattered individuals of each species are not so effective as a condensed group of one kind.

E. ruthenicus flowers in midsummer and for several weeks thereafter. The silvery white stems and handsomely cut prickly foliage of globe thistles are interesting features. They make excellent companions for the blue-stemmed eryngiums. All these plants are attractive to bees, especially *E. exaltatus*, which has considerable fame as a bee-plant. Globe thistles are sometimes used abroad for perpetual or dry bouquets.

A. *Lvs. not pubescent nor setulose above but sometimes roughish above.*

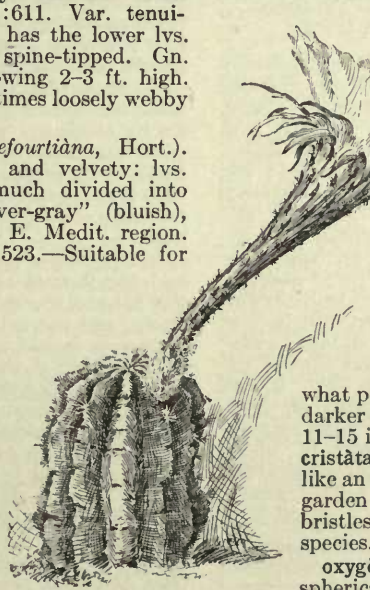
Rîtro, Linn. (*E. Vîtro,* Hort.). Tall thistle-like plant, with pinnate-lobed lvs., which (like the sts.) are tomentose beneath, the lobes lanceolate or linear and cut, but not spiny: involucre scales setiform, the inner ones much shorter: fls. blue, very variable. G.M. 46:69. R.H. 1890, p. 524. G. 31:611. Var. **tenuifòlius,** DC. (*E. ruthénicus,* Hort.), has the lower lvs. more narrowly cut, more or less spine-tipped. Gn. 45:174.—Perennials of S. Eu., growing 2–3 ft. high. They bloom all summer. Lvs. sometimes loosely webby above.

Tournefòrtii, Ledeb. (*E. Tournefourtiàna,* Hort.). Three to 4 ft., the sts. branched and velvety: lvs. rough above, white-hairy below, much divided into 5 linear segms., spiny: heads "silver-gray" (bluish), the involucral bracts free, bristly. E. Medit. region. Sept. B.M. 8217. R.H. 1906, p. 523.—Suitable for dry places.

AA. *Lvs. pubescent or setulose above.*

B. *Plant perennial.*

sphærocéphalus, Linn. Tall (5–7 ft.): lvs. pinnatifid, viscose-pubescent above, tomentose below, the teeth of the broad lobes yellow-spined: fls. white or bluish, the involucral bracts subulate-acuminate, free. S. Eu. B.R. 356 (as *E. paniculatus*).



1377. Echinopsis gemmata.

hûmilis, Bieb. Three to 4 ft.: lvs. very hairy on both surfaces, webby above, those of the st. essentially entire, the radical lvs. sinuate-lyrate, almost unarmed; st.-lvs. with spiny tips: heads large, blue, the involucral bracts all distinct and free. Sept. Asia.

bannâticus, Rochel. Lvs. hairy-pubescent above, tomentose beneath (as also the sts.), the lower ones deeply pinnately parted, the upper pinnatifid, spiny: fls. blue. Hungary. R.H. 1858, p. 519.

BB. *Plant biennial.*

exaltâtus, Schrad. Tall, the st. nearly simple and glandulose-pilose, the lvs. pinnatifid, scarcely spiny: fls. blue. Russia. B.M. 2457 (as *E. strictus,* Fisch.).—Distinguished by its simple, erect st. The garden *E. commutâtus* may be the same as this.

E. nivâlis, Hort., is a trade name that is unknown in botanical literature.

N. Taylor.†

ECHINÓPSIS (Greek, *hedgehog-like*). *Cactàceæ.* Sea-Urchin Cactus. South American small condensed cacti.

Stems spherical to ellipsoidal or rarely columnar: ribs prominent and usually sharp-angled: fls. usually long trumpet-shaped; ovary and tube covered with linear-lanceolate, cuspidate bracts which become longer toward the outer end of the tube, where they pass gradually into the outer petals, in their axils bearing long, silky, wavy hairs and usually a few rather rigid bristles.—This is a well-marked genus of about 18 species, although by some authors combined with Cereus. Cult. as for Echinocactus; see also *Succulents.*

Only a few species of Echinopsis are grown in this country, although they are more easily grown and propagated than most of the United States species of cacti. The genus is well adapted for use as window plants.

A. *Ribs of st. divided into more or less evident tubercles.*

Péntlandii, Salm-Dyck (*Echinocáctus Péntlandii,* Hook.). St. simple, later branching, spherical or ellipsoidal, reaching 6 in. diam.: ribs 12–15, divided between the areoles into oblique compressed tubercles: radial spines 9–12, spreading, straight or slightly curved, yellowish brown, the upper the longest and strongest, reaching ½–1¼ in.; central solitary, or seldom in pairs, porrect, curved, 1–1½ in., rarely 3 in. long: fls. lateral, 2–2½ in. long, yellow, orange, pink to scarlet-red: fr. spherical, green, ¾in. diam. Peru, Bolivia. B.M. 4124.—Probably not of this genus.

AA. *Ribs of sts. not divided.*

B. *Fls. red or pink.*

múltiplex, Zucc. Sts. at first rather clavate, later globose to ellipsoidal, abundantly branching, 6–12 in. diam. and the same in height, or rarely taller, light green to yellowish: ribs 12–14, straight, scarcely undulate: radial spines about 10, subulate, straight, yellow to yellowish brown, with darker tips, reaching ¾in. length, very unequal, horizontally spreading; centrals mostly 4, of these the lowest is the longest, reaching 1½ in., somewhat porrect at first, later curved and deflexed, darker colored than the others: fls. rare, lateral, 11–15 in., rose-red. S. Brazil. B.M. 3789. Var. **cristâta,** Hort. Sts. flat and spreading in growth, like an open fan or the fl.-stalk of the common garden cockscomb: spines reduced to fine, stiff bristles. This is merely a monstrosity of the species.

oxygòna, Zucc. Sts. at first simple, nearly spherical or rarely clavate, becoming short columnar, reaching 1½ ft. height and 1 ft. diam., gray-green, darker above: ribs 13–15, straight or wavy at the base: radial spines 5–15, horizontally spreading, very unequal, reaching ⅝in., subulate, obliquely upright; centrals 2–5, somewhat longer, straight, porrect or deflexed, dark horn-colored, with black tips: fls. commonly many together, lateral, reaching 13 in. length, pink to carmine-red, the inner petals lighter than the outer ones. S. Brazil.

triúmphans, Jacobi. This is a hybrid between *E. Eyriesii* and *E. oxygona,* with pink double fls.

BB. *Fls. white.*

Eyrièsii, Zucc. St. simple, commonly branching later, at first somewhat depressed, later short to rather tall columnar, reaching a height of 2 ft. and a diam. of 4–6 in., dark green: ribs 11–18, straight, undulate, with sharp-angled margins: radial spines about 10, scarcely more than ⅛in. long, rigid, straight, slender conical, pointed, dark brown to black; centrals 4–8, but very little different from the radials: fls. lateral, 10–15 in. long, white: fr. small, ellipsoidal, about 1 in. long. S. Brazil, Uruguay and Argentina. B.M. 3411. B.R. 1707 (as Echinocactus).

gemmâta, K. Sch. (*E. turbinàta,* Zucc.). Fig. 1377. St. simple or sometimes branching, at first low spherical or short columnar, later more top-shaped, reaching 1 ft. height by 4–6 in. diam., dark green: ribs 13–14, rarely more, straight or sometimes slightly spiral with sharp or obtuse margins, which are but little or not at all undulate; central spines appear first, about 3–6 in number, very short, stiff, black; later the radials appear,

about 10–14, longer, horizontally spreading, at first yellowish brown, later horn-colored: fls. lateral or from the upper areoles, 9–10 in. long, clear white, with a pale greenish midline in the petals. S. Brazil.

tubiflòra, Zucc. (*E. Duvàlii,* Hort. *E. Zuccarinii,* Pfeiff.). Sts. spherical to ellipsoidal, at first simple but later more or less branching, reaching 10 in. height by 8 in. diam., dark green: ribs 11–12, straight, with margins inconspicuously undulate: radial spines numerous, sometimes as many as 20, unequal, horizontally or obliquely spreading, yellowish white with brown tips, sometimes darker; centrals 3–4, the lowest the longest, reaching ⅝in., later deflexed: fls. lateral, about 14 in. long, white with pale green midline in the petals. S. Brazil and Uruguay. B.M. 3627.

C. H. THOMPSON.

ECHINOSPÉRMUM: *Lappula.* J. N. ROSE.†

ECHINÓSTACHYS (Greek, *spiny head*). *Bromeliàceæ.* About a half-dozen species allied to Æchmea (with which some writers unite it), from S. Amer. Outer fl. parts bristly; petals broadly clawed, with 2 fringed scales or glands; ovary thick and fleshy, 3-seeded; spike cylindrical, thin, club-shaped: lvs. small, becoming darker after flowering. The species require hothouse conditions, as for Æchmea and related things. Three names have appeared in the American trade: *E. Hýstrix,* Wittm., for which see *Æchmea Hystrix.* **E. Pineliàna,** Wittm. (*Æ. Pineliàna,* Baker). Two to 3 ft.: peduncle and bracts brilliant red: lvs. 12–18 in. long in a rosette, strap-shaped, deltoid at summit, spine-edged: spike dense, 2–3 in. long, spiny; petals golden yellow and becoming black-brown, the tips fringed and incurved. Brazil. B.M. 5321. **E. Van Houtteàna,** Van Houtte (*Æ. Van Houtteàna,* Mez. *Quesnèlia Van Houtteàna,* Morr.). Lvs. many, strong-spined, sometimes white-banded beneath: fls. white, blue-tipped, in a crowded spike, the bracts reddish at the summit and white-downy at the base: 1–2 ft. Brazil.

L. H. B.

ECHÎTES (Greek, *viper;* possibly from its poisonous milky juice or from its twining habit). *Apocynàceæ.* Tropical American twining shrubs related to Dipladenia, and of similar culture.

The genus differs technically from Dipladenia in the 5-lobed disk and the glandular or 5-scaled calyx. Lvs. simple, opposite, penninerved: fls. usually showy, purple, red, yellow or white, in sub-cymose clusters; calyx small, 5-lobed, with many glands at the base inside or else 5 scales opposite the lobes; corolla salver-shaped, the throat usually contracted, the limb 5-lobed; stamens included, the filaments very short; stigma with an appendage in the form of a reversed cup or of 5 lobes.—Some 40 species, S. Fla. to Chile.

Andrewsii, Chapm. (*E. suberécta* Andr.). Lvs. 1½–2 in. long, close together, oval or oblong, mucronate, acute or rounded at the base, margins revolute: peduncles axillary, 3–5-fld., shorter than the lvs.; fls. yellow, 2 in. long; corolla-tube much dilated above the insertion of the stamens, bell-shaped, scarcely longer than the lobes; anthers tapering into a long bristle-like awn. Sandy shores, S. Fla., W. Indies. B.M. 1064. P.M. 7:101.

paludòsa, Vahl. Lvs. oblong, oval-oblong, or lanceolate-oblong, rounded toward the mucronate top: calyx-segms. glandular, devoid of an interior scale, oblong, mucronate-blunt, spreading; corolla-tube funnel-shaped above a cylindrical base; anthers oblong-lanceolate, acuminate, rounded-cordate at the base, hirsute on the back above. Mangrove swamps, S. Fla.

umbellàta, Jacq. Lvs. ovate or ovate-roundish, mucronate: fls. greenish white; calyx-segms. glandular, devoid of an interior scale; corolla-tube cylindrical, enlarged below the middle, tapering again above; anthers rigid, tapering from a hastate base, glabrous. S. Fla., W. Indies.

WILHELM MILLER.

ÉCHIUM (from the Greek for a *viper*). *Boraginàceæ.* VIPER'S BUGLOSS. Coarse, mostly rough herbs and shrubs, with spikes of blue, violet, red or white flowers, some of them grown in the open and others under glass.

Plant usually scabrous, hispid or canescent: lvs. alternate: fls. in unilateral, scirpioid, forked or simple spikes, with either small or foliaceous bracts; calyx with 5 narrow lobes; corolla tubular-trumpet-shaped, the throat oblique and dilated and without appendages; corolla-lobes 5, roundish and unequal, somewhat spreading or erect; stamens 5, inserted below middle of tube, unequal and exserted; ovary deeply 4-lobed; style filiform, 2-parted at top: fr. 4 nutlets.—Some 30–40 species, from the Canaries and Madeira (where they are specially important) to W. Asia. One species, *E. vulgare,* Linn., is a showy intro. biennial weed in fields and along roadsides, with blue or rose-tinted fls.; it is known as blue-weed and blue-devil. The shrubby species of Madeira and the Canaries are much confused, some of the names having been established on cult. material. This is particularly true of the forms passing as *E. candicans* and *E. fastuosum,* which are very unsatisfactorily determined (See Hooker, B.M. 6868). In those islands, the plants produce much forage and they persist from the goats in inaccessible places. (The portraits quoted below are cited under the names they bear.)

In rich soil echiums grow coarse and scarcely flower, and the flowers are never as richly colored as when the plants are more or less starved. Biennials seed freely, and the seed is sown as soon as gathered. *E. fastuosum* is said to be the handsomest of the shrubby kinds, grows 2 to 4 feet high, has long, pale green leaves covered with soft white hairs, and flowers of a peculiarly brilliant deep blue. Echiums are eminently suited for dry places, and need good drainage.

cándicans, Linn. f. (*E. fastuòsum,* Jacq. f., not Ait. *E. truncàtum,* Hort.). Forms a bush several feet high, but flowers at 3 ft., the lvs. and sts. white-hairy: branches thick, leafy toward the tips: lvs. lanceolate, the upper ones smaller, crowded and narrower: panicles much looser than the spikes of *E. fastuosum;* fls. sessile, pale blue, the buds reddish purple, the pink stamens protruding. Madeira, Canaries, on mountains. B.M. 6868. B.R. 44. G.C. III. 51:368. G.M. 55:376.—The fls. are said sometimes to be streaked with white or all white.

fastuòsum, Ait., not Jacq. This has darker blue fls. in a dense spike and perhaps less hoary foliage than *E. candicans,* the protruding filaments nearly white (said by some to be white in *E. candicans*). Coast, Canaries. R.H. 1876:10. Gn. 10:546. G.C. III. 33:328. G.W. 15, p. 356.—*E. fastuosum* has dark blue, 5-lobed fls. about ½in. across, in spikes 6 in. long and 2 in. wide, perhaps as many as 200 fls. in a spike. Great masses of stamens are thrust out and add to the interest, and the young fl.-buds look like pink 5-pointed stars.

símplex, DC. Woody but biennial and not branched, 8–10 ft.: lvs. ample, oval-lanceolate: panicle very long, cylindrical, spike-like, the spikelets 2-fld., pedicelled; stigmas simple. R.H. 1912, p. 351. Gt. 51, p. 375. G.C. III. 53:20.

E. Auberiànum, Hort., not Webb & Berth.=E. Bourgeanum.—*E. Bourgeànum,* Webb. Stout and strict, 8–11 ft., the st. covered with long-linear drooping lvs.: fls. rose-colored, in a dense pyramidal spike. Mountains, Canaries. R.H. 1912, p. 440. G.C. III. 53:25. A striking plant.—*E. callithýrsum,* Webb. Woody or tree-like, robust, hispid-hairy: lvs. strongly nerved: calyx-segms. very unequal: fls. pale red: floral lvs. exceeding the different cymes of the thyrse. Canaries.—*E. formòsum,* Pers.=Lobostemon.—*E. Pininàna,* Webb. & Berth. Very large species, reaching 16 ft., with an abundance of stout spreading long-oblong lvs. G.C. III. 53:20.—*E. Wildprètii,* Pears. A tall soft-hairy biennial, with simple erect st. 2–3 ft.: lvs. sessile, narrowly linear-lanceolate, hairy: fls. pale red with long-exserted filaments, in a large terminal thyrse: floral lvs. much exceeding the different cymes. Canaries. B.M. 7847. G.C. III. 38:5; 52:317. G.M. 53:111. Gn. 76, p. 363. G. 27:261.

WILHELM MILLER.
L. H. B.†

EDELWEISS: *Leontopodium.*

EDGEWÓRTHIA (after M. P. Edgeworth, English botanist in East Indies, and his sister Maria). *Thymelæàceæ.* Ornamental woody subjects grown chiefly for their early yellow and fragrant flowers and for the handsome foliage.

Deciduous sparingly branched shrubs, with stout branches: lvs. alternate, entire, short-petioled, crowded at the end of the branches: fls. in dense, peduncled heads, axillary, on branches of the previous year, with or before the lvs., apetalous; calyx-tube cylindric, with 4 spreading lobes, densely villous outside; stamens 8, in 2 rows; style elongated, stigma cylindric: fr. a dry drupe.—Two species in Japan, China and Himalayas.

These plants are hardy only in warmer temperate regions, but do not stand hot and dry summers; they thrive in any good well-drained garden soil; if grown in pots, a sandy compost of peat and loam, with sufficient drainage given, will suit them. Propagation is by greenwood cuttings in spring under glass; also by seeds.

papyrífera, Zucc. (*E. chrysántha,* Lindl. *Dáphne papyrífera,* Sieb.). Small shrub with thick branchlets: lvs. deciduous, membranous, elliptic-oblong to oblong-lanceolate, acute at the ends, at first clothed with silky hairs on both sides, later glabrous above, 3–5 in. long: heads of fls. dense, up to 2 in. across, on short axillary stalks; fls. ¾in. long, densely silky-hairy outside, fragrant, yellow, drying whitish; ovary pubescent only at the apex. April. Japan, China. B.R. 33:48. F.S. 3:289.—Cannot withstand the long dry summers.

Gárdneri, Meisn. Large shrub, with slenderer branchlets: lvs. persistent, of firmer texture: fls. with a more shaggy pubescence, drying black; ovary hairy throughout: otherwise very similar to the preceding species which is, by some botanists, considered not specifically distinct. April. Himalayas. B.M. 7180.

ALFRED REHDER.

EDRAIÁNTHUS: *Wahlenbergia.* By some kept distinct, to include about a dozen species. Spelled also *Hedræanthus.*

EDUCATION, HORTICULTURAL. In the United States and Canada, instruction in horticulture is part of the publicly maintained colleges of agriculture. In Canada, these colleges are provincial rather than national or established by the Dominion. The Canadian colleges of agriculture are: Nova Scotia and New Brunswick, Truro, N. S.; Quebec, Sainte Anne de Bellevue (only in part provincial); Ontario, Guelph; Manitoba, Winnipeg; Saskatchewan, Saskatoon; British Columbia, in plan at the university being established at Victoria.

In the United States, general horticultural education is mostly a part of a national system of professional and applied education of collegiate grade or name. There is a college of agriculture in every state in the Union, being part of a national system with coöperation and aid from the State. (For list, see *Experiment Stations,* p. 1195.)

There is little development, as yet, in North America of the training-school idea on either a private or a public basis, and relatively few institutions or establishments in which persons are trained for "gardening," as they are trained in the Old World. There is no recognized apprentice system for gardeners. The whole subject, therefore, needs to be considered quite by itself and not in comparison with systems or methods of education in horticulture in other and older countries; and it is necessary to understand something of the system of publicly endowed industrial education, of which instruction in horticulture is a part. The general nature of these institutions in both Canada and the United States may be understood from a brief discussion of the land-grant institutions in the latter country.

The public industrial education of the United States, of college grade, is founded on the Land-Grant Act of 1862. By the terms of this great instrument, every state received from the federal government 30,000 acres of land for every representative that it had in Congress, the proceeds of which are to be used for "the endowment, support, and maintenance of at least one college where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislature of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life." This endowment has been supplemented by subsequent direct federal appropriations, to further the objects for which the original grant was made. On this foundation, all the forty-eight states comprising the Union have established colleges of agriculture and the mechanic arts, about half of them separate institutions and about half of them connected with or part of state universities or other general institutions. The states themselves have supplemented and extended the proceeds of the land-grant. These and the Canadian colleges represent many types of organization and method. Their purpose is increasingly to train young men and women broadly by means of agricultural and country-life subjects. They are now exerting great influence in re-directing rural civilization. They are rapidly putting agricultural and rural subjects into educational form, and are demonstrating that such subjects may have training and even cultural value equal to that of historical subjects.

The agricultural colleges contain many departments, and horticulture is usually one of these departments, coördinate with the others. Some of these departments, aside from the work in the fundamental arts and sciences, are as follows: agricultural chemistry, agronomy, entomology, plant physiology, plant pathology, bacteriology, plant-breeding, soils, farm crops, farm management (the principles of business as applied to farming), horticulture, pomology, floriculture, forestry, animal husbandry, poultry husbandry, veterinary, dairy industry or dairy husbandry, home economics, farm mechanics and engineering, rural economy or agricultural economics, landscape gardening or landscape art, drawing, rural education, meteorology, and extension teaching. It will be seen, therefore, that horticulture is only one contributing part in an educational establishment for the teaching of agriculture in a broad way.

Aside from these publicly endowed or maintained institutions, there are a few other regular colleges that teach horticulture with other work, but they have not made great headway, although the subject may assert itself strongly in some of them in the future. There are two or three training-schools, one for women. More training-schools will be needed.

The students in agriculture in the colleges of agriculture number many thousands, in some cases 1,000 and more in one institution. They come from all walks and conditions of life, and from city and country alike. Some of them, of course, have strong inclinations for horticulture, and soon specialize in that subject. The full course of instruction is four years, following college entrance requirements, and the student at graduation receives a diploma carrying Bachelor of Science or a similar degree. In many of these institutions, post-graduate work in a variety of subjects is provided, leading to a master's degree or even to a doctor's degree.

The first institutions to develop horticulture as a separate subject appear to have been those in Michigan, under W. W. Tracy, Chas. W. Garfield and successors, Mr. Tracy having been instructor in horticulture as early as 1867; New York (1874) and in Ohio under

W. R. Lazenby; and in Iowa (1876) under J. L. Budd. The instruction by means of horticulture has now grown to great importance in many of the colleges, the staffs comprising, in some cases, as many as fifteen to thirty persons.

The horticultural work in the colleges.

We may now consider the horticultural teaching work of these colleges in more detail.

In the early days of such instruction, the horticulture was set over against the agriculture, and these two comprised the main applied groups. The breaking-out of the group of horticulture was really the beginning of the broadening of these institutions and of their more perfect articulation with the conditions before them.

Horticulture, as understood in these colleges, comprises fruit-growing, flower-growing, vegetable-gardening, together with the nursery and glasshouse subjects naturally associated with them. With the further differentiation of the curriculum, horticulture tends to be split or separated into its three main parts, with separate units or teacherships for each, but this division has not yet proceeded far in most of the institutions. If this division is ever carried to its conclusion, the name "horticulture" as an educational unit may pass out.

In the colleges, horticulture is regarded as a phase of the general agricultural field. For the most part, the student approaches the subject from the point of view of farming by means of fruits or vegetables or even of flowers. The strictly amateur phase is incidentally emphasized as a rule, and this undoubtedly is one of the weaknesses of the American horticultural instruction. The amateur attitude, however, will appear more markedly as the country develops and matures. The present attitude very well represents the development that America is now making, as expressed particularly in the great orchard interests. The gardeners, as a group, have had relatively little touch with these institutions in the way of dictating or even influencing their development. So far as institutions are concerned, the gardening phase of horticulture is well expressed where the great collections are, as at the Shaw or Missouri Botanical Gardens, Arnold Arboretum, New York Botanic Gardens, and others; and these institutions will also produce highly trained specialists in small numbers in related scientific lines.

The content of the work in the land-grant colleges varies greatly, depending, of course, on the constituency of the particular college as well as on the staff. Naturally, in the states in which horticultural interests are large, the work will express itself strongly in the college. Some of the courses in horticulture now offered in different colleges of agriculture may be displayed, showing how the subject is divided and what is considered to be the content of the instruction. These examples are chosen only to show the kind and the range of representative courses, and the writer makes no comment on them. Other courses might be chosen from the catalogues, but these are sufficient for illustration. In some cases, practically the same subject is entered twice: this represents the way in which the subject is phrased in different institutions. Some of the courses in landscape work that are given by departments of horticulture are also included.

Elements of horticulture.—Fruit-growing, vegetable-gardening and ornamental planting, with special reference to the farm home.

Gardening.—A personal and informal course for lovers of plants and gardens. The course consists of actual work with identification and growing plants, supplemented by conferences and informal discussions. Attention is given to garden literature and history, planning of grounds.

Cultivated plants.—The relationship and classification of certain economic and ornamental plants of the temperate zone; identification of species; examination of living plants and herbarium specimens.

Evolution of horticultural plants.—History, botanical classification, and geographical distribution of cultivated plants; modification under culture; theoretical causes and observed factors that influence variation, particularly food-supply, climate and cross-fertilization.

Amateur floriculture.—Window-gardening; growing of flowers on the home grounds; containers; potting soils; fertilizers; preparation and planting of flower-beds; propagation and culture of plants suitable for window and garden.

Commercial floriculture.—Studies in the propagation and culture of the leading florist crops. As facilities permit, students are assigned space in the greenhouses for practical experience in the growing of roses, carnations, chrysanthemums, violets, sweet peas, and other plants. Discussions on diseases, insects, botany, and the packing, handling, and marketing of cut-flowers and plants for retail and wholesale markets. Classes participate in a required excursion.

Garden flowers.—Designed to acquaint the student with garden plants and to give practical knowledge of the propagation and culture of the annuals, herbaceous perennials, bulbs, and shrubs used for cut-flowers or in ornamental planting.

Greenhouse construction.—The development of the modern greenhouse; types of houses, materials, and methods of construction, installation of heating systems, etc. Laboratory practice in erecting section of cypress and iron frame houses, and in planning and estimating the cost of commercial ranges for flower- and vegetable-production. The class participates in a required excursion.

Greenhouse management.—Studies of the principles and practice of propagation, soils, potting, shifting, watering, ventilation, and fumigation of plants cultivated by florists.

Conservatory plants.—A study of the culture and uses of tropical and subtropical plants grown in conservatories, including palms, ferns, begonias, orchids, etc.

Floral design.—A study of the principles of floral art. Practice in the arrangement of flowers in designs and bouquets, baskets, table decorations, interior decoration, etc.

Greenhouse and garden practice.—Designed to give the student practical knowledge of greenhouse work. Lectures and exercises in greenhouse management, propagation, composting soils, potting, watering, etc.

Investigation in floriculture.—The investigation of problems in the growing of cut-flowers, exotics, and garden flowers; hybridizing; study of varieties. Designed primarily for upper classmen and graduate students.

Elements of landscape gardening.—Reconnaissance surveys and mapping, with special reference to the methods used in landscape gardening; detailed study of selected designs of leading landscape gardeners; grade design, road design and field work.

General design.—Field notes; examination of completed works and those under construction; design of architectural details, planting plans, gardens, parks and private grounds; written reports of individual problems.

Civic art.—The principles and applications of modern civic art, including city design, city improvement, village improvement, and rural improvement.

Trees and shrubs.—Plant material important to landscape gardening; landscape value of each plant with respect to adaptability to the soil and situation and the use of the plant in design.

Advanced landscape design.—Real estate subdivisions and a complete set of plans, including a sketch plan, general plan, report, detailed study of architectural features, grading plans, planting plans, set of specifications, and estimate of cost.

Landscape practice.—Interpretation of topographic maps and their relation to landscape design; calculation of cut and fill; quantities of material; preparation of grading plans and working drawings.

Exotics.—Temporary decorative plants used in landscape gardening.

Plant materials.—This course aims to make the student familiar with the character of the trees, shrubs and herbaceous perennials used in ornamental work, and with the methods of propagating them.

Decorative and bedding plants.—Tropical and subtropical plants used in decorative work in the conservatory; tender plants used in outdoor bedding.

Home vegetable-gardening.—A study of vegetables and their production for home use. The planning and management of the garden, special crop requirements, factors influencing quality, and control of pests, will be considered. The laboratory work consists of actual practice in the garden. The starting of early plants in hotbeds and frames, intercropping and succession-cropping to secure largest yields from small areas, are studied. Each student assumes charge of his own plants and carries them through to the end of the term.

Commercial vegetable-gardening.—The principles of vegetable-growing as applied in commercial production; the scope of the industry and its opportunities; choice of location; equipment; management. The vegetable crops are considered singly, as to their adaptation, culture, special requirements, varieties, enemies, marketing, and profits. The laboratory work includes exercises in growing plants under glass and in the planting and care of early outdoor vegetables. Each student assumes full charge of his own plantings.

For students specializing or desiring a fuller knowledge of vegetable-gardening, another course is given, throughout the year. Advantage is taken of the opportunity for practice in harvesting, packing, and marketing fall crops. A two-days' excursion to two or three important vegetable-growing centers some time during May constitutes a part of the course. Each student gives a part of his time to a special problem, to be agreed on. Report on this problem is presented in typewritten form.

Vegetable-forcing.—Vegetable-growing under glass. Important

forcing crops. Laboratory consists of practical work in crop-production. Each student is assigned a plot in the greenhouse on which he grows vegetables to maturity, assuming full charge except in heating and ventilation. This is supplemented by descriptive studies.

Systematic vegetable crops.—Lectures and descriptive studies dealing with vegetable crops, their origin and botany. Special attention is given to varieties, and their adaptation to different cultural and market conditions. The important commercial types of the different vegetables are grown in the garden each year, and there is an abundance of first-hand material for the course.

Advanced vegetable-gardening.—The student's time is divided between advanced studies of vegetable crops and their culture and the study of a special problem to be agreed upon. An excursion to two or three important vegetable-growing centers constitutes a part of this course.

Elementary pomology.—A study of the methods of propagation and early care of commercial fruits, including the growing of seedlings, cuttings, and layers; the principles of budding, grafting, pruning, and planting; the soils, varieties, and planting plans for the orchard.

Practical pomology.—A study of the soils and varieties for the orchard; cultivation, cover-crops, fertilization, spraying, pruning, and thinning as practised in orchard management; the picking, grading, packing, storing, and marketing of fruit. This course considers the apple, pear, quince, cherry, plum, apricot, and peach.

Systematic pomology.—A study of the varieties of the different fruits and of nomenclature, with critical descriptions; special reference being given to relationships and classification.

Bush-fruits.—A lecture course which considers the grape, raspberry, blackberry, dewberry, currant, gooseberry, and strawberry. The topics discussed are: varieties, planting, culture, picking, grading, packing, and marketing.

Small-fruits and grapes.—The strawberry, raspberry, blackberry, dewberry, currant, gooseberry, grape. History; extent of cultivation; soil; location; fertilizers; propagation; planting; tillage; pruning; insect enemies; diseases; varieties; harvesting; marketing.

Spraying of fruit trees.—A study of the preparation and application of the spray mixtures used in orchard practice.

Nuciculture.—Lectures on the practical and systematic phases of nut-culture, with special reference to the cultivation and improvement of the forms native to the United States.

Subtropical pomology.—A study of citrous and other tropical fruits, with special reference to American conditions. Laboratory work in describing and judging the various fruits.

Plant-propagation.—Grafts; buds; layers; cuttings; seeds.

Systematic pomology.—A course designed primarily for graduates and students who are preparing to do experimental work. A study of the characters and botanical relationships of the fruits of the United States. Each student is required to collect and mount a number of varieties and species.

Research in pomology.—Original investigation of problems in pomology. A typewritten thesis is required.

The equipment for the horticultural work usually consists of classrooms, laboratories with tables and sometimes equipped for microscopic work, and herbaria; workrooms in which practice may be had in the mixing of soils, the compounding of spraying materials, the testing of machines, the study of vegetables and fruits, and the like; range of glasshouses; and a number of acres of land for gardens and orchards. Sometimes the orchard area amounts to fifty and more acres. In some colleges the plant-breeding is included with the horticulture; and in some of those that are least differentiated the plant pathology and economic entomology are also included, as also forestry. In the courses detailed above, all these subjects are excluded as horticulture, since they are likely to be handled in regular departments by themselves in numbers of different courses.

The subject of landscape architecture, or landscape gardening, has developed in the institutions in the United States from two sides. When it is an offshoot of colleges or departments of architecture, or when strongly dominated by architectural ideas, it is likely to be known as landscape architecture. In the agricultural colleges, however, the subject has developed mostly from the horticultural or gardening side, and has usually been called landscape gardening. As a part of the curriculum, landscape gardening is given more or less attention in nearly all the land-grant institutions. In three or four of them, however, the subject is now being given special and professional attention, as also at Harvard. Two institutions in this country give a post-graduate degree, Master of Landscape Architecture or Master of Landscape Design.

Other forms of horticultural teaching.

The colleges of agriculture are engaged rather largely in extension work, the extension meaning all educational efforts prosecuted at the homes and on the farms of the people. The extension work is welfare work, and it is properly a necessary part of an institution that is maintained by the people for the service of the people. Some of this extension work is horticultural. It comprises tests and experiments in orchards, gardens, and greenhouses; coöperation with growers' associations; surveys of conditions and industries; the issuing of popular bulletins and other literature; lecture-courses, reading-courses, and much correspondence. See *Extension Teaching in Horticulture*, page 1199.

The experiment and research work of the institutions is also of course educational, but this effort is reserved for separate discussion. See *Experiment Stations*, page 1195.

In the public schools, there is now a strong sentiment for the introduction of agriculture. This pertains in all parts of the United States and Canada. This agricultural instruction will be organized eventually on the same basis as other instruction in the common schools. Agriculture will include a great variety of subjects, the horticultural affairs being given their due consideration. This will result in a gradual redirection of the youthful mind toward horticultural and other rural pursuits.

The nature-study movement is widespread and established, and the material of the teaching is largely of plants. School-gardening is growing in popularity and importance. All these subjects are finding their way into normal schools and colleges, in some of which there is definite horticultural work for the training of teachers. Correspondence courses, the rural press, state departments of agriculture, and other agencies and enterprises are also forwarding horticultural education as a part of the general rural betterment.

In the United States and Canada, horticulture is largely a training for citizenship, on the basis of general collegiate education. The Americans have had a continental area to discover and to conquer; they are endeavoring to conquer it by many means, and the most fundamental means is by organizing all industry educationally. The horticultural subjects are important not only in themselves but in their personal appeal, and the organizing of horticultural knowledge into large plans and methods of human training is one of the best privileges of any people.

L. H. B.

EEL-GRASS: *Vallisneria spiralis.*

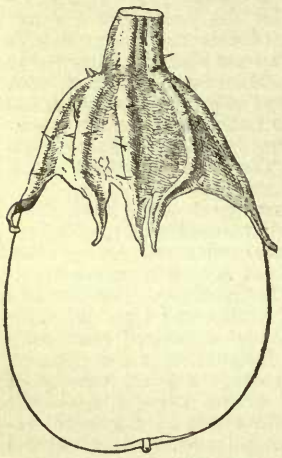
EGGPLANT (*Solànum Melongèna*, Linn.). *Solanàceæ.* GUINEA SQUASH. AUBERGINE of the French. Strong perennial herb or sub-shrub, grown as a vegetable-garden annual for its large fruits, which are eaten cooked; requires a long warm season.



1378. Rotate corolla of eggplant; stamens connivent.

The eggplant is native of the tropics, probably from the East Indies, but its native land is not known. It is cultivated to a greater or less extent throughout the entire tropical regions. The first reports of its use as a vegetable come from India, hence the above assumption. In the United States it is cultivated as a vegetable as far north as New York, but it usually grows to greater perfection in the southern states. It is much grown in Florida. The demands for it in the early months of the year have not been fully supplied. Its cultivation demands a specialist as much as either celery or tobacco, while the specialization must be in a different direction from that of either one of these. Nearly all of the fruit

that grows to proper size is edible, and there is no special demand for particular flavors. Eggplants are forced under glass to a limited extent for home use. They require the temperature of a tomato house, and great care must be taken to keep off red-spider and mites. In order to insure large fruits, practise artificial pollination. Non-pollinated fruits will grow for a time, but always remain small (Fig. 1379).



1379. Non-pollinated fruit.

Soil.—Eggplant will grow on almost any land in the South, but it develops to greater perfection on a rich, deep, loamy soil free from debris. In the clay districts this is not easily secured, but there are often small fields that are sufficiently dry and yet contain enough sand to make eggplant-growing profitable. No matter whether clay land, loam or sandy land be employed for raising this crop, it will be necesssary to plow deeply and thoroughly. The land should be drier than that required by cabbage or beets. In fact it will stand a greater drought than the ordinary vegetables. On the other hand, one should not attempt to grow a crop on land that is composed of large particles, such lands as are ordinarily called "thirsty" in the vegetable-growing sections of Florida.

Fertilizer.—On the coastal plains of the South Atlantic and Gulf States, barn manure is of doubtful value for fertilizing eggplant. When it is advisable to use this material, it is preferable to compost it and use it in the form of well-rotted stable manure. A cheaper and at the same time preferable way of securing the humus necessary in the loamy sands is to grow leguminous plants that are not subject to root-knot. Such plants will give much more humus and at a cheaper price than can be obtained by the use of stable manure. On the loamy sands, the fertilizer should not be applied until after the plants have been set out and have started. A small quantity is then applied by hand or by drill. On very poor land, as much as 200 to 500 pounds of a good home-mixed fertilizer should be used. In the course of two to four weeks, the eggplants will have shown the effect of the fertilizer and by this time will be making a considerable growth. A second application may then be made of as much more, or twice as much as was used the first time. Later in the season, when the plants are beginning to make bloom buds or setting the fruit well, an after-dressing of nitrate of soda could be applied if the plants show need of further fertilizing, using it at the rate of 100 to 300 pounds to the acre. This can be applied very readily by hand or by the use of a fertilizer drill. The hand method is more economical of fertilizer but more costly in applying. On the heavy clay lands less potash will be needed and in those places in which a stiff clay is employed for gardening purposes, the potash may be reduced to 4 or 5 per cent, or even eliminated. Ammonia and phosphoric acid are needed on nearly all the soils.

Propagating the seedlings.—The time required to bring plants into bearing from seeds varies with the condition of the soil and the temperature. During cool weather the plants grow very slowly, but during hot weather they grow rapidly and mature fruit in much less time. Those who wish to have early fruit and are able to use hotbeds or propagating-houses should sow the seed 120 to 150 days before the fruit is wanted. Prepare the hotbeds as for other seedlings, and sow in rows a few inches apart. When these are beginning to show their leaves or when the seedlings are beginning to look spindly, they should be pricked out and transferred to another bed. In this each plant should be given about a 2-inch square; then they may be forced until the plants crowd one another in the bed, when they should be transferred again. When the plants have attained the size of 6 inches, and the atmosphere will permit, they may be set out in the field. A somewhat more laborious, but at the same time more successful plan, is to plant the seedlings in 2-inch flower-pots and then shift to larger ones as often as the plants become pot-bound or crowd one another in the bed. Fig. 1380 represents a plant three-tenths natural size, just taken from a flower-pot and ready to be shifted to a larger one. By shifting until 6-inch pots are reached, the eggplant may be forced along without injury to blooming size or even to a size when fruit is beginning to set, and then set out in the field without injury to the plants or crop. Eggplant-growers should bear in mind constantly that from the time of sprouting the seeds to the harvesting of the crop, the plants cannot stand a severe shock in their growth without detriment to the crop. When the plant is once started, it should then be forced right along and never allowed to become stunted during its growth. The amount of damage done by neglecting plants before they are set in the field varies with the severity of the shock and the length of time during which the plant undergoes the disadvantageous conditions. If it becomes necessary to harden the plants off before setting them in the field, this should be done gradually.

Culture in the field.—After the field has been thoroughly prepared in the way of plowing and fertilizing, which should have been done at least two weeks before the plants were set out, the rows should be laid off 3 to 4 feet apart. The plants may be set 2 to 4 feet apart in the row, varying with the varieties to be used and the soil. Tillage should be continued and varied according to the conditions of the weather. In a wet season it is well to cultivate the land as deeply as possible, while in dry weather cultivation should be shallow, simply sufficient to keep the weeds from growing, to keep the soil well aired, and to keep mulching of dry soil on the land. Under ordinary circumstances it does not pay to prune or pinch out the buds, but when the season is short this may be resorted to with some advantage. If it is desirable to have the fruit attain a certain size before frost, one may begin to pinch out the blossoms and new growth about three weeks before its usual occurrence. This same process will be of advantage when the fruit is to be brought into market at a certain time. A great many attempts have been made to hold eggplants over the summer, that is to have a spring cropping and then allow the plants to remain in the field, cultivate them up and make a fall crop from the old stalks. Sometimes this process is successful but generally speaking it is a wasteful and expensive method. The old plants that have borne a crop should be discarded and a fresh seed-bed started to bring the plants in at the



1380. Pot-grown plant ready for setting in the field.

time desired. If about 150 days are allowed from the time of sowing the seed, the grower will have a good field of fresh plants to start in with, which will produce a higher quality and larger quantity of fruit.

Marketing.—It is better to cut the fruit from the plant than to attempt to break it, especially if the work is being done by careless laborers. After cutting the fruit, it may be placed in large baskets and hauled to the packing-house for crating. Each fruit should be wrapped separately in heavy paper, either manila or brown, and care must be exercised not to wrap it while moist. Formerly the large crate was generally employed, but in the last ten years there has been a decided tendency toward reducing the size of the crate. The eggplant crate is now about double the size of the bean crate, and usually ships at the 80-pound rate. The eggplant is regarded as a staple vegetable, consequently fancy wrapping-paper or fancy methods of packing do not pay for the trouble. It stands shipment well to distant markets, so that freight shipments are usually employed. At times in the winter and spring, the price of eggplant becomes very high and then the shipments go forward by express.

Varieties.—There are only a few varieties offered in the market. The New York Improved Spineless matures a little earlier than the Black Pekin. The New York Purple (Fig. 1381), Black Pekin and the New York Spineless are excellent for shipping purposes. The above varieties are the black-fruited, and the most popular in the United States, while the white-fruited sorts are said to be the most popular in Europe. For home use, the white-fruited varieties are preferable, but as these make poor sellers in the United States, one must raise the purple sorts for market. For home gardens, the early and small Early Dwarf Purple (Fig. 1382) is useful. It is particularly recommended for northern climates. There are three main types of eggplants, as follows: The commoner garden varieties, *Solanum Melongena* var. *esculentum*, Bailey (Figs. 1381, 1383); the long-fruited or "serpent" varieties, *S. Melongena* var. *serpentinum*, Bailey; the Early Dwarf Purple type var. *depressum*, Bailey (Fig. 1382). See *Solanum*. The so-called Chinese eggplant is a different species, for which consult *Solanum*.

Seed-growing.—This is by no means a difficult operation and may be done profitably in certain sections of the South. For this purpose all defective or dwarfed plants in the field should be cut out. By a little attention one will be able to know when the seeds have matured sufficiently for gathering. At this time the eggs usually turn a lighter color or even somewhat yellow. The fruit should be gathered and carried to the packing-house, where it may be left in a pile for two or three days, as there is very little danger from rotting. When a sufficient number have been collected, the laborers may be set to paring off the extra amount of meat on the outside of the seed. The remaining core may then be cut longitudinally into quarters or eighths,



1381. Field-grown plant of New York Improved eggplant.



1382. Sprays of Early Dwarf Purple eggplant.

using a dull knife to avoid cutting the seed. After a quantity of these have been pared, they may be placed in a barrel and covered with water. The barrel should not be made more than two-thirds full. In a day or two fermentation will set in and the meaty portion will macerate from the seed. The seed may then be separated from the meat by means of sieves, using first wide-meshed ones to remove the meat and then finer-meshed ones to screen out the seed from the finer pulp. The seed should not be allowed to stand more than two or three days in the macerating barrel, as the heat evolved by fermentation and the heat of the summer is liable to cause them to germinate. After separating the seed from the pulp, it should be dried in the shade and wrapped in secure packages. By covering with tin-foil or oil-paper, the atmospheric moisture will be kept out and molding prevented.

Diseases.—The most destructive of diseases in the lower South is a blight fungus which attacks the plant just beneath the surface of the ground, causing the softer tissues at this point to rot off and the plant to die. The fungus is not able to penetrate the harder portion of the stem, consequently the plant lingers along for weeks after being attacked. A number of attempts have been made to cause this blight fungus to produce fruiting organs so it could be classified, but up to the present this has proved futile. In such cases as this there is no remedy. After the plant is attacked, it is usually doomed. Much, however, can be done in the way of preventing the spread of this fungus. If all plants are destroyed as soon as found to be affected, the fungus cannot perfect its sclerotia, or rusting state, and thus its propagating is prevented. The normal home of this fungus is in decaying vegetable matter. If, therefore, a field is kept free from this sort of material one will do much to prevent this fungus from being present. Some soluble form of fungicide, as Eau Celeste or potassium sulfide, may be sprayed about the roots of the plants to good advantage. Practise rotation of crops. A second form of blight is caused by *Bacillus solanacearum*. This disease has its origin of infection in the leaves, and is introduced by means of insects

which have fed upon diseased plants and carried the infection to the well ones. The disease works rapidly down the tissues and causes the death of the leaf and finally of the whole plant. The only remedy for this is to destroy all plants that are affected with the disease as soon as detected, and kill off all insects. When this disease is known to be present in a section, it is best to set the plants as far apart as practicable. In this way the danger of infection from insects is somewhat reduced. When the disease is known to be present in a field it should not be planted to this crop. Anthracnose (*Glœosporium melongenæ*) does not cause great damage to this crop, but is one of the agents that reduce the profits. "It may be recognized by its producing decided pits in the fruit, upon which soon appear minute



1383. Long White eggplant.

blotches bordered with pink." Bordeaux mixture may be used to good advantage for preventing this disease. *Phoma solani* frequently causes damping-off in the hotbed. It often renders a whole bed worthless. Plants affected with this fungus usually fall over as if eaten off by some insect. Some plants, however, continue a miserable existence and finally die. Careful examination will reveal the point of injury, which is at the ground-level. The best preventive is to use well-drained beds and then avoid excessive watering. When damping-off is detected in a seedling bed, the atmosphere and surface soil should be dried as rapidly as possible, followed by one application of fungicide.

Insect enemies.—Among the most annoying of the insect enemies is the cutworm (larvæ of Noctudiæ). These insects are almost omnipresent, and when nearly full grown are liable to cut off plants that are 4 or 5 inches high. It is not common for one insect to cut off more than a single plant, but in ordinarily fertile soil there are enough cutworms present to destroy the entire field. So that, on the whole, it becomes very annoying. When these insects are quite destructive, it is possible to kill them with poisoned bran or poisoned cottonseed meal, sweetened with syrup or sugar. Another insect that does more or less damage is the cotton bollworm (*Heliothis armiger*). This insect does its damage by boring a hole into the stems or the fruit. In the latter case it causes it to rot before it is picked, or possibly in transit. As the fruit becomes larger there is less danger of attack from this insect, so that the main trouble occurs in the earlier stages of its growth. The eggplant aphis (*Siphonophora cucurbitæ*) is one of the most annoying pests to this crop. It usually makes its appearance about the time the crop is fit to ship, and appears in such numbers that the plants are ruined in the course of a week or two. The insect attacks the lower surface of the leaves, making it difficult to reach the pests with insecticides, but persistent efforts and a good tobacco decoction, applied with a fine nozzle, will give considerable relief. Sulfur spray or other mild contact insecticide will be found more uniformly effective than tobacco decoction. Whale-oil soap is an excellent insecticide to use. Kerosene emulsion and insecticides made from the miscible oils, largely employed in proprietary insecticides, should be avoided. While they may be used effectively, there is considerable danger from scalding in handling by indifferent laborers.

P. H. Rolfs.

EGLANTINE: *Rosa rubiginosa;* also applied to *Rubus Eglanteria, Rosa Eglanteria,* and perhaps *Lonicera Periclymenum.*

EGYPTIAN LOTUS: *Nymphæa Lotus;* also *Nelumbium.*

EHRÈTIA (G. D. Ehret, botanical painter, born in Germany, 1708 or 1710, died in England 1770). *Boraginàceæ.* Tender trees and shrubs, found in the warmer regions of the world.

Plants with or without rough, short hairs: lvs. alternate, entire or dentate: fls. small, often white, in cymes, corymbs, terminal panicles, or rarely all borne in the upper axils; calyx 5-parted or -cleft; corolla short-funnelform to rotate, with 5 obtuse spreading lobes; stamens 5, affixed in the tube, exserted or rarely included, the filaments very slender; style 2-lobed or -parted: fr. a small drupe, usually containing two 2-celled 2-seeded nutlets.—Species 40–50, the larger number in the Old World tropics, but widely dispersed about the globe. A few species are planted in S. Calif. and perhaps elswhere along the southern parts.

A. *Lvs. toothed.*

B. *Foliage hairy.*

macrophýlla, Wall. Tree: lvs. 6–8 in. long, broadly elliptic, acuminate, bristly above and soft-hairy beneath, serrate: panicle terminal, pubescent; calyx ciliate: fr. globose, obscurely 4-grooved. Himalayas, China.

BB. *Foliage not hairy.*

acuminàta, R. Br. (*E. serràta,* Roxbg.). Heliotrope Tree. Tree, to 40 ft.: lvs. 3–4 in. long, elliptic to oblong, acuminate, serrate: panicles terminal and axillary; fls. clustered, sessile; corolla-tube very short. Trop. Asia, Japan and Austral. B.R. 13:1097. Hardy at Arnold Arboretum.

AA. *Lvs. usually not toothed.*

ellíptica, DC. Tree, 15–50 ft. high: lvs. oval or oblong, sometimes serrate, nearly smooth, or with minute hairs and very rough above: fls. small, white, fragrant, in cymes or panicles; calyx-lobes broad-lanceolate and acute, as long as the corolla-tube: fr. a yellow globose drupe, the size of a small pea, with edible thin pulp. Texas, Mex.

Wilhelm Miller.
L. H. B.†

EICHHÓRNIA (after J. A. F. Eichhorn, a Prussian Minister, born 1779). *Pontederiàceæ.* Tropical aquatic herbs, grown for showy flowers and interesting habit.

Perennial, floating, rooting at the nodes: immersed lvs. on young sts. linear; emersed lvs. obovate or

rounded (or rarely lanceolate), the petioles in some species much inflated and acting as buoys: fls. in a spike or panicle, the scape 1-lvd.; perianth funnel-shape with a long or short tube; stamens 6, attached unequally in the tube, part of them exserted; ovary sessile, 3-celled; style filiform: fr. a caps. contained in the withering perianth, ovoid to linear.—About a half-dozen species in S. Amer., one reaching Afr.

This genus includes the water hyacinth (see Fig. 1384), the famous "million-dollar weed" that obstructs navigation in the St. John's River, Florida, and is a source of wonder and delight in every collection of tender aquatics in the North. The curious bladders made by the inflation of the petioles help the plant to float freely. About flowering time the plant sends down anchoring roots which, if the water be only 3 or 4 inches deep, penetrate the soil. The true hyacinths belong in an allied family (Liliaceæ); the pickerel weed, in the allied genus Pontederia, the ovary of which by abortion is one-celled, and each cell one-ovuled, while Eichhornia is three-celled and many-ovuled. The plants of this family have been greatly confused botanically, partly because the fugacious, membranous flowers are not well preserved in dried specimens, and partly because of variation in form of leaves, depending upon whether the plants grow in deep or shallow water, or in mud. The common water hyacinth sends out two kinds of roots, the horizontal ones often thick and fleshy, and apparently for reproductive purposes, the vertical ones long, slender, and clothed with innumerable small, horizontal fibers.

The flowers are most beautiful, and the plant is worthy of special cultivation. It is often called a water-orchid, being of such delicate coloring and texture. The plants must be more or less stationary although it is a floating plant, for they will not flower when drifted about by any light breeze or where the water is 2 or more feet deep as is often the case where nymphæas are grown. A depth of 9 to 12 inches of water is sufficient with a guard to keep the plants in bounds. Good soil underneath is necessary so that the plants will derive some nourishment. They will grow rapidly and flower profusely all through the season, and it may be necessary to thin out the plants, for when too crowded the petioles will become elongated and the plants unsightly. They can also be grown in a tub or tank observing the same method of culture. Propagated by division. (Wm. Tricker.)

A. *Lf.-stalks inflated: inner perianth-segms. not serrated.*

crássipes, Solms (*E. speciòsa,* Kunth. *Pontedèria crássipes,* Mart.). Fig. 1384. Lvs. in tufts, all constricted at the middle, bladder-like below, sheathed, many-nerved: scape 1 ft. long, with wavy-margined sheaths at and above the middle; fls. about 8 in a loose spike, pale violet, 6-lobed, the upper lobe larger and having a large patch of blue, with an oblong or pear-shaped spot of bright yellow in the middle; stamens 3 long and 3 short, all curved upward toward the tip. Brazil. B.M. 2932 (as *Pontederia azurea*). I.H. 34:14. A.F. 5:511. Var. **màjor,** Hort., has rosy lilac fls. Var. **aùrea,** Hort., has yellowish fls.

AA. *Lf.-stalks not inflated: inner perianth-segms. beautifully serrate.*

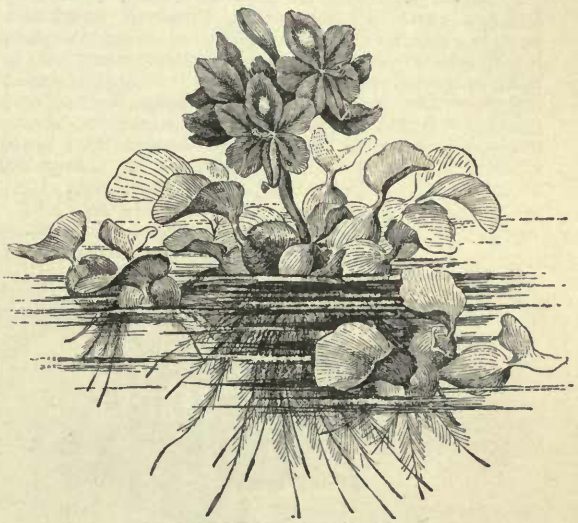
azùrea, Kunth. Lvs. on long or short not-inflated petioles, very variable in size and shape: scape often as stout as the lf.-stalk, gradually dilated into a hooded spathe; fls. scattered or crowded in pairs along a stout, hairy, sessile rachis; perianth bright pale blue, hairy outside, inner segms. beautifully toothed, the upper a trifle larger, with a heart-shaped spot of yellow, which is margined with white. Brazil. B.M. 6487. G.C. II. 25:17. I.H. 34:20. R.H. 1890:540.—One plant will become 5 or 6 ft. across in a season.

E. paniculàta, Spreng. Fls. in a compound spike or panicle, 2-lipped, purple and blue and with large white spots: lvs. long-petioled, cordate-acuminate, without petiole bladders: st. 12–18 in., often several. B.M. 5020 (as E. tricolor).

WILHELM MILLER.

ELÆÁGNUS (ancient Greek name, meaning a kind of willow; from *elaios,* olive). *Elæagnàceæ.* Shrubs and small trees, grown chiefly for their handsome foliage and for their ornamental fruits, edible in a few species.

Deciduous or evergreen, sometimes spiny: lvs. alternate, short-petioled, entire, clothed more or less with silvery or brownish scales: fls. axillary, solitary or in clusters, apetalous, perfect; perianth campanulate or tubular, 4-lobed; stamens 4, included, on very short filaments: fr. a 1-seeded drupe.—About 40 species in S. Eu., Asia and N. Amer. Monograph by Servettaz in Bot. Centralblatt, Beihefte 25, pt. 2:1–128 (1908).



1384. Eichhornia crassipes.

These are highly ornamental shrubs with handsome foliage and mostly decorative fruits; the flowers are inconspicuous, but mostly fragrant. Some of the deciduous species, as *E. argentea, E. multiflora* and *E. umbellata,* are hardy North, while the evergreen ones are hardy only South. A distinct feature of some species, as *E. argentea, E. angustifolia* and *E. parvifolia,* is the conspicuous silvery hue of their foliage, while *E. multiflora* and *E. umbellata* are the most ornamental in fruit.

They grow in almost any well-drained soil, including limestone, and prefer sunny position. Propagation is by seeds which do not germinate until the second year and ought to be stratified and sown the second spring, and by cuttings of mature and half-ripened wood; also sometimes increased by layers and by root-cuttings; varieties and rarer kinds can be grafted on seedlings of vigorous-growing species.

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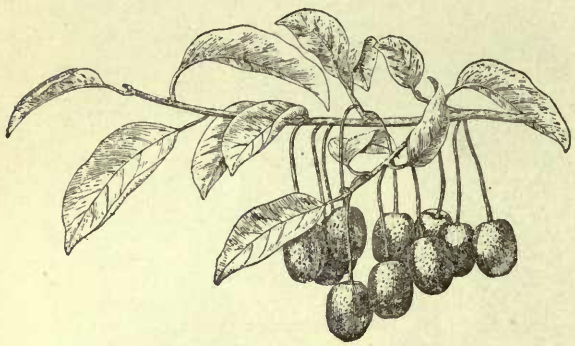
A. *Lvs. deciduous.*

B. *Winter-buds and lvs. beneath and usually the branchlets silvery white, without any brown scales.*

1. **angustifòlia,** Linn. (*E. hortènsis,* Bieb.). OLEASTER. Shrub or small tree, to 20 ft., sometimes spiny:

lvs. lanceolate or oblong-lanceolate, quite entire, light green above, 2–3 in. long: fls. short-pedicelled, 1–3, axillary, on the lower parts of the branches; perianth campanulate, tube about as long as limb, yellow within, fragrant; style at the base included by a tubular disk: fr. oval, yellow, coated with silvery scales. June. S. Eu. W. Asia to W. Himalayas. Var. **orientàlis,** Dipp. (*E. orientàlis,* Linn. f. *E. horténsis* var. *orientàlis,* Schlecht.). Often spineless: lvs. often oblong or oval, usually rounded at the base, clothed more with stellate hairs beneath than with scales, usually glabrous above at length: fr. rather large to 1 in. long. A.G. 21:405, 519, 613, 645. Var. **spinòsa,** Schneid. (*E. spinòsa,* Linn.). Spiny: lvs. linear-lanceolate or lanceolate, narrowed at the base, scaly above and densely scaly beneath: fr. smaller. L.B.C. 14:1339. B.R. 1156.

2. **parvifòlia,** Royle (*E. japónica,* Hort. *E. umbellàta* var. *parvifòlia,* Servettaz). Shrub or small tree to 20 ft., with erect sts. and spiny, spreading branches: lvs. elliptic-ovate or oblong-lanceolate, crisped at the margin, usually with stellate hairs above, glabrous at length, silvery beneath, 1½–3 in. long: fls. axillary, usually crowded on short lateral branchlets, short-pedicelled; perianth narrow, tube longer than limb, whitish within, fragrant: fr. globose or nearly so, densely silvery when young, pink when ripe, ½in. long. June; fr. in Aug. Himalayas, China, Japan. B.R. 29:51. Mn. 5:145.—Not quite hardy N. Sometimes cult. under the name of *E. reflexa,* which species, however, is evergreen. Var. *japonica macrophylla* is advertised but probably does not belong to this species.



1385. Elæagnus multiflora. (×½)

BB. *Winter-buds and branchlets with reddish or yellowish brown scales and sometimes silvery besides: lvs. silvery white beneath, often with few brown scales.*

C. *Fr. juicy, scarlet-red or brownish red.*

3. **umbellàta,** Thunbg. Spreading shrub, to 12 ft., often spiny, with yellowish brown branchlets, often partially silvery: lvs. elliptic or oval to ovate-oblong, above usually with silvery scales while young, sometimes glabrous, often crisped at the margin, 1½–3 in. long: fls. yellowish white, fragrant, 1–7 in the axils, usually crowded on short lateral branchlets, tube much longer than the limb, slender: fr. globose or oval, scarlet, ¼–⅓in. long, erect, on stalks ⅓–½in. long, clothed with silvery scales, mixed with brown scales while young. May, June; fr. in Sept., Oct. M.D.G. 1899:569. A.G. 12:206. R.H. 1901, p. 85. S.I.F. 2:54.

4. **multiflòra,** Thunbg. (*E. lóngipes,* Gray. *E. edùlis,* Sieb.). Gumi. Fig. 1385. Shrub, to 6 ft., with reddish brown branchlets: lvs. elliptic, ovate or obovate-oblong, with stellate hairs above, usually glabrous at length, mostly with scattered brown scales beneath, 1–2½ in. long: fls. usually solitary in the axils, sometimes 2 on the lower part of the branches or on short branchlets, yellowish white, fragrant; tube as long as the limb: fr. pendulous, oblong, ¾in. long, scarlet, on slender pedicels, much longer than the fr.; fr. with brown scales when young, ripening in June or July, of agreeable, slightly acid flavor. April, May. Japan, China. B.M. 7341. L.I. 4. G.F. 1:499. G.C. 1873: 1014. G.M. 31:715. B.H. 33:217. F.E. 13:830. A.G. 1890:565. M.D.G. 1901:573. Gng. 1:275, 277. Var. **rotundifòlia,** Servettaz (*E. rotundifòlia,* Gagnaire). Lvs. broadly oval, half-evergreen, glabrous above. Var. **ovàta,** Servettaz. Lvs. usually with stellate hairs above while young, soon glabrous: fls. 1–3: fr. oval, ⅓–½in. long, nodding, with brown scales when young, ripening July or Aug.; pedicels ½in. long or longer. Japan. M.D.G. 1899:569 (as *E. multiflora*). Var. **crìspa,** Servettaz. Similar to the preceding var., usually spiny: lvs. oblong-lanceolate: pedicels as long as fr.

CC. *Fr. rather dry, silvery white.*

5. **argéntea,** Pursh. Silverberry. Erect shrub, to 12 ft., spineless, stoloniferous, with reddish brown branchlets: lvs. ovate or oblong-lanceolate, silvery on both sides, often with scattered brown scales beneath, 1–3 in. long: fls. 1–3, axillary, yellow within, fragrant: fr. oval or roundish oval, densely clothed with silvery scales, short-pedicelled, ⅓–½in. long. May, June. Canada, south to Que., Minn., Utah. B.B. (ed. 2) 2:576. B.M. 8369.

AA. *Lvs. evergreen: usually flowering in fall.*

6. **macrophýlla,** Thunbg. Spineless shrub, to 6 ft., with silvery white branchlets: lvs. broad-ovate or broad-elliptic, on stout and rather long petioles, scaly above, usually glabrous at length, silvery white beneath: fls. axillary, with silvery and brownish scales outside; tube campanulate, abruptly narrowed at the base, as long as limb. Japan. B.M. 7638. G.C. III. 25:90.

7. **púngens,** Thunbg. Spreading shrub, to 6 ft., mostly spiny, with brown branchlets: lvs. oval or oblong, undulate and often crenulate at the margin, at length glabrous above, silvery beneath, more or less interspersed with brown scales, 2–4 in. long: fls. in axillary clusters; tube cylindrical, slightly narrowed at the base, longer than the limb: fr. short-stalked, about ¾in. long, with silvery and brown scales. Japan. Var. **Frederìci variegàta,** Servettaz. Lvs. with yellow center and green margin. Var. **maculàta,** Hort. (var. *aùreo-maculàta,* Hort.). With a large yellow blotch in the middle. A. G. 13:122. A.F. 23:1015. Var. **Sìmoni,** Rehd. (*E. Sìmoni,* Carr.). Lvs. rather large, oblong-elliptic, with few brown scales beneath or nearly without. Var. **Sìmoni trícolor,** Hort. Lvs. like the former, but variegated with yellowish and pinkish white. Var. **reflèxa,** Rehd. (*E. reflèxa,* Morr. & Decne.). Branches elongated and flexile: lvs. ovate-lanceolate, acute or acuminate, lustrous above, only scaly while young, ferrugineous below. H.U. 4:328. Var. **variegàta,** Rehd. (var. *aùrea,* Servettaz., var. *aùreo-variegàta,* Hort.). Lvs. margined yellowish white. G.M. 54:327.

E. ferrugínea, A. Rich. Spineless evergreen shrub, with spreading brown branches: lvs. with yellowish and brown scales beneath: perianth with quadrangular, abruptly contracted tube: fr. long-stalked. Japan.—*E. glàbra,* Thunbg. Spineless evergreen shrub, with brown branches: lvs. shining above, with yellow and brown scales beneath: perianth with slender, tubular tube, gradually narrowed toward the base, twice as long as the limb: fr. short-stalked. Japan. S.I.F. 2:54.

Alfred Rehder.

ELÆIS (Greek, *olive*). *Palmàceæ,* tribe *Cocoíneæ.* Tropical spineless palms with pinnate foliage, of which the best known is the oil palm of western Africa, whose red fruits, borne in large clusters, yield the palm oil of commerce, which is used in making candles and soap.

Leaves terminal, numerous, large and pinnately divided, the segms. sword-shaped, the margins in some species spiny: spadix short and thick. Young plants are grown for ornament in S. Calif., and in the N., but it is not hardy outdoors in U. S., according to Franceschi. The other 6 species are from Trop. S. Amer. The genus is separated from Cocos by the 1–3-seeded frs., with 3 pores above the middle.

guineénsis, Jacq. Oil Palm. Sts. stout, 20–30 ft., coarsely and deeply ringed: lvs. 10–15 ft.; petiole spiny-serrate; lfts. 50–60, linear-lanceolate, acute, the same color above and below. F.S. 14:1492.—From an early stage in growth, this is one of the most ornamental palms. Until it reaches several feet in height, it is a slow grower, consequently one does not see much of it, except in collections. It does best in a warm temperature, although it will thrive in an intermediate house. Seeds are always obtainable from several of the large European houses. It is but little grown as a commercial palm, as young plants do not show their full character. Given same treatment as *Areca lutescens*, will grow well. This treatment includes night temperature of 65° and plenty of water. Jared G. Smith. N. Taylor.†

ELÆOCÁRPUS (Greek, *olive-fruit*). *Elæocarpàceæ;* formerly included in *Tiliàceæ*. Tropical trees, with showy flowers, in their juvenile stages also sometimes cultivated under glass.

Leaves simple, usually alternate; to 50 and 60 ft. high or some of them practically shrubs in cult.: fls. perfect or polygamous, in axillary racemes; sepals distinct, 4 or 5; petals 4 or 5, cut or fringed (rarely entire), attached about a thickened torus; stamens many (rarely 8–12), with long-awned anthers opening by a slit at the apex; ovary 2–5-celled: fr. a drupe, with a large and bony stone, sometimes 1-celled by abortion. —Perhaps 100 species, in the Old World tropics. They are little known in cult. but are sometimes mentioned in greenhouse lists. The pulp of the fr. in some species is said to be edible; and the interesting sculptured stones of some kinds (as of the bead-tree of India, *E. Ganitrus*, Roxbg.) are used for beads, heads of ornamented pins, and other decorations. They propagate by ripened shoots with the lvs. left on, and also by seeds when obtainable.

grandiflòrus, J. Smith. A much-branched shrub, about 7 ft. high under glass: lvs. considerably clustered at the ends of branches, 3–6 in. long, broadly lanceolate; petiole ¼–1 in. long, with a few distant saw-teeth, or more or less round-toothed or wavy-margined: sepals 5, red outside, white inside; petals 5, white or pale yellow, silky outside, fringed. Java. B.M. 4680 (as *Monocera grandiflora*). F.S. 8:817. J.F. 4:339.—Lvs. rather leathery, dark green above, paler beneath. Warmhouse. Prop. by cuttings of nearly ripened wood.

cyàneus, Sims (*E. reticulàtus*, Smith). Under glass a shrub, but in the wild a small tree and sometimes reaching 60 ft., glabrous: lvs. elliptic-oblong, or lance-oblong, acuminate, prominently reticulate: fls. cream-white, fringed, in loose racemes that are shorter than the lvs.; stamens many: drupe globular or nearly so, blue (whence the specific name). Austral. B.M. 1737. B.R. 657. G.C. III. 36:272; 51:393. G.M. 55:423. G. 34:389. Gn. 77, p. 301. L. H. B.†

ELÆOCÓCCA: *Aleurites cordata.*

ELÆODÉNDRON (Greek for *olive tree*, from the resemblance of the fruit). *Celastràceæ.* Tropical shrubs or small trees, some kinds of which are grown in the juvenile state under glass for the interesting foliage.

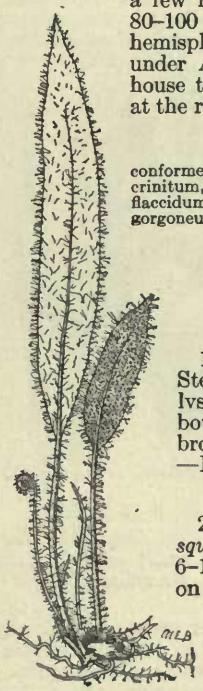
Leaves simple, entire or crenate, opposite or alternate, thickish, frequently evergreen: fls. inconspicuous, greenish or white, in axillary or lateral clusters; calyx usually 4–5-parted; petals 4–5, and exceeding the calyx; stamens 4–5, inserted under the edge of the thick disk; ovary single, mostly 3-celled; style very short: fr. a small fleshy or nearly dry drupe.—Species probably upward of 40, in Afr., India to Austral., and somewhat in S. Amer. Very closely allied to Cassine, a South African genus.

orientàle, Jacq. A graceful and handsome plant: the mature lvs. are very different from the juvenile lvs., being obovate, obtuse, crenate, cuneate at base, and 2–3 in. long, and the slender graceful young lvs. pass into them by gradual transition: fls. less than ¼in. across in close axillary cymes which are shorter than the lvs.; pedicels equaling or surpassing the corolla; calyx deeply lobed; petals yellow-green: drupe size of olive, oblong. Madagascar, Mauritius.—The plant holds its lower foliage well, or throws out new foliage to take the place of that which drops. It thrives in either an intermediate or a warmhouse. Prop. by single eye cuttings in small pots, kept rather warm. It has been said that *Aralia Chabrieri* of gardens belongs to this species (although of a different family), but this is apparently an error. See *Polyscias* for a discussion of this plant.

austràle, Vent. Intro. into S. Calif. from Austral., and prized for its holly-like foliage. In its native habitat it is a tree 30–40 ft. high, producing useful close-grained wood: lvs. mostly opposite, ovate to oblong-lanceolate, nearly or quite obtuse, entire or open-crenate, coriaceous, very reticulate beneath: fls. with parts in 4's: drupe about ½in. long, red, ovoid or globular. L. H. B.

ELAPHOGLÓSSUM (Greek, *serpent tongue*). *Polypodiàceæ.* A large group of tropical ferns, with creeping rootstocks and simple leaves.

The sporangia cover the entire under surface of the fertile leaves which are usually much smaller than the sterile ones. Nearly all the species are free-veined but a few have netted venation.—There are 80–100 species in the tropics of both hemispheres. They were formerly included under Acrostichum. All require warmhouse treatment, an abundance of water at the roots, and an open porous compost.



1386. Elaphoglossum villosum. (×½)

INDEX.

conforme, 7. crinitum, 9. flaccidum, 8. gorgoneum, 11. hirtum, 2. muscosum, 3. petiolatum, 4. pilosum, 5. reticulatum, 10. simplex, 6. villosum, 1.

A. *Veins all free.*

B. *Surface of lvs. densely scaly throughout.*

C. *Texture thin, flaccid.*

1. villòsum, J. Smith. Fig. 1386. Sterile blades 6–9 in. long; fertile lvs. scarcely more than half as large, both with abundant slender, dark brown scales. Mex. and W. Indies. —Dwarf, variable.

CC. *Texture thick, leathery.*

2. hírtum, C. Chr. (*Acróstichum squamòsum*, Swartz). Sterile blades 6–12 in. long, the fertile narrower, on longer sts., both surfaces matted with bright reddish brown linear or lanceolate scales. Tropics of both hemispheres.

3. muscòsum, Moore. Sterile blades 6–12 in. long, fertile much shorter; upper surface slightly scaly, the lower densely matted with ovate, rusty scales. Tropics of both hemispheres. S. 1:211 (as Acrostichum).—Very distinct in habit, and an interesting greenhouse species.

BB. *Surface of lvs. slightly scaly.*

4. petiolàtum, Urban (*Acróstichum viscòsum*, Swartz). Sterile blades 6–12 in. long, narrowed gradually at the base; the fertile shorter, on longer stalks; texture

leathery, the surfaces somewhat viscid. Tropics of both hemispheres.

5. **pilòsum,** Moore. Blades flexuous, 6–8 in. long, ¾in. wide, with tufts of star-like scales beneath; texture herbaceous. Mex. to Colombia.—Chiefly of botanical interest.

BBB. *Surface of lvs. not scaly; texture leathery.*

C. *Margins of lvs. thick, cartilaginous.*

6. **símplex,** Schott. Sterile blades 4–12 in. long, with a very acute point, the lower portion gradually narrowed into a short, somewhat margined stalk. W. Indies to Brazil.

7. **confòrme,** Schott. Sterile blades 2–9 in. long, with a bluntish point and wedge-shaped or spatulate base; fertile lvs. narrower. Tropics of both hemispheres.

CC. *Margins of lvs. not thickened.*

8. **flàccidum,** Moore. Sterile blades 6–12 in. long, with very acute point, the lower portion gradually narrowed to the short stalk; fertile lvs. on stalks 3–4 in. long. S. Amer.—Of botanical interest only.

AA. *Veins uniting to form a network.*

B. *Surface of lvs. densely clothed with narrow scales.* (*Hymenodium.*)

9. **crinìtum,** Christ. ELEPHANT-EAR FERN. Fig. 1387. Blades 10–18 in. long, 4–8 in. wide, on densely scaly stalks; fertile lvs. smaller, on shorter stalks. W. Indies. F.S. 9:936 (as *H. crinitum*).—Omit sand in potting, and avoid over-watering.



1387. Elaphoglossum crinitum.

BB. *Surface of lvs. mostly smooth, 6–15 in. long.*

10. **reticulàtum,** Gaud. Blades on distinct stalks, with wedge-shaped bases, 1½ in. wide; veins forming copious meshes. (*Chrysodium.*) Hawaiian Isls.—Of botanical interest only.

11. **gorgòneum,** Brack. Blades tapering gradually downward to the short stalks, 2–3 in. wide; veins forming meshes only near the margin. (*Aconiopteris.*) Hawaiian Isls.—Of little decorative value.

L. M. UNDERWOOD.
R. C. BENEDICT.†

ELATÌNE (Greek name of doubtful application). *Elatinàceæ.* Small mostly glabrous creeping herbs, probably annuals, of temperate and warm regions (perhaps 10 species), sometimes used in bog- and water-gardening. They root at the nodes, spreading along the margins of streams and ponds. Lvs. opposite or verticillate, mostly broad, entire: fls. minute and inconspicuous, mostly solitary in the axils; sepals and petals 2–4, and stamens as many or sometimes twice as many; styles or stigmas 2–4: pod 2–4-valved. The plants are grown for their foliage cover. Four species are native in the U. S. and Canada, but they appear not to be in the trade. Abroad, **E. macrópoda,** Guss., of the Medit. region, is offered. Lvs. oblong, short-petioled: fls. axillary and terminal, 4-merous, stalked: caps. half shorter than the sepals.

The family Elatinaceæ is allied to the Hypericaceæ. It comprises perhaps 25 species in many parts of the world. The only other genus is Bergia, which differs from Elatine in being terrestrial and in having 5-merous fls. *B. texàna,* Seub., occurs in swamps and on wet banks from S. Ill. to Texas and Calif. The bergias are apparently not in cult.

L. H. B.

ELDER AND ELDERBERRY: *Sambucus.*

ELECAMPANE: *Inula Helenium.*

ELECTRO-HORTICULTURE is a term used by Siemens to designate the application of the electric light to the growing of plants. The term is an unfortunate one, since the use of electric light is not an application of electricity to plant-growing, but is a way of securing illumination. Any strong artificial light hastens assimilation and thereby causes plants to grow more rapidly. The practical questions to be considered are, therefore, the expense of using the light, and whether there are injurious elements in the spectrum of the given light.

The spectrum of the electric arc light is the spectrum of carbon plus that of certain gases incident upon combustion. The spectrum of the arc light is rich in rays which light beyond the luminous part, and these rays are very injurious to most plants. These rays of the ultra-violet part of the spectrum are eliminated by a plain glass, so that when the electric light is surrounded by a globe, or when the light is hung above the roof of the greenhouse, the injuries are reduced to a minimum. Experiments at Cornell University showed that each kind of plant behaves in its own way in the presence of electric light. It is not possible to prophesy what the results may be in a given species, without experiment. A few plants, as tomatoes, cucumbers, melons and carrots, seem to be very little affected either injuriously or beneficially. Nearly all flowers are hastened into bloom by the influence of the light, and their colors are often brighter than under normal conditions; but in very many cases they do not last so long. The best results are secured if the light is applied to the plants when they have reached nearly or quite their full stature. If applied very early in its growth, the plant tends to make flowers before it has attained sufficient size. In floriculture, therefore, the practical value of the electric arc light seems to be its influence in hastening the flowering of certain plants in dark climates, or when plants must be had for a definite season. For example, if the light is applied to Easter lilies for a month before their normal blooming time, the period of bloom may be hastened four to ten days.

Lettuce has shown greater beneficial results from the application of the electric light than any other plant with which careful experiments have been made. Lettuce which receives light from the arc lamp for half of each night may be expected to reach marketable size from one to two weeks before that which is grown in normal conditions.

As a rule, better results are secured when the light runs only half the night. A common two-thousand candle-power light has a marked effect on the growth of many plants at a distance of sixty to even one hundred feet. The incandescent light has a similar influence, but not so marked. It has no injurious effect, however.

As now understood, the application of the electric light to the growing of plants is a special acceleration to be used when the climate is abnormally cloudy or

when it is desired to hasten the maturity of crops for a particular date. Only in the case of lettuce is it yet thought to be of any general commercial importance; and even with lettuce, it is doubtful whether it will pay for its cost in climates that are abundantly sunny. For the literature of the subject, consult the publications of the experiment stations of Cornell University and of West Virginia. See the article *Light*, Vol. IV.

Electroculture is a term employed to designate any culture of plants under the influence or stimulus of electric currents. The electric stimulation may arise from the electrification of the atmosphere in the immediate vicinity of the plants, or from the application of electric currents to the plants themselves. In either case, electricity exerts an appreciable and often a very marked influence, resulting in accelerated germination and growth (see the discussion, pp. 30–35, Vol. II, Cyclo. Amer. Agric.).

In recent years much more attention has been given to the stimulation of plants by electricity directly through the atmosphere than through the soil. According to experiments made at the Massachusetts Experiment Station, this method appears to be successful and offers a most promising field for future research. Of the various methods used to stimulate plants by electricity, direct currents applied through the soil prove less valuable than alternating currents or static charges. In a series of experiments made with radish plants in closed glass cases, an average increase of 50 per cent was secured, and in another case 45 per cent increase when the case was charged from a static machine with an average potential of 150 volts for a few minutes each day. There are some obstacles in the way of electrically treating plants by the use of high tension wires or static machines owing to the possibility of grounding through steam-pipes and iron posts, and nothing very definite has been obtained as yet from this method. High tension wires (100,000 volts, more or less) have been used in the field with fairly good results, but winds affect a charged atmosphere to a certain extent. The use of high poles provided with points to collect atmospheric electricity has proved successful in laboratory experiments for the stimulation of plants and the fixation of nitrogen, and in the future probably some such method will become of practical use. At present the various methods cannot be considered as of great economic importance. (G. E. Stone.)

ELEÓCHARIS (Greek-made word, meaning *delighting in marshes*). Sometimes written *Heleócharis*. *Cyperàceæ*. Rush-like native plants, mostly of low, wiry growth, and commonest in marshes and on muddy shores, mostly perennial. The culms are simple, terete or angular, bearing a spherical or oblong head of inconspicuous fls.: lvs. usually reduced to mere sheaths. They are interesting for the borders of ponds, and are very easy to naturalize. Numbers of species are likely to be offered by dealers in native plants; three have been listed: **E. interstíncta** R. &. S. (*E. equisetoìdes*, Torr.). A shore plant, with terete knotted culms 2–3 ft. high, and cylindrical heads about the thickness of the culm; resembles horse-tail (Equisetum). **E. aciculàris**, R. & S. Hair-like, 3–6 in. high, making grass-like mats. **E. ovàta**, R. & S. Culms nearly terete, 12–15 in. high: head globose or ovate. Eleocharis has about 100 species, widely distributed, of which nearly half occur in Canada and the U. S. L. H. B.

ELEPHANT'S EAR is a name for begonias. The elephant-ear Caladium is a Colocasia.

ELEPHANT'S FOOT: *Testudinaria.*

ELETTÀRIA (East Indian name). *Zingiberàceæ*. CARDAMON. Hothouse perennial herbs, sometimes seen in collections of economic plants.

Differs from Amomum in technical characters, as in the slender tube of the perianth, the presence of internal lobes in the perianth, and the filaments not prolonged beyond the anther. Probably only 1 species, although more have been described. **E. Cardamòmum**, Maton (*Cardamòmum officinàle*, Salisb. *Amòmum Cardamòmum*, Linn.), affords the small or true cardamons of commerce, which are the dried capsules and which are used in medicine. Species of Amomum yield other kinds of cardamon. The elettaria is native to India, but is cult. in Jamaica, and it will no doubt thrive in parts of S. Fla., where plants have been offered. The cardamon plant grows 5–10 ft. high, bearing a curving jointed, closely sheathed st. and oblong-lanceolate acuminate entire nearly sessile lvs. often 2 ft. long: rootstock horizontal: fls. purple-striped: caps oblong or nearly globular, with many thin vertical ribs, indehiscent; seeds small, angled. Gt. 62, p. 93. It is said to prefer shade and a moist soil. In three or four years plants give full crops, but they become more or less exhausted after bearing three or four crops. Prop. by dividing the roots and by seeds. Under glass, handled the same as Alpinia. L. H. B.

ELEUSÌNE (Greek, *Eleusin*, the town where Ceres, the goddess of harvests, was worshipped). *Gramíneæ*. CRAB-GRASS. YARD-GRASS. Coarse tufted annual grasses, more or less grown as ornamentals; also for the grain in Africa.

The stout unilateral spikes digitate at the apex of the culm; spikelets several-fld., awnless, arranged in 2 rows along one side of a continuous rachis; rachilla articulate above the empty glumes; fls. perfect or the upper one staminate: grain loosely inclosed by the lemma and palea.—Species about 6 in tropical regions of the Old World. Some are valued as cereals in Afr., India, and some other eastern countries. For *E. ægyptiaca*, see *Dactyloctenium*.



1388. Eleusine indica. (×½)



1389. Eleusine coracana. (×½)

índica, Gaertn. WIRE-GRASS. GOOSE-GRASS. Fig. 1388. Erect, or in open ground prostrate, 2–4 ft. high: culms flattened: spikes 5–7, about 2–4 in. long, digitate, often with one or two lower down; spikelets 3–6-fld. Blooms from June to Oct.—A very common grass in cult. fields and dooryards in the S., often troublesome as a weed on lawns throughout the S. and in Calif.

coracàna, Gaertn. AFRICAN MILLET. Fig. 1389. Erect, 2–4 ft. high, closely related to and much resembling *E. indica.* Can be distinguished from it by its stouter habit, shorter, broader and larger spikes.—Cult. in S. E. Asia for the grain. Beer is brewed from the grain in Abyssinia. In cult. in Amer. as an ornamental grass. Coracana means "pertaining to crows."



1390. Elliottia racemosa. (×½)

tristàchya, Kunth (*E. barcinonénsis,* Costa). Culms tufted, 6 in. to 1 ft. high: lf.-blades short, about $\frac{1}{16}$in. wide, obtuse at the apex: spikes broad, mostly 3, digitate, 1–1½ in. long, ⅓in. thick; spikelets closely imbricate, 5-fld. India.—Intro. into Amer. on ballast, and in cult. as an ornamental plant.

P. B. KENNEDY.
A. S. HITCHCOCK.†

ELEUTHERÌNE (Greek *free,* referring to the stamens). *Iridàceæ.* Two or three species in the W. Indies and S. Amer., perhaps forms of one; bulbous plants of warmhouse cult., allied to Cipura and Ixia: fls. white, several on a naked scape, the perianth-tube none and the segms. obovate and spreading; stamens attached to base of perianth-segms., the filaments short and free; ovary oblong, 3-celled; style very short, 3-branched: lvs. long, radical. *E. plicàta,* Herb. (*Galatèa plicàta,* Salisb.), has a large ovoid bulb: root-lvs. 1–2, linear to linear-lanceolate, plicate, 18 in. or less long: scape 6–12 in. high; perianth white, 1 in. or less diam., not lasting: something the general habit of Babiana. B.M. 655 (as *Marica plicata*).

ELEUTHEROCÓCCUS: *Acanthopanax.*

ELÍSMA (suggested from Alisma). *Alismàceæ.* One species in W. Eu., sometimes grown in water-gardens. It is known also as Alisma (p. 246, Vol. I) but has been separated from that genus because of its floating rather than erect habit, sub-solitary fls., and character of the ovules. **E. nàtans,** Buch., is a slender perennial, with the sts. and developed ovate or oblong lvs. floating: radical lvs. of the original tuft represented by a lf.-stalk which is only slightly or not at all widened at the top, every succeeding node producing the floating lvs. and roots: fls. 1–3 or 5, large, white, with 3 broad obtuse petals: carpels forming a globular head, each with many slender ribs: summer. Of easy cult.

L. H. B.

ELLIÓTTIA (after Stephen Elliott, South Carolina's early and excellent botanist. For a fine portrait and sketch of him, see G.F. 7:204–6). *Ericàceæ.* Deciduous shrub cultivated for its handsome racemes of delicate white flowers.

Leaves alternate, entire, without stipules: fls. in terminal racemes; calyx small, 4-parted; petals 4, oblong; stamens 8, with short filaments; ovary 4-celled; cells 1-ovuled; style slender, exserted: fr. unknown.—One species in S. C. and Ga., very rare and local. The Japanese species formerly referred to this genus are well distinguished by the 3-merous fls. and by the many-ovuled cells of the ovary; they form the genus Tripetaleia. Like Cladothamnus, Ledum and Leiophyllum, the genus differs from most other Ericaceæ in having distinct petals, but is easily distinguished from the genera mentioned by its racemose infl. and other characters.

Elliottia is very rare in cultivation owing to its difficult propagation; it is not hardy North and seems to grow best in a humid sandy or peaty soil. Propagation by suckers, which appear only occasionally.

racemòsa, Muhl. Fig. 1390. Shrub, 4–10 ft. high: branches slender: lvs. alternate, oblong, acute at both ends, glandular-mucronate, entire, thin, membranous, 3–4 in. long, 1–1½ in. wide; petioles slender, grooved, hairy, about 1 in. long: racemes 6–10 in. long, often branched at the base; calyx-lobes short, rounded; petals spatulate-oblong, ½in. long. Wet, sandy woods of S. C. and Ga. G.F. 7:205 (adapted in Fig. 1390). B.M. 8413. G.C. III. 51:11. Gn. 75, p. 471.

ALFRED REHDER.

ELM: *Ulmus.*

ELODÈA (Greek, *marshy*). *Hydrocharitàceæ.* Aquatic herbs, one of which is grown in aquaria.

The genus is known in horticulture as including the ditch-moss, an interesting hardy perennial plant found in slow streams and ponds nearly throughout N. Amer., except the extreme north and particularly desirable for home and school aquaria. It is a slender, wholly submerged plant, with branching sts. 4 in. to 3 ft. long, according to the depth of the water. The pistillate fls. are raised to the surface by their long calyx-tubes, and float there. The minute staminate fls., which are rarely seen, commonly break off below, rise to the surface, float about, open, and shed their pollen. The fr. ripens below the surface, and the seeds rise. It reached England in 1841 and choked up many canals and waterways, notably the Cam. It was very abundant in 1852 and 1853, but declined in the next few years. Ducks, geese and swans are fond of it, and render great service in getting rid of it. It can be used for manure where it grows in sufficient quantities. Like many other water plants, it makes heavy buds in the fall (Fig. 1391), which drop to the bottom and grow in the spring. This genus contains perhaps 10 species.



1391. Winter-bud of Elodea. (Nat. size)

canadénsis, Mich. (*Anácharis canadénsis,* Planch. *A. Alsinástrum,* Bab. *Philòtria canadénsis,* Brit.). WATER-WEED. DITCH-MOSS. WATER-THYME. Lvs. in whorls of 3 or 4, or the lower ones opposite, linear, minutely toothed or not, 2–7 lines long, ½–2 lines wide: fls. white; calyx-tube of the pistillate fls. 2–12 in. long; spathes 5–7 lines long.

Var. **gigantèa**, Hort. GIANT WATER-WEED. A much stronger grower than the species and a desirable plant for the aquarium, and a good oxygenator. Now generally used in preference to the type.

WM. TRICKER and WILHELM MILLER.



1392. Elsholtzia cristata.

ELÒDES: *Hypericum.*

ELSHÒLTZIA (John Sigismund Elsholtz, author of unpublished Flora Marchica, the MS. of which is in the Royal Library, Berlin). *Labiàtæ.* Herbs or undershrubs grown chiefly for their blue or lilac flowers appearing in dense spikes late in summer.

Usually aromatic: lvs. opposite, short-petioled, serrate: fls. in usually 1-sided, terminal spikes; calyx tubular or campanulate, 5-toothed; corolla 2-lipped or slightly so; lower lip 3-lobed, the upper undivided, emarginate, concave; stamens 4, exserted; anther-cells diverging: fr. consisting of 4 ovoid or ovoid-oblong nutlets.—Twenty species in E. and Cent. Asia, south to Java, 1 in Eu. and 1 in Abyssinia. Of the cult. species *E. cristata* and *E. Stauntonii* are hardy N., while *E. polystachya* is tender. They are chiefly valued for their late-appearing fls., profusely produced in dense upright spikes; they do not seem particular as to the soil, but demand a sunny position to bloom well. Prop. is by seeds, sown in spring; also with the suffruticose species by greenwood cuttings in summer.

cristàta, Willd. Fig. 1392. Twelve to 18 in. high, with opposite, petioled, ovate-oblong toothed lvs. and small, light blue fls. in crowded, more or less 1-sided spikes: calyx enlarging in fr. Asia. B.M. 2560.—Hardy annual, with very aromatic foliage and attractive, upright habit. Said to be a good bee plant.

Staùntonii, Benth. Undershrub, to 5 ft.: branchlets terete, pubescent: lvs. ovate-oblong to oblong-lanceolate, acuminate, serrate, bright green and glabrous above, lighter green and densely glandular below, 3–5 in. long: fls. lilac-purple, in dense 1-sided spikes 4–8 in. long, usually panicled at the end of the branches; stamens and style long exserted. Sept., Oct. N. China. B.M. 8460. G.C. III. 51:21. Gn. 75, p. 533. M.D.G. 1910:541–2; 1913:52.

E. polystàchya, Benth. Undershrub, to 6 ft.: lvs. elliptic-oblong to lanceolate, serrate, pubescent on the veins beneath and glandular, 3–5 in. long: fls. white, in very slender spikes 2–6 in. long. Himalayas, W. China.

ALFRED REHDER.

ÉLYMUS (Greek name for a kind of millet). *Gramíneæ.* LYME-GRASS. WILD-RYE. Erect perennial grasses with terminal usually bristly spikes somewhat resembling rye, sometimes grown as ornamentals and having other uses.

Leaves flat or convolute: spikelets 2–6-fld., often long-awned, the uppermost imperfect, sessile, in pairs (rarely in 3's or 4's), at each joint of the continuous or articulate rachis, forming terminal spikes; glumes acute or awned, often placed at the front of the spikelet.—Species about 25, in the temperate regions of both hemispheres. For *E. Hystrix*, see *Hystrix*. See p. 3568.

arenàrius, Linn. SEA LYME-GRASS. Stout, coarse perennial, 2–8 ft. high, with strong, creeping rootstocks: lvs. long, rigid, smooth: spikes dense, terminal, 6–12 in. long; spikelets about 1 in. long and 3–4-fld., awnless. G. 15:701. Dept. Agric., Div. Agrost., 7: 319.—Sometimes used for binding the drifting sands of our Atlantic and Pacific coasts, especially when combined with beach grass, *Ammophila arenaria*. The seed is also used by the Digger Indians for food.

canadénsis, Linn. CANADA LYME-GRASS. TERREL GRASS. Fig. 1393. Rather stout, smooth perennial, 2–5 ft. high, with broad, flat lvs. 6–12 in. long: spikes 4–9 in. long, exserted, nodding; spikelets very rigid, 3–5-fld.; lemmas long-awned. Common in low thickets and along streams in rich, open woods throughout the country.—Cult. as an ornamental plant. Var. **glaucifòlius**, Gray (*E. glaucifòlius*, Hort.), is pale and glaucous throughout, with usually more slender awns. Cult. as an ornamental grass.

condensàtus, Presl. GIANT RYE-GRASS. The largest of the native rye-grasses, growing to the height of 5–10 ft.: culms in dense tufts, stout: spikes 6–12 in. long, very variable, compact or interrupted, bearing branching clusters of spikelets at each joint; glumes subulate; lemmas awnless or mucronate. Rocky Mt. regions and the Pacific slope.—Cult. as an ornamental. A Pacific Coast form has large branched heads.



1393. Elymus canadensis. (×½)

E. glàucus, Regel. A glaucous-leaved, dense, cespitose, hardy perennial grass 3–4 ft. high, with very short, smooth lvs. and erect, elongated spikes: spikelets in 2's, erect, usually 5-fld., densely villous-pubescent, short-awned. Turkestan. —Rarely in cult. as an ornamental grass.

P. B. KENNEDY.
A. S. HITCHCOCK.†

EMBÒTHRIUM (name refers to the structure of the anthers). *Proteàceæ.* A few trees and shrubs of S. Amer., one of which is offered abroad as a greenhouse subject, grown from seeds, and apparently prized for the fls. Foliage sparse, coriaceous, entire: fls. in dense racemes, showy, perfect; perianth with a cylindrical split tube, the limb ovoid or globose in bud but becoming oblique or recurved; stamens 4, the anthers attached in lobes of the perianth: follicles oblong, 1-celled, many-seeded. **E. coccíneum**, Forst., is a shrub bearing bright scarlet fls. about 2 in. long in many-fld. terminal sessile racemes: perianth tubular, upwardly curved, the 4 reflexing twisting lobes representing a third of its length; anthers imbedded in the concave apices of the perianth-lobes; pistil with an elongated cylindrical ovary and long-exserted red style: lvs.

oblong to elliptic, short-stalked, alternate, obtuse and mucronate, pale beneath. Chile. B.M. 4856.—Should be hardy in warm-temperate parts.

EMÍLIA (perhaps a personal name). *Compósitæ.* Flower-garden herbs, perennial or annual, with orange or scarlet bloom.

Related to Senecio (to which some authors refer it), but always without rays: heads rather small, the involucre very simple and cup-shaped, with no small outer scales; style-branches long or short: achenes with 5 acute ciliate angles: florets all perfect.—A dozen or more species have been described from warm parts of Afr., Asia to China, Polynesia and Amer. One species in common cult.

flámmea, Cass. (*E. sagittàta,* DC. *E. sonchifòlia,* Hort., not DC. *E. sonchifòlia,* Linn., var. *sagittàta,* Clarke. *Cacàlia coccínea,* Sims, B.M. 564. *C. sonchifòlia,* Hort., not Linn. *C. sagittàta,* Vahl. *Senècio sagittàtus,* Hoffm.). Tassel-Flower. Flora's Paint-Brush. A neat annual, erect, 1–2 ft., glabrous or sparsely hairy, the long sts. terminated by clusters of small scarlet (golden yellow in the form called *Cacalia lutea,* Hort.) heads: lvs. lance-oblong or ovate-lanceolate, clasping the st., remotely crenate-dentate: involucre-scales much shorter than the florets. Probably tropics of New World. H.F. 7:50.—This much-named annual is one of the commonest garden fls. It is of the easiest cult. in any good soil. Blooms from July until frost, if sown as soon as weather is settled. Two species are sometimes recognized in this variable group,—*E. sagittata,* DC., with involucre shorter than the fls., and *E. sonchifolia,* DC., involucre as long as the fls.

E. purpùrea, Cass. (E. sonchifolia, DC., not Hort. Cacalia sonchifolia, Linn. Senecio sonchifolius, Moench). Radical lvs. often more or less lyrate, st.-lvs. broader and clasping, the heads fewer in the cluster and the involucre-scales nearly as long as the florets. Apparently not in cult. in this country. L. H. B.

EMMENÁNTHE (Greek, *enduring flower;* the persistent corollas retain their shape when dry). *Hydrophyllàceæ.* A half-dozen low annual herbs from western North America, of which the most interesting species was introduced to cultivation in 1892, under the name of California yellow- or golden-bells.

Diffuse, depressed or erect: lvs. mostly alternate: fls. yellow or cream-color, the corolla campanulate and persistent; corolla-lobes 5; stamens 5; style 2-cut. The species named below belongs to a section of the genus, with calyx-lobes broader downward, and coarsely pitted seeds. All the others have the calyx-lobes broader upward and the seeds more or less wrinkled transversely.

penduliflòra, Benth. California Yellow- or Golden-Bells. Somewhat sticky, with long or short soft hairs: lvs. pinnatifid, lobes numerous, short, somewhat toothed or sharply cut: ovules about 16; seeds 1 line long. Calif. G.C. III. 11:339.—It grows 9–12 in. high, forming bushy plants, each branch loaded with broadly bell-shaped, pendulous, unwithering fls., about ½in. long, of creamy yellow. The general effect of a branch suggests the lily-of-the-valley, but the foliage is pinnatifid. Wilhelm Miller.

EMMENÓPTERYS (Greek, *persistent,* and *wing;* referring to the wing-like calyx-lobe, persistent on the fruit). *Rubiàceæ.* Ornamental tree grown for its large leaves and the handsome flowers.

Deciduous: lvs. opposite, petioled, with caducous stipules, entire: fls. in many-fld. terminal panicles; calyx small, 5-parted, deciduous, in some fls. 1 lobe leafy and changed into a petioled, oblong, obtuse whitish lf. persistent on the fr.; corolla campanulate-funnelform, tomentulose outside, with a narrow tube and 5 ovate lobes pubescent inside; stamens 5, included; ovary inferior, 2-celled; style filiform, not exceeding the stamens: fr. a spindle-shaped 2-celled caps., with numerous irregularly winged seeds.—One species in Cent. China. A tall tree, with large elliptic lvs. and showy yellow fls. in many-fld. dense terminal panicles. It will succeed in warmer temperate regions only and is yet little known in cult., as it has been only recently intro. Prop. is by seeds and possibly by softwood cuttings under glass.

Hénryi, Oliver. Tree, to 40 ft., quite glabrous: lvs. chartaceous, elliptic, acute, cuneate at the base, entire, 4–6 in. long; petiole 1–2 in. long: fls. in many-fld. panicles, yellow, about 1 in. long: caps. spindle-shaped, about 1¾ in. long, often at the apex with a persistent enlarged wing-like calyx-lobe 1½–2 in. long on a petiole of equal length. Cent. China. H.I. 19:1823.

Alfred Rehder.

ÉMPETRUM (Greek, *en,* in, *petros,* rock; growing often on rocks). *Empetràceæ.* Crowberry. Ornamental low shrubs sometimes grown for the evergreen foliage and attractive fruits.

Leaves linear-oblong, obtuse, thick: fls. diœcious or monœcious, axillary, 1–3, nearly sessile; sepals and petals 3; stamens 3, exserted; ovary superior, 6–9-celled with as many stigmas on a short and thick style: fr. a 6–9-seeded drupe.—Five species through the northern hemisphere in mountainous and arctic regions, also in Chile, antarctic Amer. and Tristan da Cunha.

The crowberries are hardy, evergreen, densely branched, prostrate or creeping, heath-like shrubs, with small, crowded leaves, inconspicuous purplish flowers, and globose, red or black, edible berries. They grow best in moist, sandy or peaty soil, and are especially handsome for rockeries. Propagated usually by cuttings of nearly ripened wood in late summer under glass.

A. *Branchlets and margin of expanding lvs. glandular, the latter not tomentose.*

nìgrum, Linn. Lvs. linear to linear-oblong, divergent, soon reflexed, glabrous or nearly so, entire, ⅛–¼in. long: fls. purplish: fr. black, about ⅕in. diam. April, May; fr. in Aug., Sept. N. Eu., N. Asia., in N. Amer. south to N. H., N. Y., Mich. and N. Calif. B.B. (ed. 2) 2:479. S.E.F. 8:1251.

AA. *Branchlets and margins of expanding lvs. white-tomentose.*

atropurpùreum, Fern. & Wiegand (*E. nìgrum* var. *andìnum,* Fern., not *E. andìnum,* Philippi. *E. nìgrum* var. *purpùreum,* Auth., not DC.). Trailing: lvs. linear-oblong, soon loosely divergent, rarely becoming reflexed, those of the leading shoots ⅛–¼in. long: fr. red to purplish black, opaque, ⅕–⅓in. across. Gulf St. Lawrence to Maine and N. H.

Èamesii, Fern. & Wiegand (*E. nìgrum* var. *purpùreum,* Auth., not DC. *E. rùbrum,* La Pylaie, not Vahl). Lvs. linear-oblong, crowded, ascending, becoming slightly divergent, those of the leading shoots ⅛in. or less long: fr. pink or light red, becoming translucent, ⅕in. or less across. S. Labrador, Newfoundland, E. Que.—Very handsome in fruit.

E. rùbrum, Vahl (E. nigrum var. rubrum, DC.). Closely related to E. Eamesii. Lvs. less crowded, spreading, somewhat larger. Antarctic Amer., Tristan da Cunha. B.R. 1783.

Alfred Rehder.

ENCÈLIA (Christopher Encel in 1577 wrote a book on oak galls). *Compósitæ.* Herbs or sub-shrubs, one or two of which have been sparingly introduced for planting in the southern parts of the United States.

Rather showy plants with mostly yellow-rayed naked-stalked heads (rays now and then absent), and yellow or brownish disk: lvs. alternate or opposite, entire, toothed or lobed, often white-tomentose: rays neutral, disk-fls. perfect; pappus none or an awn or scale for each margin or angle of the achene.—About 30 species, Utah and Calif. to Chile.

califórnica, Nutt. Woody at base, 2–4 ft. high, strong-scented, rather hoary, or becoming green: lvs. 1–2 in. long, ovate to broadly lanceolate, usually entire, indistinctly 3-ribbed from the base, abruptly stalked: heads 2½ in. across, the golden yellow rays numerous, 2–4-toothed: seeds obovate, with long, silky hairs on the callous margins and a shallow notch at the tip. Calif., Ariz.

adenóphora, Greenm. Stout almost woody herb, 3–6 ft., sometimes 10 ft., glandular-hairy throughout: lower lvs. opposite, stalked, ovate or deltoid, 2½–4 in. long, 3-nerved; upper lvs. gradually smaller: fls. cymose, the rays pale yellow, sometimes tinged with orange. Autumn. N. Mex.—Not hardy north of Washington, D.C. N. TAYLOR.†

ENCEPHALÁRTOS (Greek combination, alluding to the bread-like interior of the trunk). *Cycadàceæ.* Excellent cycads from tropical and southern Africa, grown chiefly for their evergreen foliage.

The species are probably 20 or more, allied to Dioon and Macrozamia; with Stangeria, they constitute the peculiarly African representatives of the family. They are trees with stout cylindrical often fleshy trunks, and a terminal crown of stiff mostly spiny pinnate long lvs. or fronds: fls. dicœcious, in cones; staminate cone oblong, ovoid or cylindrical, the scales in many series, imbricate, thick and often rough, broadly or elongate-cuneate, with anthers on the under surface; pistillate cone ellipsoid or oblong, thick, the scales numerous in many series and imbricated, peltate, with the ovule beneath. For differences between this and related genera, see Vol. I, p. 120. From Dioon it is distinguished by its pinnate rather than pinnatifid lvs., and from Cycas by straight rather than circinnate segms. in vernation, as well as by technical features of cones. These plants are specially suited for large conservatories, the fronds being not easily injured. They should succeed outdoors S. The trunks of some kinds grow only a few inches in many years. Most kinds prefer a sunny, tropical house, but *E. brachyphyllus* and perhaps others may be grown in a cool greenhouse if kept a little dry in winter. The cones are always interesting and often very decorative. Those of *E. villosus* are twice as large as a pineapple, orange-yellow, half revealing the scarlet frs. They are prop. by seeds; also by offsets or suckers. Some other cycads frequently produce seed in conservatories, but Encephalartos seldom does, and plants are, therefore, usually imported. Dry trunks, weighing frequently 50–75 lbs. have been received from S. Afr. They often remain dormant for a year or more, and do not make ornamental specimens for two or more years. They are slow-growing, except in very warm houses. They like a strong, loamy soil. While making new growth they need plenty of water. See *Cycas.*

The woolliness of the stem and leaf-segments varies with the age of the plants and of the leaves. The pith and central portion of the cones of some species form an article of food among the Kafirs, hence the common name of Kafir bread. The most widely known species in cultivation are *E. villosus, E. Altensteinii* and *E. pungens.* Though very handsome cyads, they are by no means popular. They require much room for best results.

In the following descriptions "rachis" refers to the midrib of the leaf on which the leaflets or segments are borne, and "petiole" means the part of the leaf below where the leaflets begin.

A. *Lfts. toothed (sometimes entire in the first).*

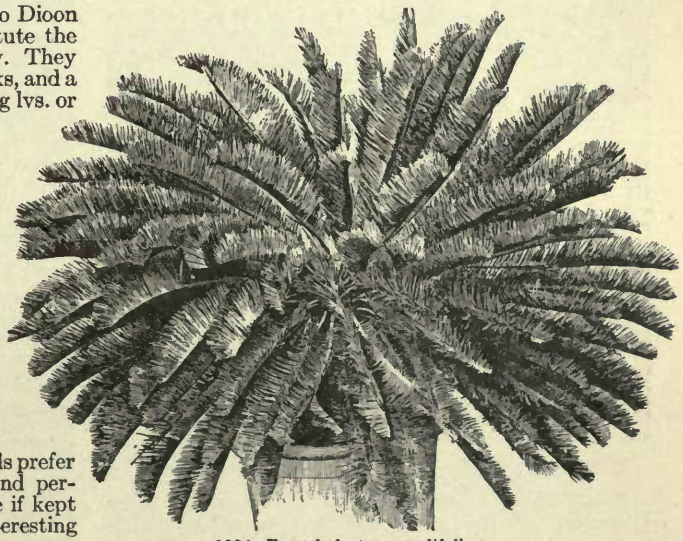
B. *Petiole 4-angled: foliage glaucous.*

hórridus, Lehm. Trunk short and stout, woolly or not: lvs. to 6 ft., reflexed at top; lfts. opposite or alternate, lanceolate, mostly entire, sometimes toothed, with a sharp spine at the apex. Var. **glaûca,** is presumably more glaucous than the type. B.M. 5371. There is a var. *trispinosus.*

BB. *Petiole sub-cylindrical: foliage not glaucous.*

Áltensteinii, Lehm. Trunk stout, not woolly: lvs. 2–6 ft.; lfts. about 6 in. long and 1 in. broad, oblong-acuminate, paler beneath, edges and apex spiny; petioles swollen at base; lfts. mostly opposite, lanceolate. B.M. 7162–3. G.C. II. 6:392, 393, 397; III. 2:281; 12:489–493; 40:206 (showing a specimen in Cape Colony over 100 years old, with a high trunk and an offshoot over half way up). G. 7:516.

villòsus, Lehm. Trunk short and thick, woolly and scaly, 6 ft.: lvs. to 6 ft.; lfts. very numerous, opposite or alternate, linear-lanceolate, spiny-toothed and pointed. B.M. 6654. R.H. 1897:36. G.C. II. 1:513; 3:400; 7:21; 13:181.



1394. Encephalartos cycadifolius.

AA. *Lfts. not toothed (except in young lvs. of the last one).*

B. *Foliage glaucous.*

Léhmannii, Lehm. (*Cỳcas Léhmannii,* Hort.). Trunk not woolly: rachis and petiole obtusely 4-angled; lfts. nearly opposite, narrowly or broadly lanceolate, to 7 in. long, rarely 1-toothed, with brown spine at apex. Gt. 1865:477.

BB. *Foliage not glaucous.*

C. *Apex of lfts. mostly obtuse, pointless.*

longifòlius, Lehm. Trunk not woolly, at length tall: rachis and petiole 4-cornered but flattish above; lowest lfts. often 1–3-toothed, margin somewhat revolute: wool soon vanishing from the rachis and lfts. S. Afr. G.W. 5, p. 404. Var. **revolùtus,** Miq., has the margins more distinctly revolute. Var. **angustifòlius** has narrower, flat lfts. Var. **Hoòkeri,** DC., has narrowly lanceolate lfts., not glaucous but intense green, and rachis not woolly. B.M. 4903, erroneously named *E. caffer,* is referred to this place, though the lfts. are distinctly pointed in the picture.

CC. *Apex of lfts. always strong-pointed.*

D. *Form of lfts. linear.*

cycadifòlius, Lehm. (*E. Friderici-Guiliélmi,* Lehm. *E. cycadifòlius* var. *Friderici-Guiliélmi,* Rod.). Fig. 1394. Trunk nearly globular, several inches in diam., woolly at first: rachis and petiole ashy-pubescent;

lfts. opposite and alternate, linear, margin revolute. I.H. 29:459. G.F. 4:209 (adapted in Fig. 1394). G.W. 10, p. 377 (as *E. cycadifolius* var. *Friderici-Guilielmi*).

púngens, Lehm. (*Zàmia púngens,* Ait.). Rachis and petiole glabrous; lfts. long-linear, dark green, rigid, flat, striated beneath, margin not revolute. Var. glaúca is also sold.

DD. *Form of lfts. lanceolate.*

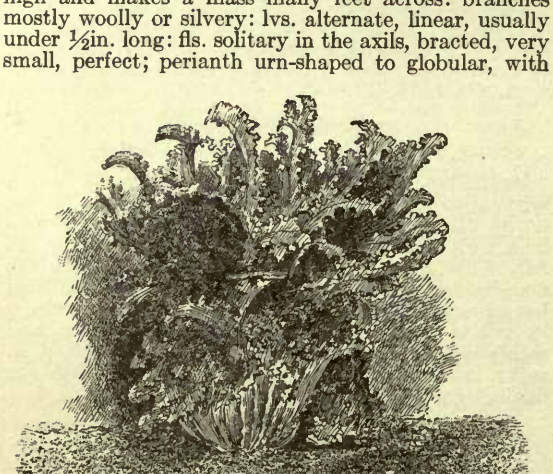
cáffer, Miq. (*E. cáffra,* Hort.). Trunk to 18 ft. and 1 ft. or more diam.: lvs. to 4 ft., very stiff, recurved; petiole 3-angled; rachis glabrous; lfts. alternate, narrower at the base, twisted, the younger ones with 1 or 2 teeth, to 6 in. long. R.H. 1869, p. 233. Not B.M. 4903, which is *E. longifolius* var. *Hookeri.*

Var. **brachyphýllus,** DC. (*E. brachyphýllus,* Lehm.). Rachis and blades of the lower lfts. spidery pubescent: male cones sessile instead of peduncled. The pinnæ are erect, and longer and narrower than in *E. caffer.*

E. Bárteri, Carr. St. short, about 1 ft. high and to 9 in. diam.: lvs. to 5 or 6 ft. long, and 10 in. broad, erect or suberect; petiole and rachis with a gray tomentum that falls off; lfts. about 80 pairs, linear-lanceolate, sharp at the apex, few-toothed: male cone to 9 in. long, pale; female cone about 8 in. long, oblong-ellipsoid, dark olive. W. Trop. Afr. B.M. 8232.—*E. Ghellínckii,* Lem. Spineless: trunk stout, woolly-scaly: lvs. 3–4 ft., erect-spreading; pinnæ very narrow-linear, densely tomentose. S. Afr. I.H. 15:567.—*E. Hildebrandtii,* A. Br. & Bouché. Trunk cylindrical: lvs. pinnate, with numerous lanceolate toothed pinnæ which become 3-parted scales toward the end of the lf., woolly at least at first. Trop. Afr. G.C. III. 27:120. R.B. 29:196. G.W. 10, p. 210. An attractive species.—*E. Laurentiànus,* Wildem. Large, the st. reaching 30 ft. or more and 2½ ft. diam.: lvs. often over 20 ft. long; lower lfts. small, 3-toothed; middle lfts. lanceolate, 12–16 in. long and 2 in. broad, spiny on both edges and at the apex. Congo. G.C. III. 35: 370. Named for Professor Laurent.—*E. Lemarineliànus,* Wildem. & Dur. St. 3–7 ft.: lvs. to 3 ft. or more; petiole shaggy; lfts. 18–60 on each side, rigid, coriaceous, glaucous, lanceolate, the edge slightly recurved, more or less spiny: male cone greenish, subcylindrical; female cone thick, green turning to salmon-color, short-peduncled, the scales triangular. Congo. Named for Capt. Lemarinel. G.C. III. 35:371. R.H. 1904, p. 59.—*E. Woòdii,* Hort. Allied to E. Altensteinii: st. 18 in. high and 8 in. thick, bearing about 25 lvs. which are gracefully curved and reach 5 ft.: lfts. 8 in. long and 2 in. broad, spiny-toothed, the broadest ones pinnatifid. Zululand. G.C. III. 43:282. R.B. 34, p. 193. L. H. B.†

ENCHOLÍRION: *Vriesia.*

ENCHYLÆNA (name alludes to the soft or juicy character of the berry-like fructification). *Chenopodiàceæ.* One procumbent or wide-branched very small-leaved shrub from Austral. recently intro. by U. S. Dept. Agric., and thriving well at the University of California. *E. tomentòsa,* R. Br., grows 3 ft. or more high and makes a mass many feet across: branches mostly woolly or silvery: lvs. alternate, linear, usually under ½in. long: fls. solitary in the axils, bracted, very small, perfect; perianth urn-shaped to globular, with 5 short teeth that close over the fr.; stamens 5, somewhat exserted: fr. inclosed in the perianth, which becomes red or yellow, fleshy and berry-like and the size of a small pea. The Australian aborigines are said to eat the berries in great quantities. The plant endures drought, and it is eaten by sheep when other herbage becomes scarce. The procumbent habit and the enduring color suggest its use in landscape work in dry mild climates.



1395. Green curled endive tied up for blanching.

ENCKÈA: *Piper.*

ENDIVE (*Cichòrium Endívia*). *Compósitæ.* A leaf-salad plant. See *Cichorium.*

Until recently endive has been almost unknown in American home gardens, but it is gradually receiving favor with salad-lovers. Although more frequently a product of the amateur, during August and September, and possibly later, it is now freely offered in the larger markets. It is especially the people of foreign descent who grow, buy and use endive. In the hot weather of summer and fall, when lettuce plants are more likely to produce seed-stalks than good solid heads, endive, although of somewhat bitter flavor when unbleached, makes a good and acceptable substitute for lettuce as a salad plant. In the unbleached state it may even be used for "greens."

The requirements as to culture are simple, as the plant succeeds well on any ordinary well-enriched garden soil. Seed may be sown in the open ground as early as June, and as late as August, the rows to be a foot apart and the plants to be thinned early to a foot apart in the row; or seed may be started in flats and the young seedlings transplanted to open ground. The latter is the better way when the ground is very dry. In extreme cases, it may be advisable for the home gardener to grow his seedlings in flats and pot them off in thumb-pots to become well rooted. This gives a chance to grow good plants, while waiting for a rain to moisten the open ground. To be tender, the plants should be forced into strong and succulent growth by high feeding and the free use of the hoe. It is a waste of effort to plant endive on poor land that is deficient in humus, or naturally dry and exposed.

The originally bitter flavor becomes pleasant and acceptable when the leaves or hearts are well blanched. The blanching is accomplished by tying the outer leaves over the heart with bast (Fig. 1395), or by placing a big flower-pot over each plant, or by setting boards, say 10 inches wide, on edge along each side of the row, in inverted V shape, and in somewhat the same fashion as for blanching celery, except that no opening is left on top. The light should be excluded from the hearts as much as possible. In any of these ways endive may be well blanched in about three weeks, and will come out with inner leaves showing a delicate whitish or creamy color, and being crisp, tender and of pleasant flavor.

If to be kept for winter use, sow the seed of Green Curled endive in August, or set the plants early in September; then take up the full-grown but as yet unblanched plants with a ball of earth adhering to the roots, and store them in a root-cellar as is done with celery. If kept in the dark, they will soon bleach and be ready for use.

Green Curled has long been the favorite variety in our markets and gardens. Its narrow curled leaves make the well-blanched plant far more attractive to the eye than the wider and plain leaves of Broad-Leaf. The latter, however, is gaining on the other in both growers' and consumers' favor. This is the only practical difference between the two varieties. The catalogues of European seedsmen list and describe several additional varieties, such as the Moss Curled and Rouen, none of which is often met with in American gardens. A few fungi and the spinach insects sometimes attack the plant. T. GREINER.

ENGELMÁNNIA (Dr. Geo. Engelmann, eminent botanist of St. Louis, died 1884). *Compósitæ*. One yellow-fld. herb, *E. pinnatífida*, Torr. & Gray, allied to Parthenium and Silphium, Kans. to La., Ariz. and Mex., that is likely to be planted in wild gardens. It grows a foot or two high, in dry places, from a stout perennial root, branching above, hirsute, with alternate and radical deeply pinnatifid lvs., and corymbose heads of golden yellow fls. on slender and naked peduncles: involucre hemispherical, somewhat double; receptacle flat and chaffy; ray-fls. 8–10, pistillate and fertile, the rays ½in. or more long; disk-fls. perfect and sterile: achene obovate, wingless, ribbed, with a persistent pappus-crown.

ENKIÁNTHUS (Greek *pregnant* and *flower*, referring to the colored involucre which subtends the flowers of *E. quinqueflorus*, giving the appearance of small flowers springing from a larger flower). Also written *Enkyanthus*. *Ericàceæ*. Ornamental woody plants, chiefly grown for their handsome flowers and the brilliant autumnal tints of the foliage.

Deciduous, rarely evergreen shrubs with whorled branches: lvs. alternate, usually serrulate, crowded toward the end of the branchlets: fls. in terminal umbels or racemes; sepals 5, small; corolla campanulate or urceolate, usually 5-lobed; stamens 10; anthers 2-awned at the apex, opening with short slits: fr. a dehiscent caps.; cells 1- to few-seeded; seeds 3–5-winged or -angled.—About 10 species in China and Japan, Cochin-China and Himalayas. Closely related to Pieris and Zenobia; chiefly distinguished by the few- or 1-seeded cells of the caps. and the winged or angled seeds.

These are charming ornamental shrubs, with bright green, medium-sized leaves turning brilliant colors in autumn and with handsome white, red or yellow-and-red, drooping flowers appearing in spring; the flowers are not of the showy kind, but very graceful and of distinct appearance. Most of the cultivated species, as *E. campanulatus*, *E. cernuus*, *E. perulatus* and *E. subsessilis*, have proved hardy in Massachusetts; they seem to grow well in any well-drained humid soil, but probably are impatient of lime, as are most Ericaceæ and in limestone regions should be grown in specially prepared beds of peaty soil. Propagation is by seeds sown in spring, by cuttings of ripe wood under glass in spring, or by greenwood cuttings in summer; also by layers.

A. *Fls. urceolate, gibbous at the base, white.*

perulàtus, Schneid. (*E. japónicus*, Hook. f. *Andrómeda perulàta*, Miq.). Shrub, to 6 ft.: lvs. petioled, obovate to elliptic-ovate, acute, sharply appressed-serrulate, glabrous and bright green above, pubescent on the veins below, 1–2 in. long: fls. in drooping umbels, slender-pedicelled; corolla urceolate, with 5 revolute lobes and with 5 sacs at the base, ⅓in. long: caps. oblong-ovoid, about ½in. long, on straight pedicels. May. Japan. B.M. 5822. G.C. III. 21:357. R.H. 1877, p. 467. S.I.F. 2:62.—The foliage turns yellow and partly scarlet in autumn.

AA. *Fls. campanulate, not gibbous at the base, usually red or yellow-and-red.*

campanulàtus, Nichols. (*Andrómeda campanulàta*, Miq.). Fig. 1396. Shrub, to 15 or occasionally to 30 ft.: lvs. petioled, elliptic or rhombic-elliptic, acute or acuminate, sharply appressed serrulate, glabrous except few scattered bristly hairs, particularly on the veins below, 1½–3 in. long: fls. slender-pedicelled, in drooping, 8–15-fld. puberulous racemes; corolla with short obtuse upright lobes, yellowish or pale orange, veined darker red, nearly ½in. long: caps. oblong-ovate on pendulous stalks turned upward at the apex. May. Japan. B.M. 7059. Gn. 75, p. 287. G. 29:361. Gt. 22:747. M.D.G. 1900:550. S.I.F. 2:62.—This is one of the handsomest species and the strongest grower; the peculiar coloring of the gracefully drooping fls. is very attractive; the foliage turns brilliant red in autumn.

cérnuus, Makino (*E. Meistèria*, Maxim. *Andrómeda cérnua*, Miq.). Shrub, to 15 ft.: lvs. short-petioled, obovate or rhombic-obovate, acute or obtusish, crenately serrate, bright green above, lighter below and pubescent on the veins, 1–2 in. long: fls. in pendulous racemes, slender-pedicelled; corolla with irregularly laciniate limb, about ⅓in. long, white in the type: caps. on pendulous stalks turned upward at the apex. May. Japan. Var. **rùbens,** Makino. Fls. red. —Only the red-fld. variety seems to be in cult. and is a very distinct-looking handsome shrub.



1396. Enkianthus campanulatus. (×½)

E. chinénsis, Franch. (E. himalaicus var. chinensis, Diels). Allied to E. campanulatus. Lvs. quite glabrous, more crenately serrate: racemes glabrous; corolla yellow and red, with darker red lobes. Cent. and W. China. J.H.F. 1900: 212.—*E. deflèxus*, Schneid. (E. himalaicus, Hook. f. & Thoms.). Closely related to E. campanulatus. Lvs. elliptic-ovate to elliptic-lanceolate, acute, slightly serrate, margin and petioles red while young: racemes many-fld.; corolla yellow, striped dark red, with darker lobes. Himalayas. W. China. B.M. 6460.—*E. himalàicus*, Hook. f. & Thoms.=E. deflexus and E. chinensis.—*E. nikoénsis*, Makino =E. subsessilis.—*E. quinqueflòrus*, Lour. (E. reticulatus, Lindl.). Lvs. elliptic, long-petioled, entire, persistent: fls. about 5, in umbels, subtended by colored bracts, drooping; corolla campanulate, scarlet. S. China, Cochin-China. B.M. 1649. B.R. 884, 885. L.B.C. 12:1101. P.M. 5:127. R.H. 1849:221. H.F. 1859:101. Tender. Var. *serrulàtus*, Wilson (E. serrulatus, Schneid.). Lvs. deciduous, membranous, finely serrulate: fls. smaller. Cent. and S. W. China.—*E. reticulàtus*, Lindl.=E. quinqueflorus.—*E. serrulàtus*, Schneid.= E. quinqueflorus var. serrulatus.—*E. subséssilis*, Makino (E. nikoensis, Makino). Allied to E. perulatus. Lvs. short-petioled, elliptic or obovate: fls. in pendulous racemes, small, white, ⅓in. long. June. Japan. S.T.S. 1:25. S.I.F. 2:62.—This is the least attractive in bloom, but the autumnal tints of the foliage are as beautiful as in the other species.

ALFRED REHDER.

ENNEÁLOPHUS (name refers to the 9 crests on the style). *Iridàceæ*. A very recently described genus of one species, *E. amazónicus*, N. E. Br., differing from Tigridia in the 3 style-branches being 3-crested rather than bifid or subulate. The perianth-segms. are free, unequal and clawed, the exterior ones much the larger, the blades of all of them more or less reflexed; stamens 3, the filaments connate into a tube. The bulb of the single known species is abut 1 in. long, ovoid: lvs. linear-lanceolate, about 4, the upper one about 2 in. long and the others 6–12 in.: fls. about 1½ in. across, blue-violet with pale brown claws and a white spot at the base of the blade of the inner segms. Brazil; apparently not in the trade.

ENTÀDA (a Malabar name). Syn. *Pusætha*. *Leguminòsæ*. Tropical woody spineless climbers.

Leaves bipinnate, often cirrhiferous: fls. not papilionaceous, white or yellow, in slender spike-like racemes which are solitary or panicled; calyx campanulate, shortly 5-toothed; petals 5, free or somewhat cohcrent; stamens 10, free, short-exserted: pod straight or arcuate, flat-compressed, jointed, the joints separating and leaving a continuous border.—Perhaps 20 species of high climbers in Afr. and Amer. The genus is remark-

able for the jointed pods, which sometimes reach several feet in length. Two of the American species are mentioned as planted in S. Fla. Some of the species yield "sea beans" (G. F. 7:503).

polystàchya, DC. At length tendril-bearing: pinnæ in 4–6 pairs; lfts. in 6–8 pairs, oblong, rounded at apex, beneath glabrous or puberulent: racemes in terminal panicles: pod oblong, straightish, reaching 1 ft. in length. W. Indies to Venezuela and Guiana.—Makes a rapid growth.

scándens, Benth. Climbing to a great height, tendril-bearing, the sts. terete: pinnæ 1 or 2 pairs; lfts. 2–5 pairs, coriaceous, oblong or elliptic, usually unequal-sided, glabrous or nearly so beneath: racemes solitary or twin: pod twisted, sometimes 8 ft. long. W. Indies, Afr., Asia, Pacific Isls. G.C. II. 15:430.—Seeds 2 in. across, dark brown or purple, handsome, used in the making of trinkets and small receptacles. Lvs. long-stalked, the rachis commonly ending in a tendril. L. H. B.

ENTELÈA (Greek, *complete;* the stamens all fertile, a distinguishing feature). *Tiliàceæ.* A shrub or small tree from New Zeal., intro. in S. Calif. Lvs. large, alternate, 5–7-nerved, cordate at base, toothed or crenate, stellate-pubescent: fls. white, 1 in. across, in terminal cymes; sepals 4–5; petals 4–5; stamens numerous, free; ovary 4–6-celled; cells many-ovuled; style simple: fr. a globose bristly loculicidal caps.

arboréscens, R. Br. Attaining 20 ft.: the heart-shaped outline of the lf. broken on each side, about two-thirds of the way toward the tip, by a projection or lobe ½in. long or nearly as long as the tip of the lf.; blade 6–9 in. long, 4 in. wide, doubly serrate. New Zeal. B.M. 2480.—Eaten by horses and cattle in New Zeal. Allied to Sparmannia, Aristotelia and Elæocarpus. L. H. B.

ENTEROLÒBIUM (name refers to the *intestine-form* pods). *Leguminòsæ.* Tropical trees.

Unarmed: lvs. bipinnate, the pinnæ and lfts. many: fls. not papilionaceous, greenish, in large heads or clusters; calyx campanulate, shortly 5-toothed; corolla 5-toothed, somewhat trumpet-shaped, the petals connate part way; stamens many, connate at base into a tube, exserted, purple or white: legume broad, circinate, attached at or near the middle, restricted between the large seeds, leathery, pulpy.—About a half-dozen species in the American tropics, 2 of which have been intro. in S. Calif.

A. *Pod bent back in a complete circle.*

cyclocárpum, Griseb. Tall tree, glabrous: pinnæ in 4–9 pairs; lfts. in 20–30 pairs, unequal-sided, oblong, pointed; the petiole with glands between bottom and top pinnæ: stamens white. Cuba, Jamaica, Venezuela.

AA. *Pod forming half or two-thirds of a circle.*

Timboûva, Mart. Said to be a fine tree: pubescent or glabrous, glaucous: pinnæ 2–5-pairs; lfts. 10–20 pairs, falcate-oblong, mostly acute: pod coriaceous and indehiscent, reniform, fleshy within; seed elliptic. L. H. B.

EOMÈCON (Greek, *eastern poppy*). *Papaveracèæ.* Herbaceous perennial, with white flowers on a slender-branching scape.

Rhizomatous, with radical lvs., glabrous: "monotypic, intermediate between Stylophorum and Sanguinaria, differing from both in the scapose habit, racemose fls. and sepals confluent in a membranous, boat-shaped spathe, and further from Stylophorum in the form of the lvs. and color of the fls., and from Sanguinaria in the 4 petals and elongate style" (Hooker).

chionántha, Hance. Rootstock creeping, ascending, full of yellow sap: lvs. all from the root; stalks twice as long as the blades; blades 3–6 in. long, heart-shaped, concave, broadly sinuate, rounded at the apex, bright pale green above, almost glaucous beneath: scape 1 ft. or more high, reddish; fls. 2 in. across, white; petals 4. Spring; hardy near New York City. E. China. B.M. 6871. WILHELM MILLER.

EOPÈPON: *Trihcosanthes.*

ÉPACRIS (Greek-made name, *upon the summit;* referring to their habitat). *Epacridàceæ.* Heath-like shrubs of Australia and New Zealand, of which half a dozen or less are grown as cool greenhouse pot-plants.

Leaves small and entire, usually sharp-pointed, sessile or short-stalked, scattered or sub-opposite: fls. small and axillary, short-stalked, the flowering sts. being elongated leafy spikes, regular and perfect; calyx bracteate; corolla tubular, 5-toothed, white or shades of purple and red; stamens 5; ovary 5-loculed, ripening into either a fleshy or capsular fr. Distinguished from Erica by the bracteate or scaly calyx, and the anthers opening by slits rather than pores.—About 40 species. In the Old World, epacrises are prized by those who grow heaths, and many good varieties are known. They bloom in early spring or late winter. The varieties of *E. impressa* may be flowered for Christmas; perhaps others may be so treated. A carnation house, 50–55,° suits them well. There are double-fld. forms.

A. *Corolla-tube decidedly longer than the calyx.*

impréssa, Labill. Three ft., erect, twiggy, downy: lvs. horizontal or deflexed, narrow-lanceolate and sharp: fls. rather large (often ½in. long), tubular, pendent, on very short stalks, red or white. B.M. 3407. There are many forms: var. **parviflòra,** Lindl., B.R. 25:19; *E. campanulàta,* Lodd., with broader fls., L.B.C. 20:1925; *E. ceræflòra,* Graham. B.M. 3243; *E. nivàlis,* Lodd., snow-white, L.B.C. 19:1821. B.R. 1531; *E. variábilis,* Lodd., blush, L.B.C. 19:1816; var. **longiflòra,** Cav., (*E. miniàta,* Lindl. *E. grandiflòra,* Willd.). Sts. woolly, straggling: lvs. ovate-pointed or cordate-pointed, sessile or nearly so, many-nerved: fls. long (nearly 1 in.), red at base and white at the limb, cylindrical. B.M. 982. B.R. 31:5.—Handsome. Var. **splèndens,** Hort., has brighter colors.

AA. *Corolla-tube shorter than the calyx or only as long as it.*

B. *Lvs. acute or acuminate.*

acuminàta, Benth. Lvs. ovate, acuminate, clasping, ascending: fls. small, red nearly sessile in the upper axils; corolla-tube not exceeding the calyx; sepals broad, ciliate.—Little known in U. S. outside of botanic gardens, but of considerable worth.

breviflòra, Stapf. (*E. heteronèma,* Hook.). A graceful shrub, 1 ft., with many wavy branches, naked below, with many lvs. above: lvs. divaricate on upper part of st., reflexed below, elliptic-ovate, 3–6 lines long, sharp-pointed: fls. spicate at the ends of the branches, white; bracts and sepals whitish. New Zeal. Flowers in May in England. B.M. 3257.

purpuráscens, R. Br. Lvs. ovate-acuminate, trough-shaped, tipped with a long curved point or spine: fls. short, the calyx nearly equaling the corolla, white or pinkish. There is a double-fld. form. L.B.C. 3:237. G.C. II. 5:340.—Probably identical with *E. pulchella,* Cav.

BB. *Lvs. very obtuse.*

obtusifòlia, Smith. An erect, much-branched shrub 1–3 ft. tall, the branches usually hairy: lvs. small, elliptic or linear, thick and obtuse: fls. small, white, in axillary racemes which are more or less one-sided. L.B.C. 3:292.

Other trade names are: *E. ardentíssima.* Fls. crimson.—*E. hyacinthiflòra* var. *candidíssima,* white, early, and var. *fúlgens,* pink.—*E. hýbrida supérba* is merely a catalogue name for mixed kinds of Epacris.—*E. rubélla.* Fls. bright red.—*E. salmònea* (?) N. TAYLOR.†

EPHÉDRA (ancient Greek name, used by Pliny for the horse-tail). *Gnetàceæ*. Woody subjects, rarely cultivated; usually found only in botanical collections, although the scarlet fruits of some species are very attractive.

Usually low much-branched shrubs, often procumbent and sometimes climbing, the green branches resembling much those of Equisetum, bearing minute, scale-like, sheathing lvs. in distant pairs or whorls: fls. diœcious, in small aments, forming usually pedunculed axillary clusters; staminate fl. with a 2–4-lobed perianth and with the 2–8 stamens united into a column; pistillate fl. with an urceolate perianth, including a naked ovule, developing into a nutlet; in some species the bracts of the ament become fleshy, and form a berry-like syncarp.—About 30 species from S. Eu., N. Afr., Asia and in Trop. Amer. Latest monograph by O. Stapf, in Denkschr. Akad. Wissensch. Wien., vol. 56 (1889), (in German and Latin). Curious-looking, usually low shrubs, with pale green apparently leafless branchlets, much resembling those of the horse-tail and with inconspicuous fls., but fr. in some species decorative, berry-like and scarlet. They are but rarely grown, and most of them are tender; half-hardy N. are *E. distachya*, *E. foliata*, *E. nevadensis*, *E. trifurca*. They can be used for covering dry, sandy banks or rocky slopes. Prop. is by seeds or by suckers and layers.

E. altíssima, Desf. Climbing shrub, to 20 ft., green: lvs. to 1 in. long: aments paniculate or solitary; fls. with 2–3 stamens; pistillate fls. 1–2: fr. berry-like, ovoid, ½in. long, scarlet. N. Afr. B.M. 7670. G.C. III. 7:792.—*E. distàchya*, Linn. (E. vulgaris, Linn.). Low, often procumbent, 1–3 ft., pale or bluish green: lvs. one-twelveth in. long: aments usually clustered, staminate oblong; fls. with about 8 stamens, pistillate 2-fid.: fr. berry-like. S. Eu., W. Asia. R.F.G. 11:809. Var. *monostàchya*, Stapf. Aments usually solitary.—*E. foliàta*, Boiss. (E. kokanica, Regel). Procumbent or erect, to 15 ft., bright or bluish green: lvs. to 1 in. long: aments usually clustered, ovate; staminate fls. with 3–4 sessile stamens; pistillate 2-fid.: fr. berry-like. W. Asia.—*E. kokànica*, Regel=E. foliata.—*E. nebrodénsis*, Tineo. Erect, with rigid, pale green branches: lvs. ½in. long: aments solitary or few; staminate globular; pistillate 2-fid.: fr. berry-like. Medit. region to Himalayas.—*E. nevadénsis*, Wats. Erect, 2–3 ft., with pale or bluish green branches: lvs. ½in.: aments usually solitary; staminate ovate, 6–8-fid.; pistillate 2-fid.: fr. dry, with ovate bracts. Calif., New Mex.—*E. trifúrca*, Torr. Erect, with rigid, yellowish or pale green branches: lvs. in 3's, connate, about ¼in. long; aments solitary; pistillate 1-fid.: fr. dry, the roundish bracts with transparent margins. Ariz. to Colo.—*E. vulgàris*, Linn.=E. distachya.

ALFRED REHDER.

EPICÁTTLEYA (compounded of *Epidendrum* and *Cattleya*). *Orchidàceæ*. A genus established to contain hybrids between Epidendrum and Cattleya.

The following are some of these: *E. balarucénsis* (C. labiata × E. eburneum).—*E. cándida* (C. Skinneri × E. nocturnum).—*E. decípiens* (C. gigas × E. ciliare).—*E. Lílianæ* (C. Gaskelliana × E. costaricense).—*E. madeburgénsis*.—*E. Nèbo* (C. Clæsiana × E. O'Brienianum).—*E. nemoràle-gigas* (C. Warscewiczii × E. nemorale).—*E. O'Brìenniæ* (C. Bowringiana × E. O'Brienianum).—*E. Òrpetii* (C. amethystoglossa × E. O'Brienianum).—*E. salmonícolor* (C. Mendelii × E. aurantiacum).—*E. Sédenii* (C. Bowringiana × E. radiatum).—*E. Wolteriàna* (C. Schrœderæ × E. aurantiacum).

GEORGE V. NASH.

EPIDÉNDRUM (*upon trees*, alluding to their epiphytal habit). *Orchidàceæ*. Epiphytic orchids, some requiring hothouse and some coolhouse conditions; although a large genus, of minor importance horticulturally.

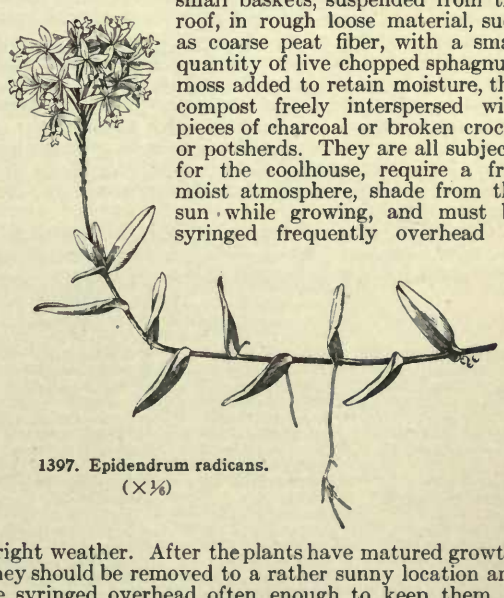
Inflorescence simple or branched, nearly always terminal; claw of the labellum more or less adnate to footless column, the blade spreading and usually deeply lobed; pollinia 4, 2 in each anther-cell, separated.—Nearly 500 species discovered and described from the New World tropics, chiefly from Cent. Amer.

Cultivation of epidendrums.

Epidendrums are noted as the rankest weeds amongst the orchid tribes. The remarkable success in the raising of hybrids, be it in the genus itself or with the related Cattleya and Lælia, has opened a wide field for the breeder. Epidendrum seedlings grow freely; the time required to bring them to the flowering stage is little compared with other orchids, and it is but a question of a short time till the blood of the epidendrums will be infused into the weaker but more gorgeous flowers of genera more difficult to grow. It is also the long stem and the grace of the racemes of the epidendra, as well as the odor of some of their species, which the hybridist will try to blend with the largeness of short-stemmed flowers, of cattleyas for example. Therefore a list of the species but rarely found under cultivation is given below, the value of which, however, will call for and justify large importations of their kind before long.

It is scarcely possible to apply any one rule for the cultivation of this widely divergent and large genus, which includes many hundreds of variable individuals geographically distributed all over tropical America. For convenience they are treated under their several separate sections.

Section I. BARKERIA embraces several deciduous small-growing species which generally deteriorate sooner or later under cultivation. They succeed best in small baskets, suspended from the roof, in rough loose material, such as coarse peat fiber, with a small quantity of live chopped sphagnum moss added to retain moisture, this compost freely interspersed with pieces of charcoal or broken crocks or potsherds. They are all subjects for the coolhouse, require a free moist atmosphere, shade from the sun while growing, and must be syringed frequently overhead in bright weather. After the plants have matured growth, they should be removed to a rather sunny location and be syringed overhead often enough to keep them in sound condition until they start new action. While resting during winter the temperature may range from 50° to 55° F. at night, and a few degrees higher during the day. They are increased by division. This should take place as the plants start growth action in early spring, allowing at least three pseudobulbs to each piece.



1397. Epidendrum radicans.
(×⅙)

Section II. ENCYCLIUM, of which *E. atropurpureum*, *E. nemorale* and *E. prismatocarpum* are good examples, may be grown either in pots or baskets in equal parts clean peat fiber and live chopped sphagnum, with a liberal amount of drainage, and excepting *E. vitellinum*, which must be grown cool, they require a moist sunny location with a winter temperature of 58° to 65° F. by night and several degrees advance during the day. In February and March, many species will start root or growth action; such as need it should then be repotted or top-dressed, as occasion requires. The temperature should be increased several degrees, and a greater amount of water be allowed with frequent overhead syringing on bright days. Ventilation should be given whenever the weather will permit, to keep the young growths from damping-off and the atmosphere active; at this time the plants will need light shading to pre-

vent sun-burning. The stock is increased by cutting nearly through the rhizome three or four bulbs behind the lead, when starting action; this will generally cause the latent eyes to grow, but the pieces should not be removed until the new growth is well advanced.

Section III. AULIZEUM includes such species as *E. ciliare, E. cochleatum,* and the like, the several requirements being identical with the preceding.

Section IV. EUEPIDENDRUM. These are mostly tall-growing species, some reed-like as in *E. evectum,* and others rambling in an irregular way, producing aërial roots along the stems as they grow; a good example of this is seen in *E. radicans.* All are best grown in pots and placed near a partition or end of a greenhouse where support may be given as the growth advances. There is, in fact, no better example of an epiphyte than *E. radicans,* the roots often attaining several feet in length, and appearing from nearly every node. A structure in which 50° F. is maintained in winter will be ample, and full exposure to sun should be permitted at all times. This prevents immature growth, and flowers are produced very freely. After flowering time, young shoots appear, often from the old stems, and when a few roots are formed and before they become too long to go into a small pot without injury, remove them and pot with care, place the young plants in a shady place for a few weeks; in this way propagation is easily accomplished. This section of epidendrums produce seeds the largest known among orchids. They are green in color, and under favorable conditions germinate very readily. It is, in fact, much easier to get the seeds to grow than to get the species to produce good seeds, for when flowering plants are produced from seed, there is an infinite variation that has not yet been understood.

Section V. PSILANTHEMUM contains but one species, *E. Stamfordianum,* which requires the same general treatment as those in Section II.

ROBERT M. GREY.
E. O. ORPET.

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vitellinum, 15.

A. *Infl. radical.* (*Psilanthemum.*)

1. **Stamfordiànum,** Batem. Sts. fusiform, 12 in. long: lvs. 7–9 in.: large panicles of yellow and green fls., crimson-spotted, fragrant. Mex. to Colombia. B.M. 4759. G.C. III. 17:655. J.F. 3:251.

AA. *Infl. terminal.*

B. *Sts. without bulbs: lvs. distichous, alternate: only top of column free from lip.* (*Euepidendrum.*)

C. *Fls. red, orange or vermilion.*

2. **Catillus,** Reichb. f. (*E. imperàtor,* Hort.). Fls. cinnabar-red. Colombia. I.H. 21:162.

3. **cinnabarinum,** Salzmann. Sts. 3–4 ft.: fls. orange-red, 2 in. diam., lobes of lip deeply fringed. Brazil. B.R. 28:25.—A beautiful species.

4. **radìcans,** Pav. (*E. rhizóphorum,* Batem.). Fig. 1397. Sts. semi-scandent, up to 5 ft. long, long white roots from opposite the lvs.: fls. up to 2 in. diam., numerous; most brilliant of the red-flowering species. Guatemala, amongst heavy grass. Gn. 24:390. O.R. 5:273.

CC. *Fls. white.*

5. **Endresii,** Reichb. f. Sts. 6–9 in.: racemes 9–12-fld.; fls. 1 in. diam., pure white; lip and column spotted purple. Costa Rica. G.C. II. 23:504. B.M. 7855. O.R. 12:145.

CCC. *Fls., at least sepals and petals, rose or purple.*

6. **ellípticum,** Graham (*E. crassifòlium,* Hook.). Fls. on long scapes, clustered, rose or purple, ½in. diam. Brazil. B.M. 3543.

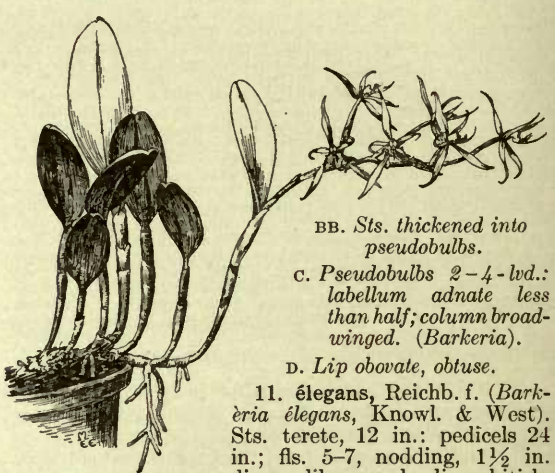
7. **paniculàtum,** Ruiz & Pav. Sts. 3–4 ft.: fls. ¾in. across, lilac-purple, lip whitish yellow. Venezuela to Peru, high altitudes. B.M. 5731. I.H. 22:211.—Most free-flowering and best of paniculate species.

8. **evéctum,** Hook. Sts. 3–5 ft.: peduncles nodding, 2 ft.; fls. rich purple, lip deeply fringed. Colombia. B.M. 5902.—Easily cult. and on account of its free-flowering habit deserves a place in the warm greenhouse.

CCCC. *Fls., at least sepals and petals, yellowish green.*

9. **leucochilum,** Klotzsch (*E. imperàtor,* Hort.). Sts. 2 ft.: fls. 5–9, on long pedicels, greenish yellow; lip pure white. Colombia, 6,000–9,000 ft.

10. **ebúrneum,** Reichb. f. Sts. terete, 2–3 ft.: fls. 3–4 in. diam., yellowish green; lip ivory-white, with yellow calli; raceme terminal, 4–6-fld. Panama, in swamps. B.M. 5643.



1398. Epidendrum ciliare. (×⅐)

BB. *Sts. thickened into pseudobulbs.*

C. *Pseudobulbs 2–4-lvd.: labellum adnate less than half; column broad-winged.* (*Barkeria*).

D. *Lip obovate, obtuse.*

11. **élegans,** Reichb. f. (*Barkèria élegans,* Knowl. & West). Sts. terete, 12 in.: pedicels 24 in.; fls. 5–7, nodding, 1½ in. diam., lilac-purple; lip whitish, with purple blotch. Pacific coast of Mex. B.M. 4784.

DD. *Lip acute.*

E. *Fls. about 1 in. across.*

12. **Skínneri,** Batem. (*Barkèria Skínneri,* Paxt.). Lvs. ovate-oblong, sheathing the slender st.: peduncle terminal, bearing rose-lilac fls. about 1 in. across; petals and sepals nearly equal, petals so twisted at the base as to present dorsal surface to the observer; labellum ovate, with 3 raised lines. Guatemala. B.R. 1881. P.M. 15:1 (var. *major*).

EE. *Fls. 2–4 in. across.*

13. **Lindleyànum,** Reichb. f. (*Barkèria Lindleyàna,* Batem.). Sts. slender: fls. numerous, about 2 in. across, rose-purple; labellum with a white disk; petals broader than the sepals Cent. Amer. 1839. J.H. III. 44:53.

14. **spectábile,** Reichb. f. (*Barkèria spectábilis,* Batem.). FLOR DE ISABAL. Sts. tufted, cylindrical, 4–5 in. high: lvs. 2: raceme about 6-fld.; fls. 3–4 in. across, bright lilac; sepals linear-lanceolate; petals ovate-lanceolate; labellum white at base, red-spotted. Guatemala.

CC. *Pseudobulbs 1–2-, rarely 3-lvd.: labellum adnate at base, or not up to the middle; column not winged. (Encyclium.)*

D. *Fls. cinnabar.*

15. **vitellìnum,** Lindl. Pseudobulbs ovoid, 2 in. long: lvs. 6–9 in.: peduncles 15–18 in., 10–15-fld.; fls. cinnabar-red; lip and column orange. Mex., 6,000–9,000 ft. B.M. 4107. G.C. III. 10:141.

Var. **màjus,** Veitch. Pseudobulbs shorter: racemes denser; fls. larger and more brilliant. G.C. III. 12:159. —Very superior to the species; type no longer imported.

DD. *Fls. rose.*

16. **nemoràle,** Lindl. Pseudobulbs subglobose, 3–4 in. high: lvs. 9–12 in.: peduncles 2 ft. long, covered with warts; fls. 3–4 in. diam., rose-colored; lip rosy mauve, streaked with purple. Mex. B.M. 4606 (as *E. verrucosum*). G.C. II. 24:332. A.F. 6:633.

DDD. *Fls. other than above.*

E. *Sepals and petals white.*

17. **dìchromum,** Lindl. Fls. white, lip rose-colored, yellow and downy at base. Brazil.

EE. *Sepals and petals green.*

18. **osmánthum,** Rodr. (*E. Godseffiànum,* Rolfe. *E. Capartiànum,* Lindl.). Fls. 1½ in. across, in large panicles, light green, suffused with brown; lip white, lined with rose-purple, fragrant. Brazil. B.M. 7792.—One of the handsomest species.

19. **prismatocárpum,** Reichb. f. (*E. maculàtum,* Hort.). Pseudobulbs ovoid, tapering, 4–5 in.: lvs. 12–15 in.: fls. 1½ in. across, pale yellow-green, with purplish black spots; lip pale purple, with yellow tip and white border. Cent. Amer., 5,000 ft. B.M. 5336. G.W. 5, p. 126. O.R. 12:57.

EEE. *Sepals and petals purple or brown.*

20. **atropurpùreum,** Willd. (*E. macrochìlum,* Hook.). Pseudobulbs ovoid, 3–4 in high: lvs. lanceolate, 12–15 in. long, dull purple-colored: peduncle 6–10-fld.; fls. 2½ in. diam., purplish brown upon greenish ground; lip yellowish white, with crimson stripes. Mex. to Venezuela. B.M. 3534. A. F. 6:609. J.H. III. 51:243, 401.

Var. **Randiànum,** Lind. & Rod. Sepals and petals margined with light yellowish green, the white middle lobe of lip with a red-purple-rayed blotch.

Var. **ròseum,** Reichb. f. Sepals and petals purplish, lip bright rosy. Guatemala. P.M. 11:243.

21. **Brassávolæ,** Reichb. f. Pseudobulbs pear-shaped: lvs. 6–9 in.: racemes 18–24 in., 6–9-fld.; fls. 4 in. across; sepals and petals narrow, yellowish brown; lip trowel-shaped, purple, white and green. Mex. to Guatemala, 8,000 ft. B.M. 5664.

CCC. *Pseudobulbs 1–2-, rarely 3-lvd.: lip adnate up to apex of column. (Aulizeum.)*

D. *Lip fringed.*

22. **ciliàre,** Linn. Fig. 1398. Pseudobulbs clavate, 4–6 in.: lvs. 4–6 in., springing from sheathing bract: peduncles 5–7-fld.; fls. yellowish green; lip white. Trop. Amer., between 5th and 20th parallel of north latitude. B.R. 784.—Plant resembles a cattleya. Intro. to cult. in 1790.

DD. *Lip not fringed.*

E. *Fls. vermilion.*

23. **aurantìacum,** Batem. Once classed in the separate group of Epicladium, now often accepted as a species of Cattleya, where it was first referred by Don. The plant grows with, and much resembles *Cattleya Skinneri.* Fls. 1½ in. across, orange-red, appearing in Feb. and March and lasting several weeks. Guatemala. Gt. 5:130.

EE. *Fls. not vermilion.*

F. *The lip deeply 3-lobed, the middle lobe long and lanceolate.*

24. **falcàtum,** Lindl. (*E. Parkinsoniànum,* Hook.). Pseudobulbs thin, rising from running rhizomes, monophyllous: lvs. 6–12 in., fleshy, channeled on one side: peduncles 2–5, sheathed, 1-fld.; fls. 5 in. across, greenish yellow; lip white, greenish at apex. Mex. to Guatemala. B.M. 3778. G.C. III. 44:378.—Plants grow inverted.

FF. *The lip not as in* F.

25. **venòsum,** Lindl. Butterfly Orchid. Scape 1 ft., with white sheaths: lvs. 3, 4–6 in. long, linear-lanceolate: scape tumid at base, 5–7-fld.; fls. pink, chocolate and green, about 1 in. long, lasting a long time. On oaks, etc., Mex.—Of easy cult. The Fla. representative of this species is *E. tampense,* Lindl. See 9th Rept. Mo. Bot. Gard. 137, pls. 38, 39.

26. **fràgrans,** Swartz. Pseudobulbs fusiform, monophyllous, 3–4 in.: lvs. 8–12 in.: fls. inverted, 2 in. diam., very fragrant, pale greenish or whitish; lip crimson-streaked. Guatemala, through the W. Indies to N. Brazil. B.M. 1669.

27. **cochleàtum,** Linn. Pseudobulbs 3–4 in.: lvs. 6 in.: racemes 4–7-fld.; fls. 3–4 in. across, greenish white; lip deep purple beneath, light green above, with maroon blotch on each side, column white. Trop. Amer. from Fla. to Colombia. B.M. 572.—Intro. 1787; first epiphytical orchid to flower in England.

Garden hybrids: *E. Bérkeleyi* (E. Stamfordianum×E. O'Brienianum).—*E. Búrtonii* (E. O'Brienianum×E. ibaguense).—*E. Clarrissa supérbum* (E. elegantulum×E. Wallisii).—*E. dellénse* (E. xanthinum×E. radicans).—*E. elegántulum* (E. Wallisii×E. Endresio-Wallisii). G.C. III. 19:361.—*E. Endrèsio-Wállisii.*—*E. kéwense* (E. evectum×E. xanthinum).—*E. O'Brieniànum* (E. evectum×E. radicans). G.C. III. 3:771.—*E. Phœbus* (E. O'Brienianum ×E. vitellinum).—*E. radicánti-Stamfordiànum.*—*E. rádico-vitellìnum.*—*E. Wállisio-ciliàre.*—*E. xántho-radìcans.*

Euepidendrum: *E. arachnoglóssum,* André. Sts. 4–5 ft.: fls. rich purple-lilac; lip fringed, with orange calli. Colombia. R.H. 1882:554.—*E. Clæsiànum,* Cogn. Sts. up to 2 ft. tall: racemes numerous, pendulous; fls. pure white. Colombia. G.C. III. 29:70.—*E. cnemidóphorum,* Lindl. Sts. 4–6 ft.: racemes ample, drooping; fls. purple, brown and yellow, fragrant. Guatemala, 7,000 ft. B.M. 5656.—*E. conópseum,* R. Br. Scape few- to many-fld.: lvs. 1–3, thick: fls. green, tinged with purple, the sepals spatulate and revolute, the petals narrower and obtuse. S. Fla. and S. Once offered by Reasoner.—*E. Cooperiànum,* Batem. Sts. 2–3 ft.: fls. yellow-green; lip bright purple. Brazil. B.M. 5654.—*E. costàtum,* Rich. & Gal. Raceme nodding; fls. about 1 in. across, the sepals and petals reddish brown, the lip whitish, purple-marked. Mex. G.C. III. 44:425.—*E. decípiens,* Lindl. Fls. orange or vermilion. Colombia. —*E. Éllisii,* Rolfe. Fls. carmine-rose, very handsome. Colombia. *E. fúlgens,* Brongn. Fls. orange-scarlet, in crowded racemes. Guiana to Brazil.—*E. grácilis,* Lindl., was once offered by John Saul.—*E. ibaguénse,* HBK. Sts. 2–3 ft.: fls. orange-scarlet; lip yellow. Colombia to Peru, 4,500 ft.—*E. Lambeauànum,* De Wild. Sepals and petals whitish, the lip claret. G.C. III. 44:228.—*E. myriánthum,* Lindl. Sts. 3–5 ft.: enormous panicles of rich purple fls.; lip with 2 yellow calli. Guatemala. B.M. 5556.—*E. noctúrnum,* Linn. Sts. 2–3 ft.: peduncles 8–10-fld.; fls. white and yellowish, 5 in. across, very fragrant. S. Fla. and Mex. to Peru and W. Indies. B.M. 3298. Once offered by Reasoner.—*E. palpígerum,* Reichb. f. Fls. beautiful lilac. Mex.—*E. Pfávii,* Rolfe. Sts. 4–6 ft. high: fls. light purple; lip with white disk, in numerous racemes. Costa Rica.—*E. Pseudepidéndrum,* Reichb. f. Sts. 2–3 ft.: fls. 3 in. diam., green; lip orange-red and yellow. Cent. Amer., 4,000 ft. B.M. 5929.—*E. ranìferum,* Lindl. Sts. 2–3 ft.: fls. yellow-green, thickly spotted with purple. Mex. to Guiana. B.R. 28:42.—*E. rígidum,* Jacq., was once catalogued by Reasoner.—*E. Schómburgkii,* Lindl. Sts. 2–3 ft.: fls. vermilion. Guiana, Brazil, Quito. B.R. 24:53.—*E. stenopétalum,* Hook. Sts. up to 2 ft.: fls. 1½ in. across, rosy mauve, the lip with a white blotch. Jamaica. B.M. 3410.—*E. syringothýrsis,* Reichb. f. Sts. 4–5 ft.: fls. deep purple; lip and column with orange and yellow, crowded in long racemes. Bolivia, 8,000–9,000 ft. B.M. 6145.—*E. Wállisii,* Reichb. f. Sts. 4–6 ft.: fls. yellow, some purple spots; lip orange and purple, upon white ground. Colombia. 4,000–7,000 ft. Has lateral as well as terminal racemes.

Encyclium: *E. ádvena,* Reichb. f. Fls. yellow, veined brown; lip yellowish white, purple-streaked. Brazil.—*E. alàtum,* Batem. Fls. 2 in. across, purple and green; lip yellowish, streaked with purple, fragrant. Cent. Amer. B.M. 3898.—*E. bífidum,* Aubl. Fls. pale green, dotted with purple; lip rose, orange and white. W. Indies, Guiana. B.R. 1879.—*E. Fridertci-Guiliélmi,* Warsc. & Reichb. f. Bulbs 4–5 ft.: fls. dark purple; base of lip white and yellow. Peru, 6,000–8,000 ft. I.H. 18:48.—*E. gallopavinum,* Reichb. f. Fls. brown in large racemes; lip yellow. Brazil.—*E. oncidioides,* Lindl. Panicles up to 6 ft. long; fls. yellow and brown, sweet-

scented. Stately species. Guiana. B.R. 1623.—*E. phœníceum*, Lindl. Panicles 2–3 ft.; fls. deep purple, mottled green; lip rich violet, stained crimson. Handsome. Cuba.—*F. virgàtum*, Lindl. Scape up to 7 ft. high; fls. small, up to 20, greenish, stained brown. Mex.

Aulizeum: *E. variegàtum*, Hook. Racemes many-fld.; fls. fragrant; sepals and petals pale yellow, the lip rose or white-and-rose-spotted. S. Amer. B.M. 3151.

Other species mentioned in horticultural literature are: *E. campylostàlyx*, Reichb. f. A curious species with glaucous green pseudobulbs and lvs.: fls. yellowish tinged with chocolate color. Cent. Amer.—*E. Lámbda*, Lind. Closely allied to E. fragrans. Sepals and petals light salmon-color; lip cream-yellow with violet lines; crest velvety. Colombia.—*E. laterále*, Hort. Infl. produced on a rudimentary pseudobulb as in E. Stamfordianum. Cent. Amer.—*E. pterocárpum*, Lindl. Of diminutive growth, chiefly of botanical interest. Mex.—*E. punctíferum*, Reichb. f. Fls. in erect spikes, green, the lip spotted with purple. Brazil.—*E. purpurachýlum*, Rodr. "Sepals and petals dull olive-green, tinged with brown; corrugated front lobe of lip deep purple, with whitish yellow margin; fls. fragrant, not unlike violets."—*E. saccharàtum*, Kränzl. Raceme 15–20-fld.; fls. green, marked with dark brown; lip white, rose-purple at apex. Guiana.—*E. Stallforthiànum*, Kränzl. Sepals and petals dull brown; column ivory-white; fls. have a peculiar and disagreeable odor. Mex. G.C. III. 51:114.—*E. tripunctàtum*, Lindl. Intro. in 1881 and now reappearing in cult.

GEORGE HANSEN.
GEORGE V. NASH.†

EPIDIÀCRIUM (compounded of Epidendrum and Diacrium). *Orchidàceæ*. A genus established to contain hybrids between Epidendrum and Diacrium.

The following is sometimes found in collections: *E. Còlmanii* (E. ciliare × D. bicornutum).

EPIGÆA (Greek, *epi*, upon, *gaia*, earth; in reference to the trailing growth). *Ericàceæ*. Evergreen spring-blooming plants, herbaceous in appearance but with woody creeping stems, sometimes planted.

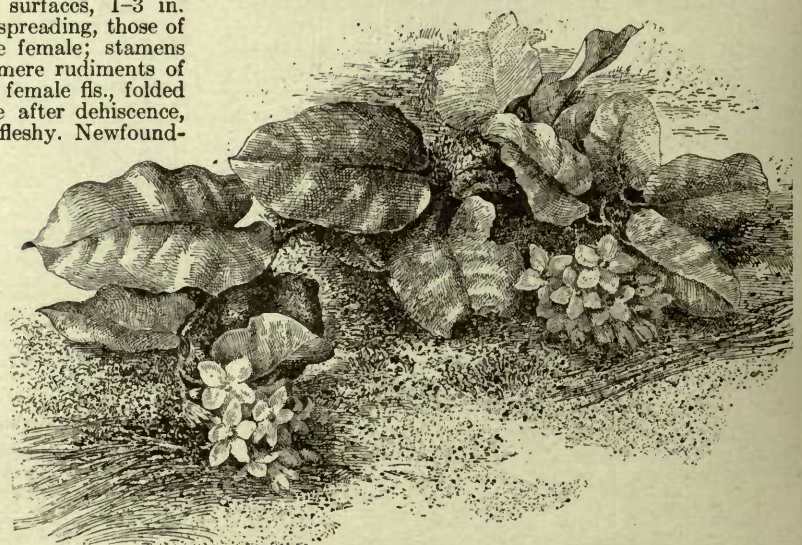
Leaves alternate, petiolate, entire, leathery: fls. usually dicœcious, sometimes perfect, in short terminal or pseudo-axillary spikes, each in the axil of a green bract and with 2 green bractlets; sepals 5, green; corolla pink or white, salver-shaped, with 5 lobes; stamens 10, attached to the base of the corolla-tube, the 2-celled anthers dehiscing by slits not, as is usual in the Ericaceæ, by pores; style columnar; stigma 5-lobed; ovary densely hairy, 5-celled, with many ovules: fr. depressed-globose, fleshy, dehiscent along the partitions, the many minute seeds set on the surface of the white succulent placentæ.—Two species, N. E. Amer. and Japan.

rèpens, Linn. TRAILING ARBUTUS. MAYFLOWER. Fig. 1399. Spreading on the ground in patches sometimes 2 ft. diam., the hirsute sts. rooting: lf.-blades ovate-oblong to orbicular, cordate or rounded at the base, obtuse or broadly acute at the apex, sparingly hirsute on the margins and both surfaces, 1–3 in. long: fls. fragrant, the corolla-lobes spreading, those of the male fls. much larger than the female; stamens in the female fls. often reduced to mere rudiments of filaments; stigmas spreading in the female fls., folded together in the male: fr. berry-like after dehiscence, the axis, dissepiments, and placentæ fleshy. Newfoundland to Sask., south to Fla., Ky., and Wis.—It grows only in acid soils.

Trailing arbutus, probably the best beloved of all the early wild flowers of the eastern United States, is rarely seen in cultivation. Yet it thrives in the same acid peaty sandy well aërated soils as the blueberry, and like the blueberry it has in and on its roots a mycorhizal fungus upon which it probably depends for nutrition. One of the most satisfactory potting mixtures is nine parts finely sifted kalmia peat, one part clean sand, and three parts clean broken crocks. In watering the plants one should use rain-water, bog-water, or some other water free from lime. Wild plants may be transplanted, preferably in autumn or very early spring, care being taken to lift a large portion of the root-mat without disturbing the roots. Such plants should be kept in a coldframe or coolhouse and until abundant new roots are formed should receive little or no direct sunlight. They may be propagated by division or by layers, but the resulting plants are seldom symmetrical.

The best method of propagating trailing arbutus is by the seed. The fruit, which is often borne in abundance on vigorous female plants, ripens at the same season as the wild strawberry. At maturity and while still herbaceous the wall of the fruit splits from the center into five valves which turn backward in a green rosette exposing the white fleshy edible berry-like interior, ¼ to ⅓ of an inch in diameter and dotted with seeds. The fruits disappear quickly after dehiscence, commonly within a few hours, being eagerly sought by ants, snails, and birds. A fruit bears usually 300 to 500 seeds. The seeds, which are easily separated from the pulp by rubbing between the fingers, should be sown at once in a well-drained shallow box, in a mixture of two parts finely sifted kalmia peat and one part of clean sand, covered about $\frac{1}{16}$ of an inch with the same material, and watered slowly but thoroughly with a very fine rose. If covered with a glass and kept away from direct sunlight a second watering may not be required before germination. The seeds come up in three to four weeks, and in their earliest stages after germination often require protection from ants. This is best accomplished by setting the seed-boxes on pots inverted in saucers of water. In the heat of summer young seedlings, and older plants as well, can not stand full sunlight. A lath shade with spaces of the same width as the lath usually furnishes sufficient protection. In the third or fourth month from germination, when the plants are about $\frac{3}{8}$ of an inch in diameter, they should be potted in 2-inch pots in the mixture of peat, sand, and crocks already described, and the pots plunged in sand in shallow boxes.

If carried through the first winter in a greenhouse, with a night temperature of 55° to 60° and a day temperature of about 65° to 70°, the plants continue their growth all winter, and in the following summer some of them even without transfer to larger pots will lay down a few clusters of flower-buds, in preparation for the next spring's blooming, when they are a year and a half old. Many of the plants, however, do not flower until they are two and a half years old, their



1399. Trailing arbutus or Mayflower—Epigæa repens.



XXXVIII. The California poppy.—Eschscholtzia californica.

rosettes having reached a diameter of about 7 to 10 inches.

The flower-buds are formed from midsummer to autumn. If the plants are kept in a warm greenhouse during the winter the flower-buds seldom open. To make them open normally the plants must be subjected to a prolonged period of chilling. Actual freezing is not necessary. The best chilling temperature for the greenhouse is a little above freezing, about 35°. Alternate freezing and thawing, with strong sunlight, is likely to injure the foliage. Strong sunlight without freezing heightens the color of the flowers. After two to three months of chilling the plants may be forced, if early flowers are desired, by alternating the same low night temperature with a day temperature of 45° to 60°. Plants kept in a cool humid atmosphere often remain in flower three to four weeks, redolent with their well-known delightful fragrance. The male flowers, with their yellow centers, are much larger and prevailingly much pinker than the green-centered female flowers. In cultivated plants the corollas sometimes have a spread of ⅞ of an inch. The most robust plants have been secured by plunging the pot in moist sphagnum in a pot of 2 inches greater diameter. The roots then grow through the hole in the bottom of the inner pot and develop profusely in the moist, well aërated sphagnum of the outer pot. Old plants which have become ragged at the center may be revivified by cutting the stems back almost to the main root immediately after flowering. They then throw out a new circle of branches with new and bright foliage and flower profusely the following spring.

FREDERICK V. COVILLE.

EPILÆLIA (compounded of *Epidendrum* and *Lælia*). *Orchidàceæ*. A genus established to include hybrids of these genera.

E. belairénsis (E. ciliare × L. autumnalis).—*E. Charleswórthii* (E. radicans × L. cinnabarina).—*E. Fletcheriàna* (E. atropurpureum × L. harpophylla).—*E. Hardyàna* (E. ciliare × L. anceps). C. O. 1.—*E. heateriénsis* (E. O'Brienianum × L. cinnabarina).—*E. Lawrencei* (E. vitellinum × L. tenebrosa).—*E. Lionétii* (E. atropurpureum × L. purpurata).—*E. Márgaritæ* (E. Parkinsonianum × L. grandis).—*E. Sylvia* (L. cinnabarina × E. Cooperianum.)—*E. Veìtchii* (E. radicans × L. purpurata).—*E. vitellbròsa* (E. vitellinum × L. tenebrosa).

GEORGE V. NASH.

EPILÒBIUM (Greek, *upon the pod*, referring to the structure of the flower). Including *Chamænèrion*. *Onagràceæ*. Border plants, with willow-like foliage, and large showy spikes of deep pink, rosy crimson or white or even yellow flowers borne from June to August.

Herbs or sub-shrubs, sometimes annual, erect, sprawling or creeping: lvs. alternate or opposite, toothed or entire: fls. axillary or terminal, solitary or in spikes or racemes, rosy purple or flesh-colored, very rarely yellow; calyx-tube little, if at all, produced beyond the ovary; petals 4, obovate or obcordate, erect or spreading; stamens 8; ovary 4-celled; seeds comose; stigma often 4-lobed: caps. long and narrow, 4-sided and 4-valved.—Species about 200 or more, in many parts of the world, mostly in temperate regions.

The taller species, like *E. angustifolium* and *E. hirsutum*, make very rank growth in moist places, and are therefore especially adapted for the wild garden or for naturalizing along the water's edge and in low meadows. The underground runners reach far, and the plants spread fast when not kept in bounds. Propagation is by division or seeds.

angustifòlium, Linn. (*E. spicàtum*, Lam. *Chamænèrion angustifòlium*, Scop.). GREAT WILLOW-HERB. FIRE-WEED. In cult. mostly branched and 3–5 ft. high; in the wild simple or branched, 2–8 ft. high: lvs. alternate, very short-petioled, lanceolate, entire or minutely toothed, 2–6 in. long, 4–12 lines wide, pale beneath, acute, narrowed at bases: fls. spreading, in long, terminal spike-like racemes, petals rounded at tip; stigma 4-lobed: caps. 2–3 in. long. Eu., Asia, N. Amer. B.B. 2:481. Var. **álba**, Hort., has pure white fls. suitable for cutting; also occurs wild. This variety was perfected in England. It forms a compact bush.

hirsùtum, Linn. Stout, 2–4 ft. high, with short but conspicuous soft straight hairs: lvs. oblong-lanceolate, usually opposite, sessile and often clasping, with many small, sharp teeth, 1–3 in. long, pubescent on both sides: fls. erect, axillary, about 1 in. across; petals notched: weed from Eu., showy, and sometimes found in old gardens.

Dodonàei, Vill. (*E. rosmarinifòlium*, Haenke). Perennial, 1–3 ft., blooming in midsummer, mostly erect: lvs. linear, tapering somewhat toward either end, entire, smooth or somewhat soft-hairy: fls. red, the infl. terminal on the branches. Eu.

obcordàtum, Gray. Glabrous perennial: decumbent, sts. 3–5 in. long, 1–5-fld.: lvs. numerous, opposite, ovate, sessile, ¾in. or less long: fls. bright rose-color, the petals ½in. long and obcordate; stamens yellow, shorter than declining style: caps. short and thick. Calif. in the high Sierras, and in Nev.—Offered as an alpine. A handsome species.

lùteum, Pursh. Nearly simple, 1–2 ft., nearly glabrous: lvs. ovate or elliptical to broad-lanceolate, toothed, slightly fleshy, 1–3 in. long, sessile or with a short-winged petiole: fls. bright yellow, the petals ¾in. long; style often exserted: caps. long-stalked, somewhat puberulent. Ore. to Alaska.

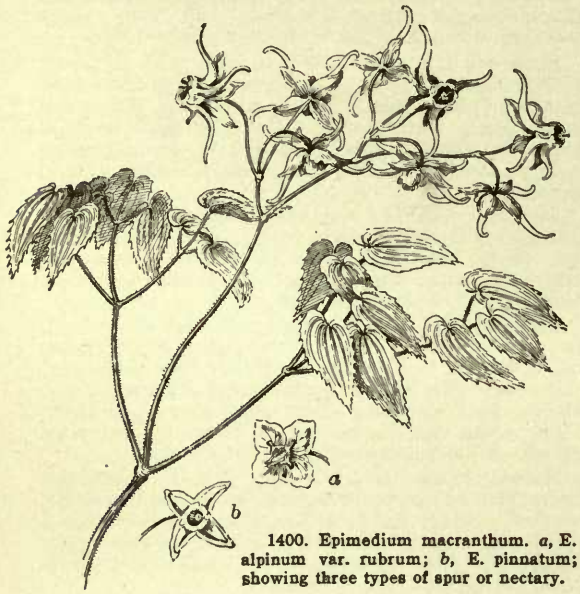
E. abyssínicum álbum is offered abroad, as "pure white, pretty:" the name does not appear to have botanical standing.—*E. latifòlium*, Linn. (Chamænerion latifolium, Sweet). Erect, canescent, about 1½ ft.: lvs. lanceolate or ovate-lanceolate, tapering at both ends, thick: fls. purple, showy, sometimes 2 in. across. Newfoundland to Ore. and north.

L. H. B.

EPIMÈDIUM (Greek, *like Medion*, a plant said to grow in Media; a name from Dioscorides, retained by Linnæus). *Berberidàceæ*. Herbs suitable for rock-gardens and shady places.

This genus contains some of the daintiest and most interesting plants that can be grown in the hardy border, and *E. macranthum*, particularly, is as distinct, complicated and fascinating as many of the rare, tender and costly orchids. The whole family to which it belongs is exceptionally interesting, and is one of the most striking of those rare cases in which the cultural, botanical and artistic points of view have much in common. Of the 8 or 9 genera of this family only Berberis and Nandina are shrubs, all the others being herbs, with creeping, underground sts., and all small, choice, curious, and cult. to a slight extent, except Bongardia and Leontice. Podophyllum contains our mandrake; Caulophyllum the quaint blue cohosh; and the others are Aceranthus, Achlys, Diphylleia, Jeffersonia and Vancouveria. A collection of all these plants should make a charming study. What appear to be petals in *E. macranthum* are really the inner row of sepals, colored like petals, and performing their functions, while the long spurs or nectaries are supposed to be highly specialized petals. Epimedium has 8 sepals and 4 petals, which are mostly small and in the form of nectaries: stamens 4: caps. opening by a valve on the back: lvs. pinnately twice or thrice dissected. They grow a foot or two high. For *E. diphyllum*, see *Aceranthus*, which is distinguished by its flat, not nectary-like petals, and its lvs. with a pair of lfts. on each of the 2 forks of the petiole.—There are 11 species, all natives of the northern hemisphere, but some are found as far south as N. Afr. There is none native in Amer. The Garden, 48, p. 486, shows what a charming picture can be made of the foliage alone when cut and placed in a bowl. The plants retain their foliage all winter, especially in sheltered spots under trees.

Epimediums thrive best in partial shade, and are particularly well suited for rockeries and the margins of shrubberies. Almost any soil will answer for them. The peculiar bronzy tints of the young foliage contrast well with the variously colored flowers. Propagation by division. (J. B. Keller.)



1400. Epimedium macranthum. *a*, E. alpinum var. rubrum; *b*, E. pinnatum; showing three types of spur or nectary.

A. *Spurs conspicuous, often 1 in. long, sometimes twice as long as the showy inner sepals.*

macrânthum, Morr. & Decne. Fig. 1400. Lvs. thrice ternate; lfts. cordate-ovate, unequal at the base, sharply toothed; petioles with short, spreading, conspicuous hairs: outer sepals sometimes colored bright red, remaining after the larger and showier parts of the fl. have fallen; inner sepals ovate-lanceolate, violet; spurs white. Japan. B.R. 1906. P.M. 5:151. Not Gn. 46:356, which is *E. pinnatum.* Var. **níveum,** Voss (*E. níveum,* Hort.), has pure white fls. G.W. 3, p. 591. Var. **ròseum,** Voss (*E. ròseum,* Hort. *E. níveum* var. *ròseum,* Hort.), has fls. white, tinged with pink or pale rosy red. Var. **violàceum,** Voss (*E. violàceum,* Morr. & Decne.), has violet spurs, shorter than in *E. macranthum,* but much larger than in the other species. B.M. 3751. B.R. 26:43. H.F. 4:168.—A very interesting species. The *E. lilàcea* advertised in some American catalogues seems to belong here. *E. lilacea* is a name unknown in botanical literature.

AA. *Spurs medium-sized, nearly as long as the inner sepals.*

B. *Inner sepals bright red.*

alpìnum, Linn., var. **rùbrum,** Hook. (*E. rùbrum,* Morr.). Fig. 1400. Lvs. biternate (but Hooker's picture shows tendency to thrice ternate condition), minutely toothed: spurs white, marked with red, as in Fig. 1400, which shows the very distinct appearance of the fls. Japan. B.M. 5671. R.B. 3, p. 33.—Hooker says this differs in no way from *E. alpinum,* except in the larger and red fls., while the type which grows wild in England (though probably not native) has dull reddish yellow fls., and, though advertised, is probably not in cult.

BB. *Inner sepals whitish or pale yellow.*

Musschiànum, Morr. & Decne. Lvs. only once ternate, sharply toothed, as in *E. macranthum:* all floral parts whitish or pale yellow. Japan. B.M. 3745.—The least showy kind, but worth growing in a collection, its spurs having an individuality difficult to describe. Var. **rùbrum,** Hort., is presumably an error, as a red-fld. form would be very unexpected.

AAA. *Spurs much shorter than the inner sepals, being, in fact, merely small nectar-glands.*

B. *Lvs. once or twice ternate.*

pinnàtum, Fisch. Fig. 1400. Lvs. usually biternate, with 5 lfts., 3 above and 1 on each side; lfts. with a deeper and narrower basal cut than in *E. macranthum,* the whole plant densely hairy: scape about as long as the fully developed lvs.; fls. typically bright yellow; nectaries red, a third or a fourth as long as the inner sepals. Shady mountain woods of Persia and Caucasus. B.M. 4456. Gn. 46:356, (erroneously as *E. macranthum*); 48, p. 486. G. 18:706.—Best suited to the alpine garden.

Var. **élegans,** Hort., presumably has larger, brighter and more numerous fls. *E. sulphureum* of European catalogues is regarded by J. W. Manning and J. B. Keller as a pale yellow-fld. form of *E. pinnatum,* but by Voss as a variety of *E. macranthum.* A yellow form of the violet-fld. *E. macranthum* would be very surprising.

Var. **cólchicum,** Hort. (*E. cólchicum,* Hort.), has brilliant golden yellow fls. and nectaries 1–1½ lines long.

BB. *Lvs. always once ternate.*

Perralderiànum, Coss. This is the African representative of *E. pinnatum,* from which it differs in the key characters and also in the much more strongly ciliate-toothed lfts.; when young the lfts. have rich bronze markings, making a handsome showing. Its fls. are a "paler yellow than the typical *E. pinnatum.* It is far from improbable that specimens connecting them will be found in S. Eu., if not in Afr." Algeria. B.M. 6509.—Lvs. remain all winter. Less desirable than *E. pinnatum.*

E. diphýllum, Lodd. See Aceranthus diphyllus.—*E. níveum* is catalogued by Van Tubergen as a synonym of E. Musschianum, but the chances are that all the plants advertised as E. niveum are E. macranthum var. niveum. The spurs are so obviously longer in E. macranthum that there is no reason for confusion.

WILHELM MILLER.
N. TAYLOR.†

EPIPÁCTIS (Greek, *epipegnuo;* it coagulates milk). *Orchidàceæ.* Hardy terrestrial orchids of minor value.

Leafy orchids with creeping rootstocks and unbranched sts.: lvs. ovate or lanceolate, with plaited veins: fls. purplish brown, nearly white or tinged red; lower bracts often longer than the fls.; sepals free, spreading, nearly as large as the petals; lip free, deeply concave at base, without callosities, narrowly constricted and somewhat jointed in the middle, the upper portion dilated, petaloid.—Ten or a dozen species in the north temperate zone. The first mentioned may be secured through dealers in native western and Japanese plants; the second is listed in the American edition of a Dutch catalogue. For other definitions of the name Epipactis, see *Goodyera.*

Royleàna, Lindl. (*E. gigantèa,* Douglas). Stout, 1–4 ft. high: lvs. from ovate below to narrowly lanceolate above, 3–8 in. long: fls. 3–10, greenish, strongly veined with purple. June, July. Wash. to Santa Barbara, east to S. Utah and W. Texas, on banks of streams. Also Himalayas. Intro. 1883. Mn. 8:145.

atrórubens, Schult. (*E. rubiginòsa,* Crantz). Lvs. often reddish: fls. and ovary dark purple; lip oval, acute, or slightly notched; bracts equaling the fls. or rarely longer. July-Sept. Eu., W. Asia. L. H. B.

EPIPHRONÌTIS is a bigeneric orchid hybrid of Epidendrum and Sophronitis, for a picture of which see R.H.1896:476. It has about 10 fls., chiefly a brilliant scarlet, set off with bright yellow. Gt. 46, p. 555.

Veìtchii, Hort. (*Epidéndrum radìcans* × *Sophronìtis grandiflòra*). Fls. like those of *Epidendrum radicans*, which it much resembles in habit, but the parts all broader. C.O. 1. GEORGE V. NASH.

EPIPHYLL. A plant that grows on a leaf. It is a kind of epiphyte. The epiphylls are algæ, lichens, liverworts, and mosses. The name is applied to those species or kinds that find their physical support on foliage leaves rather than to those that are parasitic on them as are the fungi. Epiphyllous plants are likely to be most abundant in the tropics.

EPIPHYLLÁNTHUS (*flower upon the leaf*). *Cactàceæ*. Epiphytic: sts. much branched, jointed, ribbed: areoles bearing setæ instead of spines: fls. resembling those of Zygocactus; ovary angled.—One species known. Native of Brazil. For cult., see *Succulents*.

obtusángulus, Berger (*Cèreus obtusángulus*, Schumann). Joints somewhat flattened, about 10-ribbed: stamens of two kinds.—Although usually considered a Cereus, it is more closely related to Zygocactus, but from both it seems generically distinct. Indeed Berger says it resembles certain Opuntias and seems to have a relationship with Rhipsalis. It is not grown in this country, and is still rare in Eu. J. N. ROSE.

EPIPHÝLLUM (*on a leaf;* refers to the leaf-like branches on which the flower grows). *Cactàceæ*. Spineless upright branched flat-stemmed cacti with very large and showy flowers, some of them popular as houseplants.

Branches flat, 2-edged, crenate or serrate on the margins, spineless: fls. usually large, mostly nocturnal; petals white, red, or yellow; stamens elongated, numerous: fr. oblong in outline, bearing a few bracts, red, juicy; seeds numerous, black. In the Cyclopedia of American Horticulture, the name Phyllocactus was used for this genus, but this is a much later name and hence it is given up. The epiphyllums of the first Cyclopedia will be found under *Zygocactus*. For cult., see *Succulents*.

Several hundred hybrids are in the trade, the most common ones being with *E. crenatum*, *E. Ackermannii* and *E. phyllanthoides*. Fig. 1401. Crosses are often made with the various Cereus allies, such as *Heliocereus speciosus*, and with some species of Echinopsis.

A. *Tube of fl. always elongated, usually much longer than the limb; petals white or yellowish: mostly night-bloomers.*

B. *Style white.*

C. *Branches thin, usually spreading in some plane: petals pure white.*

oxypétalum, Haw. (*Phyllocáctus grándis*, Lem.). Very large, sometimes 20 ft. long, with numerous short side branches, and these in the same plane with the main st., thin and lf.-like: fl. large (nearly a foot long), white, night-blooming (sometimes described as day-blooming). Originally from Mex., but said to be found in Honduras and Guatemala; also reported from Cuba, but surely not native there. G.W. 10:560 (as *Phyllocactus latifrons*).—One of the commonest and best species in cult.

CC. *Branches thick, not spreading in the same plane: petals cream-colored or yellow.*

D. *Fls. large: sts. with shallow crenations.*

crenàtum, Don (*Phyllocáctus crenàtus*, Lem.). Sts. about 3 ft. long, erect, thick, strongly crenate, somewhat glaucous: midrib very thick: fl. large, 6–10 in. long, said to be a day-bloomer; petals white or cream-colored in life, drying yellow; tube 4–5 in. long; style said to be white; very fragrant. Guatemala and S. Mex., and said to come from Honduras.

DD. *Fls. small for the genus: sts. with deeply cut margins.*

angùliger, Don (*Phyllocáctus angùliger*, Lem.). About 3 ft. high, much branched below: branches narrow, thick, with deeply cut margins: fls. 5–8 in. long, with a slender tube; petals yellow.

BB. *Style red.*

C. *Sts. stiff, erect.*

stríctum, Brit. & Rose (*Phyllocáctus stríctus*, Lem.). Erect, branching, reaching a height of 10 ft., with long cylindrical branches and shorter, lf.-like secondary branches: crenatures or teeth rather deep, unequal on the opposite sides: bristles wanting: tube of the fl. very long and slender, outer sepals brownish, inner pure white; the fl. opens late in the evening and closes before dawn; in full bloom the sepals are very strongly recurved. Said to come from Cuba.—Often found in collections under the name of *P. latifrons*.

CC. *Sts. rather weak, spreading.*

D. *Petals very narrow: areoles bearing black bristles.*

látifrons, Zucc. (*Phyllocáctus látifrons*, Link. *P. stenopétalus*, Salm-Dyck?). Branches very long and large, crenate or somewhat serrate, acute or acuminate: midrib and usually side ribs evident: areoles with rather large scales and dark bristles: fl. 8–10 in. long, spreading and in full bloom bent backward; petals narrow. Supposed to be from Mex., but not known from wild material.—Much advertised as the queen cactus.

DD. *Petals broader: areoles without bristles.*

Hoòkeri, Haw. (*Phyllocáctus Hoòkeri*, Salm-Dyck). Sts. 6–10 ft. high: branches rather thin, light green, strongly crenate: fls. night-blooming, 8–9 in. long; fl.-tube narrow, tinged with yellow; sepals narrow, lemon-yellow; petals pure white, narrow, 2 in. long; stamens in a single series; style red. Brazil and Guiana. B.M.



1401. One of the many hybrid Epiphyllums.

2692 (as *Cactus phyllanthus*).—Although long in cult., the species is not now well known, there being 2 or more closely related species in cult. under this name.

AA. *Tube of fls. short, always shorter than the limb: day-bloomers.*

B. *Style reddish: fls. 4½ in. broad.*

Áckermannii, Haw. (*Phyllocáctus Áckermannii*, Salm-Dyck). Fig. 1402. Sts. numerous, sometimes reaching 3 ft., somewhat recurved: branches usually less than a foot long, with evident middle and side ribs: areoles on the lower and younger shoots bearing short bristles: fls. scarlet-red outside, carmine-red within,

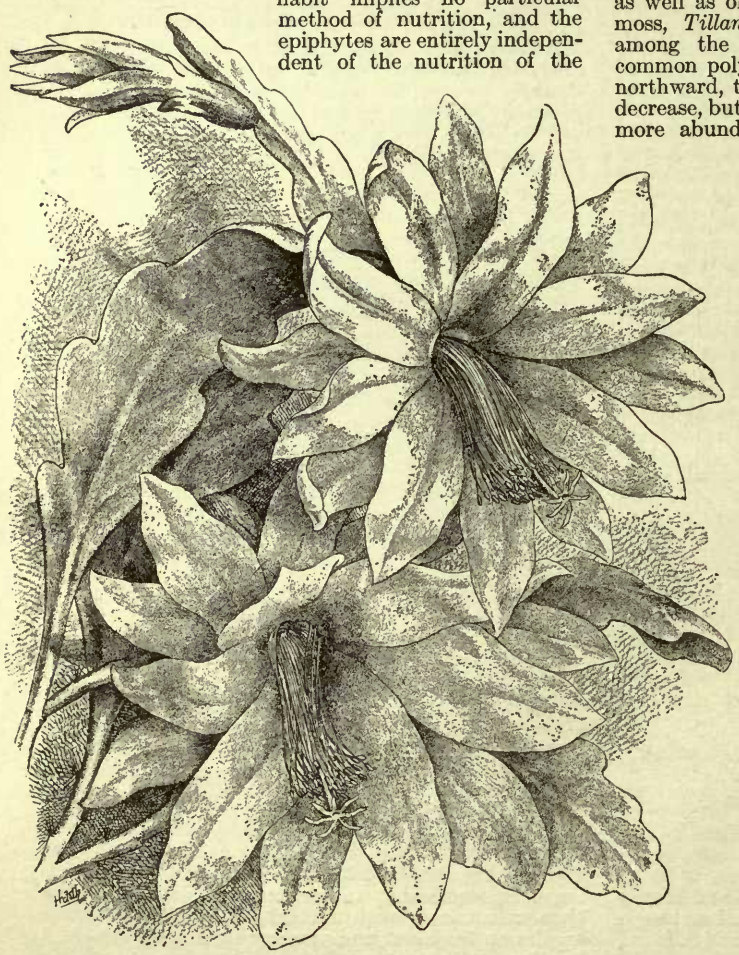
the throat greenish yellow, tube very short, the limb wide-spreading, 4–6 in. diam. B.R. 1331.—Not known in the wild state.

BB. *Style white: fls. smaller than the last.*

phyllanthoïdes, Sweet (*Phyllocáctus phyllanthoïdes*, Link). Branches at length hanging, cylindrical at base, lanceolate above; serratures obtuse; middle and side ribs evident; bristles few: fl.-tube 2 in. long or less, with spreading scales, the limb somewhat longer, often striate. S. Mex. J. N. Rose.

EPIPHYTES. Literally "air plants:" those plants that do not grow in earth or water, but are supported in air on trees or other objects and usually drawing no organic nourishment from such object or support.

True epiphytes are widely distributed in all climates, but it is in the moist tropics that they become so numerous and conspicuous as to arouse the special interest and enthusiasm of the serious student as well as of the traveler or casual observer. One thinks of epiphytes as growing upon trees, and trees are usually the supporting plants. The term merely signifies that ecological type that has the habit of growing upon other plants, although in this account it is not the purpose to discuss such seaweeds or other algæ as grow upon larger plants in the water. The word epiphyte also involves a contrast with parasite, the latter denoting that nourishment and water are derived from the living tissues of the supporting plant or host. The epiphytic habit implies no particular method of nutrition, and the epiphytes are entirely independent of the nutrition of the supporting plant. This habit is not restricted to a single class, or to a few families of plants, although in some families many representatives of the type have been developed, while in related families there may be none. The seed plants are represented by many species of tropical orchids, arums, bromeliads, and numerous others; lycopods, ferns, mosses and liverworts all contribute many examples; and in the lower groups of plants the lichens are in some regions dominantly epiphytic.



1402. Epiphyllum Ackermannii. (×½)

The luxuriant tropical rain-forest is regarded as the climax in development of vegetation. In describing this type, Humboldt declared that "forest is piled upon forest." Under such conditions the trunks and branches are clothed with larger epiphytes, and the leaves of some species accommodate algæ and lichens. It is in the South American tropical forests that the better known of our greenhouse epiphytes are native. Orchids, bromeliads, and arums are among the most abundant. In the Javanese forests, the wealth of species is great, but mosses, ferns and lycopods are particularly numerous, and these are accompanied by some interesting species of Ficus, epiphytic for a time, and by the striking *Rhododendron javanicum*, among others. In the mountain forests of tropical regions there are, as epiphytes, representatives of several families of ferns, likewise many mosses and lichens. The dicotylous and certain coniferous forests of Europe and America harbor a few mosses and liverworts and numerous species of lichens. A conspicuous epiphyte of the southern states, as well as of tropical America is the long or Florida moss, *Tillandsia usneoides*, the extremest epiphyte among the Bromeliaceæ. Accompanying this, the common polypody fern is also found on trees. Going northward, the total number of epiphytic lichens may decrease, but several of the larger forms seem to become more abundant and some of the moss-like usneas extend to the northernmost latitude of tree growth.

The habit of growing upon trees renders epiphytes subject to an inconstant water-supply. On this account the larger and more delicate epiphytes are restricted to regions constantly moist. Even in the moist forest, the species less resistant to drying out are found on the lower branches, and those more resistant maintain themselves higher up, so that there is a distribution in strata, analogous to the lateral distribution of species about the edge of a pond. In general, however, there is exposure to drying out, and, as might be anticipated, these plants exhibit the structural characteristics of xerophytes (dry-land plants). Many of them are modified so that transpiration is reduced, and they are able to withstand considerable desiccation. Among greenhouse forms this is notably true of many orchids and lichens. Moreover, many species of orchids possess special tissues to which water is transported and there accumulated as a "reserve" supply. Leaf-tissues may function in this way, but usually more important are the bulb-like enlargements of the stems.

Of special interest are the organs of absorption of certain epiphytes. Aërial roots are characteristic of tropical arums and orchids. The typical air-root is provided with an outer cylinder of tissue, the velamen, derived from the epidermis, consisting at maturity of dead cells capable of taking up liquid water and substances in solution like a sponge. From these roots as capillary reservoirs, the supply is gradu-

ally absorbed by the living tissues. Rain, dew, or moist substrata may furnish the water, but the view that these roots absorb water vapor is erroneous. The Bromeliaceæ are peculiar in the possession of certain absorbing leaf-scales or hairs. The Florida moss possesses such hairs over the entire surfaces of the thread-like stems and leaves, and the plant is rootless. There are all gradations between this and the soil-rooted pineapple-like forms. The arrangement of the leaves in many of the bromeliads possessing larger leaves is such as to establish after a rain a temporary reservoir about the leaf-bases. The absorbing scales of the bromeliads exhibit features worthy of note in three particulars: (1) When dry certain dead cells absorb water greedily; (2) with absorption they assume a position making possible the entry of water to a considerable surface of living cells, and (3) with collapse, due to loss of water, the spaces admitting water are closed and loss is minimized.



1403. Episcea cupreata.

Aside from such saprophytic fungi as might be considered epiphytic, the epiphytes are amply provided with chlorophyll-bearing tissue; therefore, organic food is manufactured as in other plants. Some of the epiphytes growing upon such humus-developing substrata as the decaying bark of trees, or such as passively accumulate humus and other materials in the vicinity of their absorbing surfaces, might absorb some organic compounds as well as salts in this way; but this supply of organic matter is certainly inconsequential in most cases. Water and salts are secured either through the air-roots, as described, or partially through normal roots, when such occur. Many species, epiphytic at first, ultimately send roots into the soil, and then secure water and salts largely through the terrestrial habit.

In the forest, certain of the seed-bearing epiphytes are specialized with respect to supporting plants, often due to the special nature of the protection offered, or to the physical advantages of the substratum in regard to fixation of the plant. Most species are markedly unspecialized and may be grown in the greenhouse most successfully.

B. M. Duggar.

EPIPRÉMNUM (*upon the trunk* of trees). *Aràceæ*. Resembling the genus Rhaphidophora but has fewer ovules, 2 or more 1-seeded berries not confluent, and albuminous kidney-shaped instead of almost terete seeds. About 8 species from Malay and Polynesia. **E. gigantèum**, Schott. A robust climber over 100 ft. high, the sts. emitting long rope-like roots from every growth: lvs. cordate-oblong, 6–8 ft. long, including the petiole which is as long as the blade and winged throughout its length: spathe about 1 ft. long, ending in a curved beak-spadix as long as spathe. Malay Penins. B.M. 7952.

EPÍSCIA (Greek, *shady;* they grow wild in shady places). *Gesneriàceæ*. Choice and interesting warm-house plants, *E. cupreata* being much prized for baskets.

Herbs, with long, short or no hairs: st. from a creeping root, branched or not: lvs. opposite, equal or not in size: fls. pedicelled, axillary, solitary or clustered; corollas mostly scarlet, rarely whitish or purplish; tube straight or curved, more or less spurred at the base; limb oblique or nearly equal; lobes 5, spreading, rounded.—Perhaps 30 species, all Trop. American.

Episcia cupreata is one of the standard basket plants, especially for the warmest greenhouses. It can also be used in pyramids and mounds, as told under Fittonia. As it does not require so close an atmosphere as the fittonias, it can be grown in some living-rooms and perhaps outdoors in summer in a shady place. Its chief charms are the slender, trailing habit, the soft hairiness of the leaves, the coppery hue, which is often laid on like paint in two broad bands skirting the midrib, and the rarer and perhaps finer metallic bluish luster of which one occasionally gets a glimpse in a finely grown specimen. Give very rich, fibrous loam, mixed with peat, leaf-mold and sand; in summer partial shade. (Robert Shore.)

A. *Fls. pale lavender to white.*

chontalénsis, Hook. (*Cyrtodèira chontalénsis*, Seem.). St. stout, more or less ascending, dark reddish purple, 6–10 in. long: lvs. opposite and irregularly whorled, 3–4 in. long, oblong-ovate to elliptic-ovate, crenate, obtuse, rounded at the base, decidedly convex on both sides of the midrib and between the much-sunk veins; margins recurved, green, marked with regular purple patches, which advance from the margins between the veins toward the midrib and are more or less oblong: fls. solitary or in small clusters; corolla-tube with a sac at the base, the limb oblique, 1½–2 in. across, with small and regular but conspicuous and beautiful teeth. Chontales region of Nicaragua. B.M. 5925. R.B. 22:241. F.S. 18:1924.

AA. *Fls. scarlet.*

B. *Lvs. usually not green, or only partially so.*

cupreàta, Hanst. (*Achímenes cupreàta*, Hook.). Fig. 1403. Sts. slender, creeping, branched, rooting at the joints, with a main branch rising erect a few inches, which bears the fls. and the largest lvs.: lvs. copper-colored above: fls. solitary, 9 lines wide, scarlet, with a small sac and denticulate limb. Nicaragua. B.M. 4312. Var. **viridifòlia**, Hook., has green foliage and larger fls., 1 in. across. B.M. 5195.

coccínea, Benth. & Hook. (*Cyrtodèira coccínea*, Hort., B. S. Williams). Lvs. dark metallic green, 3–4 in. long, 2½–3 in. wide.—Free-flowering. Some of the plants sold as *E. metallica*, a name otherwise unknown in botanical literature, probably belong here.

BB. *Lvs. a rich dark green.*

fúlgida, Hook. A beautiful, creeping, much-branched hothouse plant, covered throughout with soft villous pubescence: lvs. ovate to elliptic, wavy and serrate margined, ciliate: fls. axillary, solitary, the calyx prominently 1-sided, the sepals with recurved tips; corolla bright red, the limb deeper colored than the tube which is about 1½ in. long; corolla-lobes rounded and hairy toward the throat. N. S. Amer. B.M. 6136. G.W. 3, p. 161.

Wilhelm Miller.
N. Taylor.†



1404. Equisetum hiemale.—Common scouring-rush.

EQUISÈTUM (from the Latin *equus*, horse, and *seta*, bristle). *Equisetàceæ*. Contains the weeds known as horse-tails, or scouring-rushes which are suitable for naturalizing in waste

and wettish places and help to hold sandy banks. The following have been advertised by dealers in native plants: *E. arvénse, E. hiemàle* (Fig. 1404), *E. lævigàtum, E. limòsum, E. praténse, E. robústum, E. scirpoìdes, E. sylvàticum, E. variegàtum.* For descriptions, consult the manuals of native plants. They grow usually in moist or swale-like places. They are flowerless plants, allied to ferns and club-mosses.

Of the species named above, *E. arvense* has been found to have a poisonous effect on grazing stock when it occurs in any quantity in hay or pasturage.

R. C. Benedict.†

ERAGRÓSTIS (Greek, *er,* spring, and *agrostis,* a grass). *Gramíneæ.* Love-Grass. Annual or perennial grasses with more or less diffuse panicles of small several-flowered compressed spikelets. Some species grown in the open for ornament.



1405. Eragrostis suaveolens. (×½)

From 6 in. to several feet tall: culms simple or often branched; lemmas keeled, 3-nerved, the palea ciliate on the keels.—Species about 100 in warm and temperate regions of both hemispheres.

Some annual species are common weeds, such as *E. megastàchya,* Link (*E. màjor,* Host), Stink- or Snake-Grass, with rather large, ill-smelling spikelets in a compact panicle. Dept. Agric., Div. Agrost. 17:215. *E. pectinàcea,* Nees, a native of U. S., is a handsome perennial, with large open panicles of purple spikelets. Well adapted to cult. in sandy soils. Ibid 17:261. *E. obtùsa,* Munro (*Brìza geniculàta,* Thurb.), an annual with showy spikelets, is cult. in Eu., but little known in U. S. V. 3:247.

abyssínica, Link (*Pòa abyssínica,* Jacq.). Teff. A branching and spreading leafy annual, 1–3 ft.: panicle large and open, 1 ft. long, the branches capillary; spikelets numerous, loosely 5–9-fld., 3–4 lines long; lemmas acuminate, scaberulous on the tip and nerves. Afr.—This and the following are cult. for ornament, the spreading panicles being used for bouquets. The abundant seed used for making bread in N. E. Afr.

suavèolens, Becker (*E. collìna,* Trin.). Fig. 1405. A spreading leafy annual, 1–2 ft., differing from the preceding in the less diffuse panicles, the more compact spikelets and the less acuminate lemmas. W. Asia.

interrúpta, Doell (*E. élegans,* Nees). An erect annual, 1–2 ft.: panicle feathery, 1 ft. long, rather narrow, the branches ascending, closely fld. with numerous small spikelets. Brazil.

amábilis, Wight & Arn. (*Pòa amábilis,* Linn.). Erect or spreading annual, 1–2 ft.: panicles small, 4–6 in., rather compact; spikelets purple, many-fld., 3 lines long, 1 line wide. India.

máxima, Baker. An erect, robust annual, 2–3 ft.: blades lanceolate, cordate at base: panicle erect, lax, 6–9 in. long and broad, the pedicels capillary; spikelets oblong, ⅛–½in. long. Madagascar.

A. S. Hitchcock.

ERÁNTHEMUM (Greek, *lovely flower*). *Acanthàceæ.* Tropical shrubs and sub-shrubs, some of which are cultivated chiefly for their foliage and others for their flowers.

Leaves entire or rarely coarsely toothed: fls. white, lilac, rosy or red, borne in various ways; bracts and bractlets narrow, small; corolla-tube long, slender, cylindrical throughout or rarely with a short throat; limb 5-parted; stamens 2; ovules 2 in each cell; seeds 4 or fewer.—Perhaps 30 species. The genus Dædalacanthus, although in a different tribe, is separated only by a combination of technical characters, but the garden forms of both genera described in this work are all distinguishable at a glance. For cult., see *Justicia.* Consult *Dædalacanthus* for related species.

A. *Fls. purple.*

laxiflòrum, Gray. Height 2–4 ft.: lvs. on the same plant varying greatly in size and shape, those near the fls. 2–3½ in. long, 8–15 lines wide; petioles 2–6 lines long, widest below, at or above the middle, more or less ovate-oblong, obtuse, narrowed at the base: fls. in cymes; stamens 2, perfect, sharp-pointed. Fiji. B.M. 6336.

AA. *Fls. pure white.*

tuberculàtum, Hook. Easily told while growing by the many small roundish and rough elevations on the branches: lvs. small, ⅜–⅝in. wide, rarely if ever 1 in. long, broadly elliptical, obtuse or notched, almost sessile: fls. numerous, borne singly in the axils, in summer; corolla-tube very long and slender, 1½ in. long; limb 1 in. across; stamens scarcely exserted. Habitat unknown. B.M. 5405.

AAA. *Fls. white, speckled with red-purple.*

B. *Foliage netted with yellow.*

reticulàtum, Hort. (*E. Schómburgkii,* Lind.). Height 4 ft.: upper lvs. 2–7 in. long, ovate-lanceolate, characteristically netted with yellow; lower lvs. 6–10 in. long, not netted, but the veins prominent and yellow: fls. racemose; corolla speckled with blood-red at the mouth; anthers reddish brown, exserted. Possibly Austral. B.M. 7480. I.H. 26:349.

BB. *Foliage not netted with yellow.*

Ándersonii, Mast. Lvs. lanceolate or elliptic, narrowed into a short stalk: fls. in a spike 6 in. long; lower middle lobe of the corolla larger and speckled with purple. Trinidad. Gn. 45:11. G.Z. 25:49.

The following trade names belong to plants grown chiefly for their foliage. Probably many of them belong in other genera. —*E. álbo-marginàtum.* Lvs. broadly margined with white and irregularly suffused gray.—*E. atrosanguíneum,* Hort. Intro. by W. Bull, 1875. Lvs. large, dark, wine-purple, or blackish crimson, ovate entire, opposite, stalked. Said to endure the hottest sunshine.—*E. cultràtum.* "Lvs. shining, thick, deep-veined." —*E. Dutremblayànum,* Hort., is supposed to be a garden hybrid. Intro. from France in 1907.—*E. Eldoràdo.* Lvs. greenish yellow, veins deeper yellow.—*E. ígneum.* G.W. 3, p. 159. See Chamæranthemum.—*E. Magneànum,* Hort., is recorded as a garden hybrid. Intro. from France 1907. Scarcely known in U. S.—*E. nèrium rùbrum* presumably a misprint for *nervum-rubrum,* has lvs. "irregularly shaped, shaded with light and dark green, and blotched

with yellow, which darkens to reddish purple." Possibly=Fittonia Verschaffeltii.—*E. nervósum*=Dædalacanthus nervosus, T. Anders. —*E. nigréscens*. Presumably with blackish lvs.—*E. pulchéllum*, Hort. and Andr.=Dædalacanthus nervosus, T. Anders,.—*E. purpùreum*. "Lvs. and sts. dark, lurid purple." Siebrecht & Wadley. —*E. Wáttii*, Stapf, is probably the correct name for the plant treated as Dædalacanthus Wattii, Bedd. See B.M. 8239. G.C. III. 45:89.

WILHELM MILLER.
N. TAYLOR.†

ERÁNTHIS (Greek, *er*, spring, and *anthos*, a flower; from the early opening of the flowers). *Ranunculàceæ*. WINTER ACONITE. Low perennial herbs, grown in open flower-beds because of the very early show of bright flowers; very desirable.

Rootstock tuberous: basal lvs. palmately dissected, 1 st.-lf. sessile or amplexicaul just beneath the large yellow fl.: sepals 5–8, petal-like; petals small, 2-lipped nectaries; stamens numerous: carpels few, stalked, many-ovuled, becoming follicles.—About 7 species, natives of Eu. and Asia. The earliest generic name is Cammarum which was given in Hill's British Herbal, p. 47, pl. 7 (1756), but it is not accepted by the "nomina conservanda" of the Vienna code.

Winter aconites are very hardy, and at home in half-shady places, among shrubs or in the border.



1406. Eranthis hyemalis.

Propagated by division of roots. The place in which the tubers are planted should be marked during the summer, when the foliage is dead.

hyemàlis, Salisb. (*Helléborus hyemàlis*, Linn.). Fig. 1406. Erect, 5–8 in.: basal lvs. long-petioled: involucre 12–15-parted, the bright yellow fls. always sessile; anthers oblong. Jan.–March, or as soon as frost is out of the ground. Naturalized from Eu. B.M. 3. Mn. 8, p. 43. G.C. II. 11:245. G. 1: 628; 34:277.

Var. **cilícica**, Huth. (*E. cilícica*, Schott & Kotschy). Much like the above: involucre of deeper and more numerous lobes; anthers ovate instead of oblong; sepals broader, being about ½in. across: follicles always straight. Season a few weeks later. G.C. III. 13:266. G.M. 49:180.—The sts., when grown in gardens, said to be red-brown. Roots of this were first sent to England from its native home near Smyrna in 1892. Rare in Amer.

sibírica, DC. Much dwarfer, seldom over 3–4 in. high: fls. bright yellow, a little smaller than those of *E. hyemalis*, 5-sepaled. Siberia.

K. C. DAVIS.

ERCÍLLA (Peruvian name). *Phytolaccàceæ*. One twining shrub from Peru and Chile, apparently not in the trade but sometimes cult. in this country for its dense spikes of pale purple fls. and dark purple berries. By some it is united with Phytolacca, from which it differs in habit, the coriaceous evergreen lvs., larger bracteoles and technical characters of the fl. **E. volùbilis**, Juss. (*E. spicàta*, Moq. *Bridgèsia spicàta*, Hook. & Arn. *Phytolàcca volùbilis*, Heiml.), has alternate, petioled, ovate-cordate or oblong or orbicular lvs. 1–2 in. long: fls. perfect, in spikes 1–1¾ in. long, the perianth 5-parted, segms. oblong and obtuse;.stamens 8–10, with filiform fleshy filaments, the alternate ones being shorter: carpels 4–8, somewhat impressed in the torus, becoming as many ovoid berries. G.C. II. 9:653. Said to be excellent for covering walls, and climbs by aërial rootlets. It is easily prop. by seeds and cuttings.

L. H. B.

EREMOCÍTRUS (Greek, *desert* and *Citrus*). *Rutàceæ*, tribe *Citreæ*. AUSTRALIAN DESERT KUMQUAT. Spiny shrub or small tree: lvs. small, simple or emarginate, thick and leathery, alike on both sides; spines single, long, slender, axillary: fls. small, 4- (rarely 3- or 5-) merous, white, fragrant, borne singly, or 2 or 3 together in the axils of the lvs.; stamens free, 4 times as numerous as the petals: frs. small, subglobose, oblate or pyriform, yellow, with a thin fleshy peel like that of a lime, 4- (rarely 3–5-) celled with 1 or 2 seeds in each cell; cells containing stalked subglobose pulp-vesicles filled with a pleasant acid juice.—Only 1 species of this subtropical Australian genus is known.



1407. Spiny twig of young seedling of Eremocitrus glauca. (×⅓)

glaùca, Swingle (*Triphàsia glaùca*, Lindl. *Atalántia glaùca*, Benth.). A shrub or small tree bearing edible frs. and occurring in Queensland and New S. Wales, Austral., in subtropical regions subject to severe cold and extreme drought. The lvs. of this plant are small (1–1½ × ⅛–¼ in.), emarginate, and show marked drought-resistant adaptations; both faces of the lvs. show palisade cells, and stomates at the bottom of deep pits; the long and slender spines are borne singly in the axils of the lvs. (see Fig. 1407): frs. subglobose, flattened or slightly pyriform (see Fig. 1408), usually 4-celled and containing globose stalked pulp-vesicles (see Fig. 1408); seeds small, with a longitudinally furrowed and rugose testa. Yearbook Dept. Agric., 1911, pl. 45, fig. 1. Jour. Agric. Research, U. S. Dept. Agric. vol. 2, pp. 85–100, figs. 1–7, pl. 8.—The frs. of this species are used by the settlers in Austral. for jam and pickles and ade is made from the juice. The Australian desert kumquat is the hardiest evergreen citrous fr. known besides being the only one showing pronounced drought-resistant adaptations; it bears in the wild state edible frs. with a pleasant acid juice and a mild-flavored peel. These characteristics make this plant very promising for use in breeding new types of hardy drought-resistant citrous frs. It has been intro. into the U. S. by the Dept. of Agric., and is now growing in the greenhouse of the Dept. of Agric. and in the southern and western states. It can be grafted on the common citrous fruit trees, and can in turn be used as stocks for them.

WALTER T. SWINGLE.

EREMÓSPATHA (*solitary spathe*). *Palmàceæ*. Above a half-dozen Trop. African climbing palms, with long slender ringed sts. and pinnate lvs. Apparently none is in the trade. The fls. are perfect; calyx 3-toothed, campanulate; corolla urn-shaped, with 3 short lobes; stamens 6, with broad connate filaments; ovary 3-celled, and stigmas 3: fr. berry-like: lfts. alternate and opposite; rachis spiny, with a long tendril at end.



1408. Fruit of Eremocitrus glauca, entire and in cross-section, showing stalked globose pulp-vesicles and furrowed seeds. (Natural size)

EREMÓSTACHYS (*deserted* or *solitary spikes*). *Labiàtæ*. Outdoor perennial, apparently only 1 species of the 50 or so in the genus being in commercial cult. The genus is allied to Leonotis and Phlomis, and the species are from Cent. and W.

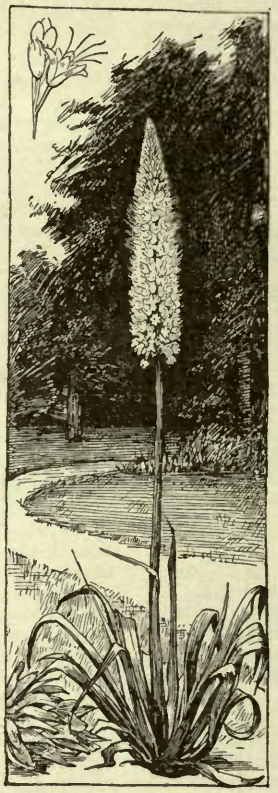
Asia. Erect herbs, with the lvs. mostly radical, large, toothed or cut-pinnatifid; st.-lvs. small, passing into floral bracts: fls. often ochroleucous, in many-fld. whorls in terminal and axillary spikes; corolla-tube included within the calyx; upper lip of corolla erect and hooded, bearded inside; lower lip 3-lobed and the middle lobe largest; stamens 4, with connivent anthers. **E. laciniàta,** Bunge, is catalogued abroad. Nearly simple, 12–20 in.: lvs. pinnatisect, the lobes again pinnatifid: fls. yellow or ochroleucous, in midsummer. Asia Minor.—Said to be an attractive perennial. *E. supêrba,* Royle, reported from Eu., has a strict st., unbranched, 2 ft., root-lvs. pinnatisect, with segms. lobed, forming a rosette: fls. deep primrose-yellow in woolly heads to 6 in. long and 4 in. broad, showy. W. Himalaya.

L. H. B.

EREMÙRUS (Greek name, probably referring to their tall and striking aspect in solitary and desert places). *Liliàceæ.* These hardy desert plants, when in flower with their great flower-stalks taller than a man and crowned with a spike of flowers from 1 to 4 feet long, are amongst the most striking objects in the choicer gardens of the North and East.

Root clusters of fleshy fibers: lvs. all from the root, in dense rosettes, long and linear: fls. white, yellow or rosy; perianth bell-shaped or more widely spreading, withering and persisting or finally dropping away; segms. 6, distinct or very slightly united at the base; stamens 6; ovary 3-celled; seeds 1–4 in each cell, 3-angled.—About 20 species, from the mountains of W. and Cent. Asia.

Probably *E. robustus* and *E. himalaicus* are the hardiest of all the tall desert-inhabiting plants of the lily family—a family including the poker plant, the aloes, the yuccas, and many others that are not so tall and striking in appearance or else too tender to grow outdoors in the North. Large specimens of *E. robustus* will annually produce a flower-stalk 8 feet or more high, with racemes 4 feet long, remaining in bloom for a month. After flowering the leaves disappear entirely, but early in spring they reappear, and should then be covered with a box or barrel, to protect the forming flower-stalk from late frosts. A mound of ashes over the crown in winter is advisable, or a box with water-tight top filled with dry leaves. Both species like a rich soil, moist but well drained, and plenty of water in the flowering period, but none afterwards. Propagation is by division, or slowly by seeds. Large plants are expensive, but they can sometimes be secured large enough to flower within a year or so of purchase. It tries one's patience to wait for seedlings to reach flowering size. The flowers look like small stars. (W. C. Egan.)



1409. Eremurus himalaicus.

A. *Fls. rosy.*

B. *Lvs. linear-ligulate.*

robústus, Regel. Root-fibers thick and fleshy: lvs. glaucous, glabrous, linear-ligulate, 2 ft. long, 1½–2 in. wide, roughish on the margin, with minute recurved teeth: raceme 4–4½ in. wide; stamens about as long as the perianth. Turkestan. B.M. 6726. Gng. 6:52, 324. Gn. 46, p. 335. Mn. 8, p. 123. J.H. III. 29:267. Gt. 61, p. 366. G.C. III. 28:228; 30:426. Var. **álbus,** Hort. Stronger and pure white.—May be grouped in the hardy perennial border with bold effect.

BB. *Lvs. ovate-lanceolate.*

Élwesii, Mich. (*E. Elwesiànus,* Hort.). Lvs. light green, ovate-lanceolate, obtuse, flat, not at all rough at the margin, shorter than in *E. robustus,* nearly triangular, even more glaucous, and beginning to decay at the time of flowering: perianth-segms. with a band of deeper color down the middle. Habitat(?). R.H. 1897:280. Gn. 54, p. 99. G.C. III. 24:137; 33:381. G.M. 44:321.—Intro. by Leichtlin as *D. robustus* var. *Elwesii.*

AA. *Fls. white.*

himalàicus, Baker. Fig. 1409. Root-fibers thick and fleshy: lvs. 9–12, ligulate, firm, persistent, 1–1½ ft. long, 6–15 lines wide above the middle: raceme 3–3½ in. wide; stamens about as long as the perianth. Himalayas. B.M. 7076. Gn. 49, p. 131. G.C. II. 16:49. G.M. 44:321; 52:631 (as *E. Elwesii.*)

Ólgæ, Regel. Lvs. narrow, glabrous, but with rough margins, about 8–12 in. long and 7–8 lines broad: fls. in a dense raceme, spreading; the white petals with a single brownish nerve down the center. Turkestan. Var. **álbus,** Hort., a white-fld. form is known.

AAA. *Fls. some shade of yellow.*

B. *Color light yellow.*

spectábilis, Bieb. Root-fibers thick and fleshy: lvs. 6–15, lorate, slightly glaucous, 12–18 in. long, 6–12 lines wide above the middle, noticeably narrowed at the base: raceme 1–1½ ft. long, 2 in. wide; stamens orange, finally twice as long as the perianth. Asia Minor, Persia. B.M. 4870.

BB. *Color pure yellow or orange.*

Búngei, Baker. Lvs. contemporary with the fls., linear, 1 ft. long, less than 3 lines wide: raceme 4–5 in. long, 2 in. wide; stamens finally twice as long as the perianth. Persia. G. 19:31. G.L. 20:155. Gn. 60, p. 53; 66, p. 150. Var. **magnìficus,** Hort. A larger form than the type and with brighter yellow fls. Var. **præcox,** Hort. An early flowering more slender form than the type, the fls. smaller and loosely scattered on the spike. Var. **citrìnus,** Hort. "More robust than the type and with larger citron-yellow fls."

BBB. *Color orange.*

aurantìacus, Baker. Closely allied to *E. Bungei,* but live plants have less acutely keeled lvs.: root-fibers tapering upward, and orange fls. and stamens. Bokhara, Turkestan. B.M. 113.

During recent years many beautiful hybrid plants have been intro. into cult., often under some specific name which gives no indication of the parentage. Of these the following are known and the parents are indicated when possible.—*E. isabellìnus,* Vilm. A hybrid between E. Bungei and E. Olgæ. Fls. large, apricot-rose.—*E. Micheliànus,* Hort., is supposed to be a hybrid between E. Warei and E. Bungei. G.C. III. 40:83, desc.—*E. Tubergènii,* Hort. A hybrid, crossed in Holland between E. himalaicus and E. Bungei. —*E. vedrariénsis,* Hort.=E. robustus × E. spectabilis? R.H. 1907, p. 229.—*E. Wàrei,* Hort., is supposed to be a natural Eastern Asiatic hybrid between E. Bungei and E. Olgæ. It is described as growing in ordinary seasons about 8 ft. high. The fls. are less bright than in E. Bungei, and in rootstock it resembles the later-flowering E. Olgæ. Gn. W. 22: suppl. May 27.

WILHELM MILLER.
N. TAYLOR.†

ÉRIA (from Greek for *wool,* as the leaves of some species are downy or woolly). *Orchidàceæ.* About 100 species of tropical Asian orchids allied to Dendrobium but with eight rather than two or four pollinia, of most diverse habit, and very little in cultivation outside the

collections of botanic gardens and fanciers, being mostly curious and botanical rather than beautiful. They require warmhouse treatment, after the manner of stanhopeas.

ERIÁNTHUS (Greek, *erion*, wool, and *anthos*, a flower). *Gramíneæ*. PLUME-GRASS. Tall reed-like ornamental perennials with large woolly plume-like inflorescence.

Spikelets in pairs, one sessile, the other pedicellate, as in Andropogon, arranged in spikes, and these in a large terminal panicle, clothed with long hairs, especially around the base, the fertile lemma awned.—Species about 18, warmer regions of both hemispheres.

Ravénnæ, Beauv. PLUME-GRASS. RAVENNA-GRASS. HARDY PAMPAS-GRASS. Fig. 1410. Three to 12 ft.: blades ½in. wide, narrowed into a firm rough point: panicle or plume as much as 2 ft. long. S. Eu. Gn. 54, p. 496. R.H. 1890, p. 546. V. 3:247.—This is one of the best of the stout and tall perennial grasses. It thrives in light and open places in well-drained soils, and makes great clumps, when well established sometimes producing as many as 40 or 50 heads. Hardy in latitude of New York City.

A. S. HITCHCOCK.



1410. Erianthus Ravennæ.

ERÌCA (practically meaningless; probably not from *ereiko*, to break, as commonly stated). *Ericàceæ*. HEATH. This is the genus that the gardener usually means by "heath." The heath or heather of English literature and history belongs to the closely allied genus Calluna. The next most important group of cultivated "heaths" is Epacris, which, however, belongs to a different family.

Ericas are perennial woody plants from 6 in. to 12 ft. or more, usually much branched: lvs. in whorls of 3–6, very rarely flat, usually 3-sided and with revolute margins that are sometimes connate with the under side: infl. usually terminal or sometimes axillary, very seldom actually, though often apparently, racemose; calyx free, 4-parted; corolla hypogynous, white, rosy or sometimes yellow, usually early deciduous, variously shaped, the commonest forms (in cult.) being bell-shaped, tubular and ventricose, usually 4-lobed; stamens 8; ovary sessile or rarely stalked, 4-celled, rarely 8-celled, with 2–∞ ovules in each cell: fr. a 4-valved caps., with minute seeds.—About 500 species, mostly from S. Afr. and the Medit. region, nine-tenths from the former. There are many hybrids and horticultural forms. So far as the S. African species are concerned, the latest monograph is that of Guthrie and Bolus, which has served as the basis for the treatment below.

Only a few of the European heaths are hardy in America, and there are no native heaths at all in this hemisphere. Of about fourteen kinds of Erica grown outdoors in Europe to produce large showy masses, only three are hardy here, and it is safest to cover these with evergreen boughs in winter. Two others (*E. mediterranea* and *E. lusitanica*) are grown under glass somewhat but they are probably hardy, with protection, from New York southward. The tree heath of southern Europe (*E. arborea*) will probably never be a feature of our southern landscapes. The heath that is naturalized in places from Rhode Island to Newfoundland is *Calluna vulgaris* (which see); and this is sometimes advertised as *Erica vulgaris*.

The halcyon days of the heaths were from about 1806 (when the English took the Cape of Good Hope) until the middle of the century. Andrews' colored engravings of heaths (1809) marks the first flush of their popularity. Practically, if not absolutely, all the heaths that are grown on a large scale have been developed from the South African species. The old English gardeners still lament the glorious days when the hard-wooded plants of Australia and the Cape formed the chief feature of European indoor horticulture. They complain that the present generation is not willing to give them the care they deserve. This is especially true of America. In America, heaths are of minor importance, even at Easter, and the kind grown most extensively for Christmas seems to be *E. melanthera*.

The great trouble with heaths is the immense amount of care they need. Few, if any, classes of plants require more attention. Hence the growing of heaths for the market is extremely specialized, and there the American retail catalogues only rarely offer more than one species. Nevertheless, all the kinds described below are grown commercially, and are of the first importance in the genus. The stock is largely imported from England. Germany has a very different set of varieties, and France still another, and there are few cases among cultivated plants showing so great a difference in the three countries. The risks of importation are considerable, and the tendencies toward American independence in this line seem to be gaining. Another difficulty in heath-culture is the poor quality of peat obtainable in America. In England the peat is more fibrous, and has been formed in past ages largely by the decay of the native heather.

The soft-wooded kinds are the ones most grown. The hard-wooded sorts require a longer period of growth and more thorough ripening of the wood. Apparently only one yellow-flowered heath is cultivated in America, *E. Cavendishiana* which is a hybrid species about which little is known. See supplementary list (p. 1132).

In general, the ericas do not grow well in this climate on account of the extreme heat of the summer months, but some varieties grow and flower even better here than in Europe. The choice of the soil is very important. A light peat, mixed with sharp coarse sand is about the best we can get here. After flowering, the plants should always be cut down to keep them bushy at the base and well shaped. They will then receive a good repotting, always using very clean pots and plenty of drainage. Cuttings are made from December to April, preferably from young plants, the tender shoots about 1 inch in length being best. These are planted firmly in a pan filled with clean fine sand, and covered with a bell-glass, or in a box covered tightly with a pane of glass. Bottom heat is not necessary. When rooted, the cuttings should be potted in small pots, and when well started should be given as much air as possible. It is well to bring the ericas out of the greenhouse as early in the spring as possible. The pots should be plunged in a good location, where plenty of air and

sunlight can be had. They should be wintered in a greenhouse extremely well ventilated, and a temperature not higher than 40° to 45° F. When in bud the plants should not be allowed to dry out too much. One drying might be enough to cause the loss of all the buds. Very often the heaths are attacked by a disease similar to mildew, brought on by an excess of humidity in the air. As this disease is very contagious, it is well, as soon as noticed, to use sulfur in powder or sulfate of copper in solution until the plants are rid of it (Louis Dupuy).

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KEY TO THE SPECIES.

A. *Heaths hardy, European, or hardy with protection from New York southward.*
B. *Lvs. and calyx-segms. ciliate: stamens included.*
C. *Fls. in spike-like clusters*..... 1. **ciliaris**
CC. *Fls. in umbel-like clusters*..... 2. **Tetralix**
BB. *Lvs. and calyx-segms. glabrous.*
C. *Anthers usually exserted well beyond the corolla-tube.*
D. *Fls. usually solitary and lateral, rose-colored*..... 3. **mediterranea**
DD. *Fls. clustered, pink, usually all lateral*..... 4. **carnea**
DDD. *Fls. all clustered at the ends of the branches*..... 5. **vagans**
CC. *Anthers included in the corolla-tube.*
D. *Fls. rose-violet or purplish.*
E. *The lvs. verticillate in 3's*.... 6. **cinerea**
EE. *The lvs. verticillate in 4's*... 7. **stricta**
DD. *Fls. pale rose, in broad panicles*..... 8. **lusitanica**
AA. *Heaths tender, S. African, always grown under glass in Amer.*
B. *Fls. mostly showy, petal-like, scarcely greenish or sepal-like.*
C. *Corolla tubular, the limb not spreading.*
D. *Length of fls. usually more than 6 lines, in cult. specimens umbellate*..... 9. **verticillata**
DD. *Length of fls. usually 10–12 lines, in 2's or 3's*.....10. **hyemalis**
CC. *Corolla various, not tubular, the limb often spreading.*
D. *The corolla-segms. spreading, the tube mostly elongate.*
E. *Length of corolla 6–8 lines; segms. ovate, acute*.....11. **ventricosa**
EE. *Length of corolla 3–4 lines; segms. ovate or sub-orbicular*.....12. **præstans**
DD. *The corolla-segms. usually not spreading, the tube rarely over 4 lines long.*
E. *Lvs. channeled.*
F. *The lvs. in 3's*.....13. **sicæfolia**
FF. *The lvs. in 4's*.....14. **propendens**
EE. *Lvs. not channeled, more or less open-backed and spreading.*
F. *Infl. variable, often terminal and axillary on the same plant*.....15. **flacca**
FF. *Infl. always terminal.*
G. *Sepals about as long as the corolla-tube.*
H. *Lvs. rough or tuberculate*.....16. **turrigera**
HH. *Lvs. not rough.*
I. *The lvs. glabrous*...17. **gracilis**
II. *The lvs. usually pubescent*.....18. **persoluta**
GG. *Sepals about half as long as the corolla-tube*.....19. **formosa**
BB. *Fls. not so showy, calyx-like, the calyx often colored also.*
C. *Lvs. in 3's: sepals colored*.....20. **melanthera**
CC. *Lvs. opposite: sepals green*.....21. **fragrans**

1. **ciliàris**, Linn. A much-branched nearly hardy shrub, 10–20 in. tall, the branches usually glandular: lvs. small, but not as in typical heaths, ovate, mucronate: fls. about 4 lines long, or more, purplish, in spike-like, lateral clusters. Eu. June–Sept. B.M. 8443.

2. **Tetràlix**, Linn. Bell Heather. Cross-leaved Heath. Lvs. in 4's, margin folded back: fls. rosy; sepals ovate-lanceolate, ciliate; anthers awl-shaped or awned, included; ovary with short, soft hairs. W. Eu.—Foliage grayish. Height in England 6–12 in. With Manning, at Reading, Mass., about 8 in.


1411. Erica mediterranea.

3. **mediterrànea**, Linn. (*E. cárnea* var. *occidentàlis*, Benth.). Fig. 1411. This is considered by Bentham a western form of *E. carnea* (No. 4), with a little smaller fls., corolla a trifle wider at the apex, and anthers shortly exserted instead of included. *E. mediterranea* of the trade is hardy in England, and perhaps second only to *E. carnea* in popularity there. In Amer. it seems to be cult. only under glass but should be hardy from N. Y. southward with protection. B.M. 471. Gn. 54:263; 55, p. 403; 61, p. 431. G.M. 45:261; 55:315. Var. **álba**, a white-fld. form is known. Gn. 59, p. 94.

4. **cárnea**, Linn. (*E. herbàcea*, Linn.). Height 6 in.: lvs. in 4's: infl. lateral; corolla broadly bell-shaped; anthers exserted; ovary glabrous. March–May. Alps. L.B.C. 15:1452. B.M. 11. Gn. 54:6 (a charming picture).—The bright rosy-fld. form is the best and most striking. There are pale red and pure white varieties. The most popular of all hardy ericas. Very easily prop. by division. *E. mediterranea* var. *hybrida*, Hort., is said to be a cross with *E. carnea*, and in England thriving almost as well in loam as in peat. See Gn. 54:262; 55, p. 127; 61, p. 399; 72, p. 176. G.M. 50: 39. J.H. III. 51:293.

5. **vàgans**, Linn. Cornish Heath. Fig. 1412. Lvs. in 4's or 5's: sepals small, ovate, obtuse; corolla ovate-bell-shaped; anthers ovate-oblong, 2-parted, exserted; ovary not hairy. W. Eu. and Medit.—Fls. pale purplish red. Grows 3–4 ft. in England; 1 ft. with J. W. Manning, Reading, Mass. Var. **álba** has white fls. Var. **capitàta**, grows 1–2 ft. high with Meehan at Germantown, Pa., and has "small whitish fls. with a purplish tip." F.E. 22:685.

6. **cinèrea**, Linn. A twisted and much-branched shrub, 8–15 in. high: lvs. verticillate, in 3's, narrow, glabrous, and usually not over 3 lines long: fls. showy, rose-violet, in usually verticillate clusters; corolla much contracted at apex, the lobes reflexed. June–Sept. Eu. Var. **álba**, Hort., a white-fld. form, and var. **coccínea**, Hort., a scarlet form, are both in the trade. Gn. 61, p.

433.—Hardy in U. S., with a little protection, from N. Y. southward.

7. **strícta,** Don. CORSICAN HEATH. Lvs. in 4's, a little more erect than in No. 2: sepals lanceolate, obtuse; corolla ovoid-oblong, narrowed at the throat; anthers awl-shaped or awned, included; fls. rosy purple; ovary densely covered with long, rough hairs. Corsica.—Summer. Attains 4 ft. in Eng., but grows 1–2 ft. high with Meehan, at Germantown, Pa. Branches strict, rigid.

8. **lusitánica,** Rudolph (*E. codonòdes,* Lindl.). SPANISH HEATH. Branches tomentose-pubescent: lvs. glabrous and ovary glabrous: fls. pale rose, in broad panicles. W.Eu. B.R. 1698. G.C. II. 7:463; III. 19:487; 35:91. I.H. 43, p. 321. Gn. 54: 263; 55, p. 125; 67, p. 328. B.M. 8018. G. 21:384; 30:130.—Hardy in England, but in U. S. only south of N. Y., and then must be protected.

9. **verticillàta,** Berg. An erect shrub, 4–6 ft., with lvs. 4–6 in a whorl: lvs. densely imbricate, erect or spreading: fls. mostly in 4's in wild specimens, but, according to Andrews, umbellately 3–10-fld. in cult.; corolla tubular, hairy, usually straight, bright rosy-scarlet, and very showy: caps. unique in splitting into 8 valves. Andr. Heathery, 58.



1412. Erica vagans. (×⅓)

10. **hyemàlis,** Hort. Fig. 1413. Written also *hiemalis.* Watson thinks it may be a winter-flowering form of *E. perspicua,* figured in L.B.C. 2:102 and 18: 1778 as *E. Linnæana.* Fls. rosy pink, tipped white. Var. **álba** has white fls. With L. Dupuy, Whitestone, L. I., it flowers in Sept. G.F. 5:137. Gn. 41:420. G. 25:567. H. D. Darlington says it is very distinct from *E. perspicua.*

11. **ventricòsa,** Thunb. Lvs. in 4's, incurved to spreading, with pilose margins: infl. terminal; sepals keeled; anthers with 2 very short ears, or awned, included; ovary glabrous. B.M. 350. L.B.C. 5:431. G. 9:565; 26:239. Var. **grandiflòra,** with tubes over ½in. long. L.B.C. 10:945(as *E. prægnans*). The following varieties are reported: *Bothwelliàna, breviflòra, cárnea ròsea, cintra, hirsùta, álba, magnífica, supérba, tricolor.* See R.H. 1858, p. 450; 1880:50. Gn. 45, p. 87. A.F. 10:1111. F.E. 9:333.

12. **præstans,** Andr. (*E. Parmentièrii,* Lodd.). Lvs. in 4's, somewhat incurved; bracts crowded: fls. nearly sessile, white, faintly flushed pink at base, in terminal groups of 4 or more; sepals ovate, rough-margined; anthers scarcely acute. Sept. Varieties are pictured under various names in L.B.C., plates 154, 197, 1695, and 1804.

13. **sicæfòlia,** Salisb. (*E. pygmæa,* Andr. and Hort.). Dwarf cushiony heath, perhaps best treated in the alpine garden, 4–8 in. high: branches ascending, nearly glabrous· lvs. in whorls of 3, linear-acuminate, 2½–5 lines long: fls. in 3's, the corolla dark purple, its segms. ciliolate. L.B.C. 5:468. B.M. 2263.



1413. Erica hyemalis. Great numbers of this heath are sold in London every Christmas.

14. **propéndens,** Andr. An erect sub-shrub, 10–18 in. high, the branches nearly straight, the younger pubescent: lvs. in 4's, linear and usually 3-sided, ciliate, or sometimes glabrous: fls. 1–4 in a cluster, the corolla red, broadly bell-shaped and hairy, about ⅓–½ in. long; ovary 4–8-celled, rough but not hairy. L.B.C. 1:63. B.M. 2140. Andr. Heathery, 141. G. 25:137. G.C. III. 32:278, 279. Gn.W. 21:759. J.H. III. 47:543.

15. **flácca,** E. Mey. (*E. ciliàris,* Thunb., not of Hort.). An erect shrub, usually branched, but not diffuse, the branches pubescent or glandular hairy: lvs. in 3's, rarely in 4's on the same plant, spreading, usually "linear, as if subterete," the margins revolute, 1½–2½ lines long: fls. in 3's, the corolla bell-shaped to tubular, the segms. about a third as long as the tube; ovary sometimes hairy on the top.

16. **turrígera,** Salisb. (*E. cupressìna,* Forbes). Lvs. glabrous, subciliate or naked: infl. terminal; fls. pedicelled, in 1's to 4's; bracts remote; sepals finally reflexed; sinuses of the corolla acute, narrow. Probably a hybrid, cult. since 1802. F.E. 9:333. A.F. 15: 1175. Gng. 9:35 (the last two as *E. cupressina*).

17. **grácilis,** Salisb. Lvs. in 4's, somewhat erect; bracts remote: sepals smaller, lanceolate; anthers with a short, sharp point. L.B.C. 3:244 (pale violet). G. 25:602. Gn. 76, p. 11. "Fls. purplish red." Var. **autumnàlis,** Hort. Fls. Sept. Var. **vernàlis,** Hort. Fls. in Oct. and Nov.

18. **persolùta,** Linn. Fig. 1414. Essentially a white-fld. and very variable species, particularly as regards hairiness: lvs. erect or spreading, hirsute or glabrous: corolla small, originally 1½ lines long; lobes ovate, 2–3 times shorter than the tube, the sinuses acute, narrow. S. Afr. The numerous varieties Bentham found impossible to separate either in the wild or in cult. Var. **hispídula,** Benth. Slightly hirsute: lvs. 2½–3 lines long, rough: anthers subovate. Var. **lævis,** Benth. Lvs. shorter, blunter, often appressed, glabrous: anthers subglobose. Var. **subcárnea,** Benth., has the corolla-lobes more evident. To this last variety Bentham seems to refer most of the horticultural varieties cult. under the name of *E. persoluta. E. assúrgens,* Link, he refers to the first variety; *E. cáffra* of Linnæus to the first, but of L.B.C. 2:196 (and the trade?) to the second. *E. regérminans* of Linnæus is a distinct species (figured in L.B.C. 17:1614 as *E. Smithiana*); of the trade=*E. persoluta* var. *hispidula;* of L.B.C. 18:1728=*E. persoluta* var. *subcarnea.* Flowers in Feb and March, while other related species mostly flower in March and April.

19. **formòsa,** Thunb. (*E. grandinòsa,* Hort.). Erect shrub, 1–2 ft., the branches hairy, covered with lvs. in whorls of 3: lvs. glossy, channeled, the younger ciliate, about 1½ lines long: fls. in 3's, the corolla white, with 8 longitudinal channels, sticky. Andr. Heathery 265.



1414. A form of Erica persoluta.

20. **melanthèra,** Linn. Fig. 1415. Lvs. thick, obtuse, grooved on the back, younger ones often rough, with glands; bracts mostly crowded: fls. rosy; sepals obovate, keeled, colored; anthers black; ovary villous. Not L.B.C. 9:867, which may be a form of *E. nigrita.* Flowers in Dec. and Jan. A.F. 11:1133; 12:579; 29:1079. F.E. 9:333. C. L.A. 9:169; 15:170. G.M. 49:56.

21. **fràgrans,** Andr., not Salisb. Lvs. opposite, erect-appressed, acute, always glabrous; bracts loose, sepal-like: fls. in 2's; sepals ovate, keeled, green; ovary glabrous or slightly bristly at the tip. B.M. 2181. L.B.C. 3:288.

The following are mostly kinds that have been grown successfully in small quantities in this country but appear not to be advertised in American trade catalogues. H=hard-wooded; the rest are soft-wooded. S. Afr., unless stated. Aside from these, *E. scopària,* Linn., of S. Eu., is sometimes listed: 2–3 ft., glabrous: lvs. in 3's: fls. greenish, in 1-sided racemes; calyx-lobes about half the length of the subglobose corolla. *E. capénsis* also appears, but it is apparently only a catalogue name.

E. ampullàcea, Curt. Lvs. ciliate, mucronate: bracts colored; fls. mostly in 4's; corolla ventricose, very sticky, typically white, lined with red; limb spreading, white. Var. *rùbra* is the only form cult. B.M. 303. L.B.C. 6:508. H.—*E. arbòrea* var. *alpìna,* W. I. Beau. An alpine variety, grown only at Kew. It is a stiff erect bush with tiny white fls. in plume-like clusters. Gn. 75, p. 384.—*E. aristàta,* Andr. Readily distinguished by the long bristle which ends the lvs.: lvs. recurved: fls. in 4's; sepals keeled with red; corolla sticky, 1 in. long, ventricose, but with not so long and narrow a neck as in E. ampullacea. B.M. 1249. L.B.C. 1:73. H.—*E. barbàta,* Andr. Bristly and glandular-pubescent: lvs. in 4's: corolla urn-shaped, villous; ovary villous. L.B.C. 2:124.—*E. Bowieàna,* Lodd. Lvs. in 4's to 6's: infl. axillary; corolla tubular, slightly inflated; limb erect or scarcely open. L.B.C. 9:842.—*E. Búrnettii,* Hort. Hybrid. F.S. 8:845.—*E. Cavendishiàna,* Hort. (E. Cavendishii, Hort.). Hybrid of E. depressa×E. Patersonii. Lvs. in 4's, margins revolute: fls. in 2's to 4's; corolla tubular; stamens included; anthers awned. P.M. 13:3. G.C. 1845, p. 435; II. 18:213; 20:597. F.S. 2:142. A.F. 12:1143. Gng. 5:331. C.L.A. 7:180. G. 6:489; 10:243.—*E. conspícua,* Soland., is a species with club-shaped, villous fls. and villous lvs. in 4's. Var. *spléndens,* Klotzsch, with the lvs. and sepals shining green and pubescent corollas, includes E. elata, Andr. L.B.C. 18:1788.—*E. cylíndrica,* Andr. and Hort. Important hybrid of unknown parentage, cult. since 1800. Lvs. in 4's: fls. nearly sessile; corolla 1 in. long, brilliant rosy red, with a faint circle of dull blue about two-thirds of the way from the base; anthers awned, included; ovary glabrous. L.B.C. 18:1734. R.H. 1859, p. 42.—Fls. very showy and unusually long. The oldest E. cylindrica. That of Wendland is a yellow-fld. species unknown to cult.—*E. Devoniàna,* Hort. Hybrid. Fls. rich purple. H.—*E. elàta,* Andr.=E. conspicua var. splendens.—*E. Irbyàna,* Andr. Allied to E. ampullacea, but with corolla narrower at the base and tapering with perfect regularity to just below the limb, where it has a prominent red bulge. It is also distinctly lined with red, and the sepals are green, although the bracts are colored, as in E. ampullacea. L.B.C. 9:816. H.—*E. nigréscens* is presumably E. melanthera (H. D. Darlington).—*E. pállida.* A confused name. The oldest plant of this name is Salisbury's, which has an urn-shaped corolla, fls. often in 3's, pubescent and hirsute branches and lvs. in 3's. L.B.C. 1:72 (as E. pura). *E. pállida* of the trade is probably the tubular-fld. hybrid of Loddiges in L.B.C. 14:1355, which has axillary and terminal fls., and lvs. in 4's to 6's.—*E. perspícua,* Wendl., has a tubular or slightly club-shaped corolla, lvs. in 4's, pubescent or rough-hairy, and fls. in 1's to 3's, but the plant in the trade is probably *E. perspicuoides,* Forbes, a hybrid, with longer and woollier hairs, fls. somewhat in umbels, nearly 1 in. long. Only var. *erécta* is grown here.—*E. Syndriàna* is grown by Louis Dupuy.—*E. translúcens,* Andr. Perhaps the first of all the garden hybrids between E. tubiflora and E ventricosa. Lvs. rigid, with or without long, soft, red hairs: fls. in umbel-like heads; bracts remote; corolla rosy, 8–9 lines long; tube narrowly ventricose, pubescent limb short, spreading; ovary sessile. Andr. Heaths, 295. Bentham considers this a synonym of E. spuria, Andr. Heaths, 60. Schultheis says "it is the finest erica grown; a poor propagator but good grower. Takes 3 months to root."—*E. tricolor* is perhaps the most confused name in the genus, and apparently one of the important kinds abroad, where it has many varieties and synonyms. In the trade it seems to stand for a handsome heath, with lvs. in 4's, distinctly ciliate and terminated by a bristle: fls. in umbels of 8–10, 1 in. long, a little too inflated at the base for the typical tubular form, rosy at the base, then white, then green, and then suddenly constricted into a short neck; pedicels red and exceptionally long. This description is from L.B.C. 12:1105 (as E. eximia), one of the earliest pictures of these charming hybrids which Bentham refers to the hybrid E. aristella, Forbes.—*E. Wilmorei,* Knowles & Westc. (E. Wilmoreana and Vilmoreana, Hort.). Hybrid: corolla tubular, bulged below the lobes, slightly velvety-hairy: fls. in 1's to 3's, rosy, tipped white. R.H. 1892, p. 202. A.F. 4:251. G.C. III. 19:201. A.G. 21:869. Var. *glaùca,* Carr., has nearly glaucous foliage. Var. *calyculàta,* Carr., has a large additional calyx. R.H. 1892, p. 203.

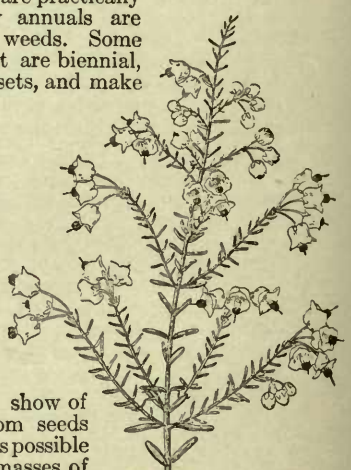
WILHELM MILLER.
N. TAYLOR.†

ERIGENÌA (Greek, *spring-born*). *Umbellíferæ.* HARBINGER-OF-SPRING. A monotypic genus of E. N. Amer. *E. bulbòsa,* Nutt., is low (4–10 in.), nearly stemless, hardy, from a deep-lying tuber, with ternately decompound lvs. and small umbels of minute white fls. A few plants may have been sold by collectors and dealers in native plants, but it is not a cult. plant. It grows in rich deciduous woods and clearings.

ERÍGERON (Greek, *old man in spring;* some of the early kinds are somewhat hoary). *Compósitæ.* FLEABANE. Hardy border plants, suggesting native asters, but blooming much earlier, growing in tufts like the English daisy, though usually from 9 inches to 2 feet high.

Stem-lvs. entire or toothed: fls. solitary, or in corymbs or panicles; rays in 2 or more series, mostly rose, violet or purple, rarely cream-colored or white, and one kind has splendid orange fls.; involucre bell-shaped or hemispheric, the bracts narrow, nearly equal, in 1 or 2 series, differing from Aster in which the bracts are in many series.—About 150 species scattered over the world, particularly in temperate and mountainous regions.

The garden fleabanes are practically all perennials. A few annuals are harmless and pretty weeds. Some species have roots that are biennial, but they increase by offsets, and make larger clumps from year to year. They are of easy culture. They do best when somewhat shaded from the midday sun. They are easily propagated by seeds or division, and doubtless by cuttings, if there were sufficient demand. Small, divided plants set out in early spring produce good-sized flowering plants the first year. A good show of bloom may be had from seeds sown outdoors as early as possible in spring. Some fine masses of these plants in the hardy border or wild garden are much more desirable than an isolated specimen or two of each kind. The most popular species is *E. speciosus.* At present it is the best kind that has the rich soft colors, from rose to violet and purple. *E. aurantiacus* has dazzling orange flowers, and is unique in the genus.



1415. Erica melanthera.

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A. *Fls. orange.*

1. **aurantìacus,** Regel. More or less velvety: height 9 in.: lvs. oval-oblong, clasping at the base, more or less twisted: heads 1 on a st.; involucral scales loose, reflexed. July, Aug. Turkestan. R.H. 1882:78. Gn. 52, p. 485. G. 5:239. J.H. III. 52:303.—Perhaps the showiest of the genus. Sold as "double-orange daisy."

AA. *Fls. creamy or white.*

B. *Lvs. linear.*

2. **ochroleùcus,** Nutt. Height 9–18 in.: sts. mostly not branched: lvs. rather rigid: rays 40–60, white or purplish, never yellow. Gravelly hills and plains N. Wyo. and Mont. to Utah.—This and the next are rare kinds in cult., sometimes sold by collectors and dealers in native plants.

BB. *Lvs. broader, lanceolate to ovate, or obovate.*

3. **Hòwellii,** Gray. Height about 1 ft.: root-lvs. obovate; st.-lvs. ovate, half-clasping, all thin: rays 30–35, 1–2 lines wide, white. Mountain meadows, Cascade Mts., Ore. and Mont.

4. **mucronàtus,** DC. (*Vittadìnia tríloba,* Hort., not DC.) Lvs. lanceolate, narrowed at base, ciliate, mostly entire, often with a long, callous mucro. Mex. This plant, grown in Calif., is a much-branched perennial with variable sometimes lobed lvs., and the white rays purple on the back. G.C. III. 48:203.

5. **Coùlteri,** Porter. A slender equally leafy perennial about 15 in. high: lvs. thin, obovate or oblong, almost mucronate, and usually soft-hairy: fls. solitary on each stalk, sometimes 2 or 3 together, the white rays about 1 in. long. July. Rocky Mts. G.C. III. 30:99. Gn.W. 3, p. 587; 16:440.

AAA. *Fls. rosy violet or purple.*

B. *Rays 100 or more, mostly narrow: lvs. entire.*

C. *Fl.-heads large.*

D. *Involucre hairy.*

E. *Height about 2 ft.: sts. several-fld.*

6. **speciòsus,** DC. (*Stenáctis speciòsa,* Lindl.). Height 1½–2 ft., the st. more or less woody: hairs few, loose: st. very leafy at top: root-lvs. more or less spatulate; st.-lvs. lanceolate, acute, half-clasping. Brit. Col. to Ore. near the coast. B.M. 3606. B.R. 1577. Gn. 52:484. G. 21:15. Var. **supérbus,** Hort., sold abroad, has lighter colored and more numerous fls. Gn. 75, p. 118. G. 31:81. Var. **màjor,** Hort., has broader rays and brighter colors. Var. **ròseus,** Hort. Ray-florets lilac; disk-florets yellow. Var. **grandiflòrus,** Hort. Fls. larger and deeper in color than in var. *superbus.*

EE. *Height 9–15 in. or less: sts. usually 1-fld.*

7. **glaùcus,** Ker-Gawl. Beach Aster. Lvs. slightly glaucous or often green in cult.; root-lvs. rarely 2–3-toothed: rays not narrow, light lavender-blue. Pacific coast, where it flowers most of the year. B.R. 10. Gn. 52, p. 484. Var. **semperflòrens,** Hort. A dwarf floriferous form.

8. **alpìnus,** Lam. (*E. Ròylei,* Hort.?). A dwarf species suitable for rockwork: sts. hairy, bearing a single head of purplish fls.: lvs. acute, lanceolate, sometimes ciliate but otherwise entire. Northern regions. L.B.C. 6:590. —Suitable chiefly for alpine gardens.

DD. *Involucre not hairy.*

9. **macrânthus,** Nutt. Height 10–20 in.: hairs numerous and long or short, sometimes nearly absent: lvs. lanceolate to ovate: rays very numerous, at least ¾in. long. Rocky Mts., Wyo. to New Mex. and S. W. Utah. Gn. 52, p. 484. G.C. III. 46:53.—A good species. Blooms later than the eastern species. Violet. Hardy. Can be used with good effect in mass plantings of autumn-flowering asters and goldenrods.

CC. *Fl.-heads (or disk) small.*

10. **glabéllus,** Nutt. (*E. ásper,* Nutt.). Height 6–20 in., the st. simple or a little branched above: root-lvs. spatulate; st.-lvs. lanceolate, gradually narrowing into bracts: involucre bristly, or at least pubescent; rays violet-purple or white, very narrow. Minn. to Rockies. Gn. 52, p. 485. B.M. 2923. B.B. 3:385. L.B.C. 17:1631.—Much cult. abroad. Var. **arizónicus,** Hort. A variety from Ariz.

BB. *Rays 70 or less, wider: lvs. entire or toothed.*

C. *Lvs. almost or quite entire.*

D. *Sts. with several fls. in a corymb.*

11. **Villársii,** Bell. Root biennial: height 1 ft.: lvs. with 3 or 5 nerves, roughish: fls. corymbose. Eu. B.R. 583. L.B.C. 14:1390.—Not cult., but in I.H. 43, p. 301, said to be a parent with *E. aurantiacus* of *E. hýbridus ròseus,* Hort., Haage & Schmidt. This is said to resemble *E. Villarsii* in habit, and *E. aurantiacus* in form of fls. but not in color. Said to bloom freely from May to autumn.

12. **philadélphicus,** Linn. Perennial by offsets: a roughish, much-branched herb with spatulate or obovate lvs. often st.-clasping along the upper part of the st.: heads several, corymbose, the numerous purplish white rays being attractive in June. N. Amer.—Almost a weed and easily grown in any ordinary garden.

DD. *Sts. mostly 1-fld.*

13. **salsuginòsus,** Gray. Height 12–20 in.: upper st.-lvs. with a characteristic mucro: rays broad, giving an aster-like effect, purple or violet; the slightly viscid character of the involucre is particularly designative. Wet ground, on higher mountains, Alaska to Calif. and New Mex. C.L.A. 21, No. 11:40.

CC. *Lvs. coarsely toothed above the middle.*

14. **bellidifòlius,** Muhl. (*E. pulchéllus,* Michx.). Poor Robin's Plantain. Makes new rosettes by offsets from underground sts.: height 2 ft.: root-lvs. wider above the middle than in most species; st.-lvs. fewer: fls. spring, clear blue, on long sts. Damp borders of woods. Canada to Ill. and La. B.M. 2402. B.B. 3:388.—Weedy.

E. cærùleus, Hort.=(?).—*E. divérgens,* Torr. & Gray. Diffusely branched with pubescent lvs. and white or purple fl.-heads. W. U. S.—*E. flagellàris,* Gray. A spreading plant bearing a profusion of white or pale lilac fl.-heads. W. U. S.—*E. grandifòlius elàtior,* Hort. "Large solitary fls. with purple disk. June and July."=(?). —*E. leiomèrus,* Gray. Lvs. small, linear: solitary fl.-heads with violet rays and a yellow disk. Colo. B.M. 7743.—*E. multiradiàtus,* Benth. & Hook f. Fl.-heads terminal, solitary; ray-florets purplish; disk yellow; height 6 in. to 2 ft. Himalayas. B.M. 6530.—*E. neomexicànus,* Gray. Fl.-heads loosely panicled; ray-florets linear, white; disk-florets tubular, yellow. New Mex.—*E. purpùreum,* Hort., according to H. A. Dreer, "rarely exceeds 10 in. height, and has medium-sized fls. of soft, rosy purple, borne in graceful, spreading panicles." Form of E. macranthus (?).—*E. trífidus,* Schlecht. Fl.-heads white or pale lilac, daisy-like. Rocky Mts. *E. uniflòrus,* Linn. Involucre hirsute, lanate, occasionally becoming naked; rays purple or sometjmes white. Arctic regions.

Wilhelm Miller.
N. Taylor.†

ERINÀCEA (Latin, *erinaceus,* hedgehog, alluding to the spiny nature of the plant). *Leguminòsæ.* A low almost leafless shrub forming dense spiny tufts covered in spring with numerous blue flowers.

Deciduous, very spiny: lvs. simple or ternate, pubescent, only present at the end of young branchlets: fls. 1–3, axillary toward the end of the branchlets; calyx tubular, with 5 short teeth, inflated after flowering; petals narrow, long-clawed, claws of the wings and keel adnate to the staminal tube; standard ovate, slightly auriculate at the base; stamens connate: pod oblong, glandular-hairy, 2-valved, 4–6-seeded.—One species in S. W. Eu. Not hardy N.; likes limestone soil and a sunny position, best adapted to be planted in rockeries. Prop. by seeds.

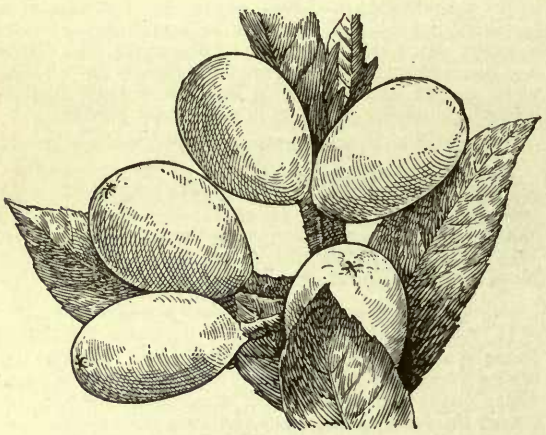
púngens, Boiss. (*Anthýllis Erinàcea,* Linn.). Shrub, to 1 ft.: lfts. 1–3, oblong-obovate or spatulate, ⅛–½in.

long, pubescent: fls. 1–3, nearly 1 in. long, violet-blue, the petals exceeding the large inflated calyx only about one-third; the short pedicels, bractlets and calyx pubescent: pod about ¾in. long. May, June. Mountains of S. France, Spain and Corsica. L.B.C. 4:318. B.M. 676. G.C. III. 41:310. Gn. 62, p. 127; 64, p. 399.

ALFRED REHDER.

ERÌNUS (a name used by Dioscorides). *Scrophulariàceæ.* A hardy tufted plant 3 or 4 inches high, suited for steep sides of alpine gardens, where it produces in spring its racemes of small purple, rosy or white flowers.

One species, in the mountains of W. and Cent. Eu.: root-lvs. crowded, opposite; st.-lvs. alternate, oblong-spatulate, with a few coarse, rounded teeth: corolla-lobes 5, obovate, the 2 upper ones slightly smaller; stamens 4, in 2 groups, included; style very short, 2-lobed at apex: caps. ovate, obtuse, dehiscent.—Several species described in this genus belong in Zaluzianskya. Not to be confounded with *Lobelia Erinus.*



1416. Loquat. (×¾)

Erinus should be planted in steep parts of the rockery where water cannot lodge on rainy days or in the winter and spring months. It needs slight shade from midday sun. Divided plants are chiefly sold in America, but the amateur can soon produce a good carpet by the use of seeds. When well established, the seeds are self-sown and the offspring gain in hardiness. It may be safest to keep a pot or two in a coldframe over winter, until the plant can take care of itself. In England, seeds may be sown in earthy holes of brick walls, and grown as informal masses on old stone steps. (J. B. Keller.)

alpìnus, Linn. Racemes 2½ in. long; fls. ½in. across, purple. April–June. B.M. 310. Vars. **álbus** and **carmíneus,** Hort., have white and crimson fls. respectively. Var. **hirsûtus,** Gren. (*E. hirsùtus,* Hort.). More vigorous: lvs. villous or hairy: violet-red.

WILHELM MILLER.

ERIOBÒTRYA (Greek, *woolly cluster*). *Rosàceæ,* subfamily *Pòmeæ.* Small tree, grown for its handsome large foliage and also for its edible acid fruits.

Evergreen trees or shrubs: lvs. alternate, short-petioled or nearly sessile, dentate, with strong veins running straight to the teeth: fls. in terminal, broad panicles; calyx-lobes 5, acute; petals 5, oval or suborbicular, clawed; stamens 20; styles 2–5, connate below; ovary inferior, 2–5-celled; cells 2-ovuled: fr. a pome with persistent incurved calyx-teeth, thin endocarp and 1 or few large, ovoid or angular seeds.—About 10 species in the warmer regions of China, Japan, Himalaya and S. Asia. Closely related to Photinia, from which it differs chiefly in the larger fr. with thin endocarp and few large seeds and in the lvs. having straight veins ending in the teeth. The only species known in cult. is *E. japonica,* an evergreen tree with large ornamental foliage, comparatively inconspicuous white fragrant fls. in terminal rusty-woolly clusters, followed by large pear-shaped yellow frs. It can be cult. only in warmer temperate regions, and if protected during the winter, may be grown as far north as Philadelphia; does not seem to be exacting as to the soil. Prop. by seeds.

japónica, Lindl. (*Photínia japónica,* Gray). LOQUAT. Fig. 1416. Small tree, to 20 ft.: lvs. thick, evergreen, nearly sessile, oval-oblong or obovate, remotely toothed, bright green and lustrous above, rusty-tomentose below, 6–10 in. long: panicles 4–7 in. long; fls. white, ½in. across, nearly hidden in the rusty-woolly pubescence: fr. pear-shaped, yellow, about 1½ in. long, with few large seeds, of agreeable acid flavor. Sept., Oct.; fr. April–June. Japan, China. B.R. 365. G.C. III. 26:660 (suppl.); 52:318. H.U. 3, p. 97. A.G. 1891, pp. 19, 370. G.W. 3, p. 439; 8, p. 314.—The loquat is native to China and Japan, but is much planted in the Gulf states and westward. It blooms from Aug. until the approach of winter, and ripens its clustered fr. in very early spring. The fr. is often seen in northern markets. It is a profuse bearer in congenial climates. See *Loquat.* Loquat is an excellent decorative plant, either as an evergreen lawn tree south of Charleston, or as a pot-plant in the N. It is a most satisfactory conservatory subject, resisting uncongenial conditions. Var. **variegàta,** Hort. Lvs. variegated with irregular markings of pale green, dark green and white.

ALFRED REHDER.

ERIOCÉPHALUS (from *erion* wool, and *kephale,* head, in allusion to the woolliness of mature heads). *Compósitæ.* A scarce little-known group of greenhouse shrubs, grown for their violet-white flowers and pleasantly scented leaves.

Leaves usually entire, sometimes 3-lobed, often in bunches: fls. in umbellate clusters in the only cult. species, in some others racemose; heads with white ray-fls. and purplish disk-fls.; involucre in 2 series, the outer series of 4–5 bracts.—Twenty species, all S. African, but only one seems to be grown and this is confined to fanciers' collections in Amer.

It is best grown in the temperate house in a mixture of sand and peat. Propagated by cuttings, in sand, under a bell-jar.

africànus, Linn. Lvs. opposite or tufted, silky-pubescent, about ½in. long, thickish, channeled: heads umbellate at the ends of the branches, the white-rayed, purple-centered heads making attractive clusters. S. Afr. B.M. 833.

E. pectiniflòlius, Linn. An attractive yellow-fld. sort with smooth green lvs. is perhaps referable to Hippia frutescens. B.M. 1855. It is known only in botanic gardens in Amer.

N. TAYLOR.

ERIOCÈREUS (*woolly* and *Cereus;* referring to the wool in the axils of the bracts on the ovary). *Cactàceæ.* Usually slender plants, at first erect, but usually afterward clambering and creeping, often forming great clumps and thickets: fls. usually large; ovary covered with more or less enlarged bracts bearing hairs and spines in their axils: fr. red, spiny; flesh white; seeds numerous, black. For cult., see *Succulents.*

Jusbértii, Riccob. Ribs 6, usually low, with broad intervals; spines very short: fls. funnelform; petals white; stigma-lobes linear, green; bracts on ovary and fl.-tube filled with long hairs. It is now believed that this species is a hybrid between an Echinopsis and some Cereus.

See Cereus for descriptions of the following species: *Bonplándii,* Riccob; *Cavendíshii,* Riccob. This is described under Cereus, but probably does not belong to either genus; *Martínii,* Riccob; *platygònus,* Riccob; *tephracánthus,* Riccob; *tortuòsus,* Riccob.

J. N. ROSE.

ERIOCHÌLUS (*woolly lip*). *Orchidàceæ*. A half-dozen species of terrestrial orchids from Austral., with small subterranean tubers and a solitary lf. at the base of the st. or higher up: fls. pink or white, 1 or more and sessile on a scape or peduncle; labellum much shorter than lateral sepals, the margins often with small and erect lateral lobes. Some of the species have been mentioned as greenhouse subjects, but they are horticulturally little known.

ERIOCNÈMA: *Bertolonia.*

ERIODÉNDRON: *Ceiba.*

ERIODÍCTYON (*woolly net*, referring to the under surface of the lvs.). *Hydrophyllàceæ*. Four species and many varieties (see Brand in Engler's Pflanzenreich, hft. 59, 1913) of shrubs of Calif. and the Great Basin, with alternate coriaceous entire lvs., and white, purple or blue fls. in scirpioid cymes. Apparently not cult. *E. Parryi*, Greene=Nama.

ERIÓGONUM (Greek, *woolly joints*). *Polygonàceæ*. About 140 species, W. N. American (with extension into Mex.), herbs tufted sub-shrubs or slender annuals, mostly densely woolly: lvs. crowded at the base of the st., alternate or whorled, entire: fls. small, perfect, in an involucrate head, fascicle or umbel, mostly recurved or reflexed with age, mostly white, rose or yellow; perianth 6-parted; stamens 9; styles 3: fr. an achene, mostly 3-angled. Now and then some of the species are listed by dealers in native plants, but they can hardly be regarded as cult. subjects. *E. compósitum*, Douglas, perhaps the best known, has very many minute neutral-colored fls., dull white to rosy, borne in compound umbels 5–6 in. deep and broad. B.R. 1774. The following have been advertised, but are practically unknown in our gardens: *E. campanulàtum*, *E. compósitum*, *E. flàvum*, *E. heracleoìdes*, *E. incànum*, *E. microthècum* var. *effùsum*, *E. níveum*, *E. nùdum*, *E. ovalifòlium*, *E. racemòsum*, *E. sphærocéphalum*, *E. thymoìdes*, *E. umbellàtum*. *E. gigantèum* makes a mound or mat many feet across. G.C. III. 28:337. Descriptions of eriogonums may be readily found in the floras of the western part of the U. S.

ERIOGÝNIA: *Luetkea.*

ERIÓLOBUS: *Pyrus.*

ERIÓPHORUM (*wool-bearing*, from the Greek; alluding to the heads of fr.). *Cyperàceæ*. Perennial rush-like plants, growing in swales: fls. in dense heads, the perianth-bristles very numerous and often becoming greatly elongated in fr. and giving the head a wool-like appearance. None of them is known in cult., but the following names have been offered by collectors for bog gardens: *E. alpìnus*, Linn.; *E. cyperìnum*, Linn.; *E. lineàtum*, Benth. & Hook.; *E. polystàchion*, Linn.; *E. vaginàtum*, Linn.; *E. virgínicum*, Linn. All these are wild in the northern states, and descriptions may be found in the regular manuals. Eriophorum comprises upward of a dozen species in the northern hemisphere.

ERIOPHÝLLUM (Greek, *woolly-leaved*). *Compósitæ*. Herbs, mostly woody, and commonly with yellow-rayed heads; one kind cult. in a few hardy borders is a low, tufted, herbaceous perennial, with much-divided lvs., covered with wool beneath (each st. bearing about 5), and 8-rayed yellow heads 2 in. across, borne in a loosely forking fashion on peduncles 3–7 in. long. The genus was included in Bahia by Bentham & Hooker, but is now kept distinct largely because of the permanently erect involucral bracts: seeds mostly 4-angled, and pappus of nerveless and mostly pointless, colorless portions. Actinolepis is included in this genus by some authors. There are about a dozen species, in N. W. Amer. **E. cæspitòsum**, Douglas (*Actinélla lanàta*, Pursh, not Nutt. *Bàhia lanàta*, DC.), described above, has been advertised. Either moist or dry ground, Mont. to Brit. Col. and S. Calif.; very variable.

ERIÓPSIS (Greek, *like Eria*, an orchid of the Epidendrum tribe, which it resembles when not in flower). *Orchidàceæ*. Five or six South American orchids of the Vanda tribe allied to Acacallis and Warrea, requiring coolhouse treatment as given to Cattleya; epiphytes.

Leaves 2 or 3, long, plicate: racemes 2 or 3, basal; fls. open, small, but showy, maxillaria-like; lip 3-lobed, the lateral lobes broad and erect and inclosing the column, the middle lobe small and spreading and sometimes 2-lobed.—About half a dozen species in S. Amer.

bíloba, Lindl. Pseudobulbs 3 in. long: lvs. lanceolate: fls. 1 in. across; sepals and petals yellow, with orange-red margins; labellum yellow spotted with brown. Colombia. B.R. 33:18.

rutidobúlbon, Hook. Stouter in habit than the above: pseudobulbs wrinkled, dark-colored: racemes drooping; sepals and petals orange-yellow, with deeper colored margins; labellum white, with purple spots. Antioquia, in exposed positions on the sts. of palms. Peru. B.M. 4437.

Hélenæ, Kränzl. Said to be the finest in the genus. It differs greatly in habit from the other members; the pseudobulbs (standing 16 in. high) somewhat resemble those of *Epidendrum Brassavolæ*, but are much stronger, and bear 3 long, coriaceous dark glossy green linear-lanceolate lvs. The fls. are twice as large as those of *E. biloba*, and are borne on tall, arching scapes. The sepals and petals are orange-colored, margined with purple, the lip similar, but with a yellow blotch, spotted with purple at the base. Peru.

E. Fuerstenbérgii, Kränzl. Racemes up to 12 in. long; fls. about 1¾ in. across; sepals and petals brown outside, orange with brown border inside; lip whitish, densely dotted with purple.

OAKES AMES.

ERIOSTÈMON (Greek, *woolly stamens*). *Rutàceæ*. Coolhouse evergreen shrubs from Australia, with starry, five-petaled flowers an inch wide, of white or blush-pink. Very little known in America, but abroad considered amongst the finest of hard-wooded winter or spring-blooming Australian plants.

Leaves alternate, entire, glandular-dotted: infl. axillary or terminal, solitary or in clusters; calyx and corolla 5-parted, rarely 4-parted; stamens 8–10, free, shorter than the petals; anthers pointed: fr. 2-valved, 1-seeded. Much care is needed to produce well-trained specimens.

Eriostemons are among the most beautiful of Australian hard-wooded plants. They are propagated from cuttings made of the points of half-ripened wood. Choose pieces about 3 inches long, and insert in a pot filled with one part finely sifted peat, and two parts sharp sand. Water them and set in a case in a temperature of 55° to 60°, shading them from the sun. After they have rooted, pinch out the heart of the shoots, and when they show signs of breaking, transfer them singly into small pots in equal parts of peat and sand. When well rooted in these pots, give them a shift about two sizes larger, using good fibrous peat, in rather a lumpy state, and about a fifth part of good sharp sand, adding a little of finely broken charcoal. This compost may be used for all future pottings. If large plants are wanted quickly, it is better to grow them indoors all the year round, but they will not set flowers so well. Eriostemons flower in the smallest sized pot in spring, if they are grown outdoors all summer. The outdoor treatment ripens the wood thoroughly and the result will be seen when flowering time arrives. These plants are liable to run into strong shoots to the detriment of the weaker ones. When this is observed, cut them well back, and this will preserve the symmetry of the plant. During their growing period they should be syringed freely. This helps to soften the wood and secure

plenty of breaks, and also keep red-spider in check. A favorite method of propagation in the British Isles is by grafting on small plants of *Correa alba*. This insures a quicker means of raising the plants and is practised largely by nurserymen. A winter temperature of 40° by night should be maintained. However, if plants are wanted to flower earlier, they may be subjected to 50° or 55°. Eriostemons are sometimes attacked by brown and white scale. Fumigation with hydrocyanic gas is the best remedy. (George F. Stewart.)

A. *Foliage linear or narrowly lanceolate.*

B. *Lvs. linear.*

scàber, Paxt. A shrub with minutely pubescent or glabrous branches: lvs. covered with minute roughnesses, sessile, acute and mucronulate: petals white, tipped pink. P.M. 13:127.

BB. *Lvs. narrowly lanceolate.*

linifòlius, Seghers. Lvs. broadest at middle, tapering both ways. R.B. 20:97.—Probably an old garden form of some well-known species.

affìnis, Sprague. Shrub, 1–2 ft., the branches glabrous and shining: lvs. sessile, linear-lanceolate, 1–2 in. long, glabrous: fls. in axillary slender clusters, quite like the next, but smaller.

AA. *Foliage conspicuously wider.*

B. *Lvs. 10–12 times as long as broad.*

C. *Apex abruptly pointed.*

myoporoìdes, DC. Lvs. widest at the middle, tapering evenly both ways, 1–3, rarely 4 in. long: fls. umbellate; petals white or sometimes pink, glandular on the back. B.M. 3180.

CC. *Apex blunt.*

salicifòlius, Smith. This willow-leaved species has perhaps the handsomest foliage. Lvs. widest above the middle, tapering more gradually to the base than to the apex: petals bright, soft pink. B.M. 2854.

BB. *Lvs. 3–4 times as long as broad.*

intermèdius, Hook. Lvs. 9–18 lines long, elliptical, abruptly pointed: petals lanceolate, white, but tipped with pink outside in the bud like the rest; ovary placed on a flat disk and not ringed at the base. Probably of garden origin. Intermediate between *E. myoporoides* and *E. buxifolius*. B.M. 4439.

buxifòlius, Smith. Lvs. as in *E. intermedius*, though perhaps smaller: petals obovate, white, tipped pink; ovary sunk into a double disk of 2 rings. B.M. 4101. G. 26:19.—*E. densiflòrus*, Seghers, R.B. 20:97, looks like a prolific horticultural variety of this species.

WILHELM MILLER.
N. TAYLOR.†

ERITRÍCHIUM: For *E. barbigerum*, see *Krynitzkia*. For *E. nothofulvum*, see *Plagiobothrys*.

ERLÁNGEA (bears the name of the University of Erlangen). *Compósitæ*. One species of this genus, blooming in midwinter and spring, is offered in England.

The genus was long considered to be monotypic, but Moore has recently (Jour. Bot. 46. 1908) incorporated Bothriocline with it, and the new species have expanded the genus to 32 species, all Trop. African excepting 1 in New Guinea; it differs from Vernonia "only in the curious reduced achenes and the pappus of few, short, very caducous setæ." **E. tomentòsa,** Moore (*Bothriocline Schimperi* var. *tomentòsa*, Oliv. & Hiern). Shrub, to 5 ft.: st. and under sides of lvs. tomentose: erect herb: lvs. opposite or at top of st. rarely alternate, oblong to ovate-lanceolate, 2–5 in. long, nearly or quite obtuse, rounded at base, serrate, villous: fls. all tubular, about 40 in the head, the heads about ⅔in. diam., short-peduncled and collected in corymbose panicles; involucre-scales ovate, acute, scarious-margined. Trop. Afr. B.M. 8269. Foliage scented: fls. mauve or lilac, lasting 2 or 3 months in winter; habit of a eupatorium, and requires the treatment given the greenhouse members of that genus.

L. H. B.

ERÒDIUM (Greek, *a heron;* alluding to the beaked fruit). *Geraniàceæ*. HERON'S-BILL or STORK'S-BILL. Annual and perennial, some of the perennials grown in flower-gardens and with alpines for their finely cut foliage and mostly purplish or white flowers.

The plants suggest the wild and hardy geraniums, from which they differ in having only 5 instead of 10 anther-bearing stamens, the other 5 being reduced to scales; also the tails of the carpels hairy inside and twisting spirally. Herbs, rarely somewhat woody or tufted: lvs. opposite or alternate, one often smaller than its mate, stipuled, toothed, lobed, or dissected: fls. regular or nearly so, mostly in umbels, of various shades, from crimson-pink to purple, with darker blotches on the 2 upper petals and the venation outlined in darker shades; sepals 5, imbricate; ovary 5-lobed, when ripe splitting into separate caps.-lobes, each lobe 1-seeded: plants usually heavy-scented.—The latest monograph (Knuth, in Engler's Pflanzenreich, hft. 53, 1912) describes 60 species, widely dispersed in temperate and warm regions. The self-planting of the seeds or carpels of some species is very interesting.

These plants are chiefly for the front row of the hardy borders and the rock-garden, where they thrive in a gritty loam. They like dry, sunny spots, and may be trusted with a conspicuous position, being chiefly valued for their steady succession of bloom from June to August. Divided plants are chiefly sold here, but the species are easily propagated by seeds. Some erodiums can be grown in chinks of walls. Some of the annual kinds are widely spread in California and other parts of the West, and *E. cicutarium* and two or three others are grown for forage. The garden species have not attained much prominence in this country.

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A. *Plant annual (or biennial).*

1. **cicutàrium,** L'Her. ALFILARIA. ALFILERILLA. PIN-CLOVER. Tufted, low and spreading, more or less glandular, often with coarse, soft, short hairs: lvs. oblong, 1–2-pinnate; lfts. small, nearly sessile, the uppermost confluent, lower ones sharply and deeply cut and with narrower lobes: stipules small, acute: sepals with 1 or 2 terminal bristles; filaments not toothed; fls. rose-purple. Abundantly run wild from the Rocky Mts. to the Pacific, on dry or barren lands, and also grown for hay and utilized as wild pasture. Feb.–Apr. Old World; immensely variable.

2. **moschàtum,** L'Her. FILAREE. MUSK-CLOVER. Also ALFILERILLA. Glandular and musk-scented, at first stemless and with a rosette on the ground but later sending up stout fleshy sts. to 1 ft.: lfts. large, short-stalked, ovate to elliptical, serrate, broad-lobed: stipules large, rather obtuse: sepals not terminated by bristles; filaments 2-toothed; fls. rose-purple. Medit., Orient. Run wild in Calif. in the rich valley lands.

3. **Bòtrys,** Bertol. Branching from the base and usually prostrate, white-pubescent: lf.-blades 1–2 in. long on petioles of similar or twice the length, oblong-ovate, pinnatifid, the lobes acute and serrate: sepals with 1 or 2 short bristles; fls. deep violet; filaments

widened upward and toothed. Medit. region, now widely spread in Calif. and also grown for forage.

AA. *Plant perennial.*

B. *Fls. yellow.*

4. **chrysánthum,** L'Her. Woody, 1–5 in. tall, silvery, the rhizome vertical: lvs. densely crowded at base, petiole and blade of equal length, broadly ovate, obtuse or nearly so, pinnate, the pinnæ cut; st.-lvs. few or none, subsessile: peduncles sometimes basal; fls. yellow, the petals exceeding sepals, broadly cuneate and retuse. Greece. Gt. 1, p. 260.

BB. *Fls. white, sometimes veined or spotted.*

5. **guttàtum,** Willd. Woody, 3–6 in., the caudex vertical: lvs. many at base of st., long-petioled, ovate-cordate or long-cordate, obscurely lobed, crenulate: peduncle 2–5 in. high; fls. clear white with a dark spot at base of upper petals; sepals lance-spatulate or obovate-spatulate; petals broadly obovate, rounded. S. W. Medit. region; a good little rock plant. Gt. 3, p. 244.

6. **pelargoniflòrum,** Boiss. & Heldr. Woody, to 1 ft. or more, the caudex vertical: basal lvs. rather numerous, long-petioled, hairy above, ovate-cordate, somewhat lobed, obtusely crenate-dentate: peduncles 1–5 in. high; fls. white, the 2 upper petals spotted with pink at base; sepals ovate; petals broadly obovate, rounded or retuse. Asia Minor. B.M. 5206. Gt. 1:194. Gn. 59, p. 448; 63, p. 107.

7. **supracànum,** L'Her. Stemless, 1–4 in. tall, the rhizome vertical: lvs. numerous, to about 2 in. long, densely silky-canescent above, green beneath, ovate or oblong, bipinnatisect, the pinnules entire or dentate or incised: fls. white, spotless, red-veined, the petals obovate and rounded, and sepals broadly ovate and 5-nerved. Pyrenees.

8. **chamædryoìdes,** L'Her. (*E. Reìchardii,* DC.). Stemless, 2–3 in. tall: lvs. numerous, long-stalked, sparsely hairy, round-ovate, slightly cordate, crenate, apex rounded: peduncles about 1-fld., about 2 in. tall; fls. white, rose-veined; sepals ovate-spatulate or lance-spatulate, minutely mucronate; petals obovate, retuse. Balearic Isls., Corsica.—An attractive alpine.

BBB. *Fls. rose, red or purple (sometimes white in No. 14).*

C. *Lvs. undivided or obscurely lobed.*

9. **córsicum,** Lem. St. 2–6 in. high, the root vertical or oblique: basal lvs. many, long-petioled, grayish tomentose or becoming glabrous, ovate or broader, more or less obsoletely lobed, coarsely crenate-dentate: peduncle 1–2 in. high, about 2-fld.; fls. ¾in. across, in shades of rosy pink veined deeper color; sepals oblong-spatulate or ovate, not mucronate; petals broadly obovate or cuneate. Corsica and Sardinia. G.C. III. 48:210.

CC. *Lvs. all pinnatisect.*

D. *St. wanting.*

10. **macradènum,** L'Her. (*E. gravèolens,* Lapeyr. *E. glandulòsum,* Willd.). Remarkable for the great length of the roots when twisting among rocks, and strong odor of the foliage: 2–6 in.: lvs. hairy, glandular, 1½–2 in. long, oblong, pinnate; segms. pinnatifid, rachis with a toothed wing: fls. light purple, the 2 upper petals a shade darker, and the spots nearly black. Pyrenees. B.M. 5665.

11. **daucoìdes,** Boiss. Plant 2–4 in., the rhizome vertical: lvs. many, tomentose, petiole exceeding blade, lanceolate or triangular in outline, the pinnæ pinnatisect and the lobes linear-lanceolate: peduncles standing above the foliage, about 4-fld.; fls. rose-color; sepals more or less ovate, 5-nerved; petals obovate, somewhat rounded. Spain.

12. **Manescàvi,** Coss. Height 10–18 in., the rhizome vertical or oblique: lvs. attaining 6 and more in. long, 2½ in. wide, lanceolate or ovate-lanceolate; segms. alternate ovate, short-stalked, dentate, with sometimes a deeper cut: fls. at best 2 in. across, strong rosy purple, the spots of the upper petals only a shade or two darker. Pyrenees. Gn. 55: 292.—Colors stronger and more uniform than No. 10.

DD. *St. evident.*

13. **Guicciàrdii,** Heldr. Woody, to 8 in. tall, from a more or less vertical rhizome: basal lvs. many, densely clustered, petiole equaling the blade (upper st.-lvs. sessile), silvery, broadly ovate or oblong-ovate, pinnate; pinnæ cut into linear or oblong-linear lobes: peduncle 1–3 in. tall, 4–7-fld.; fls. rose-colored; sepals ovate, obtuse and mucronate; petals obovate, rounded. N. Greece.

14. **absinthioìdes,** Willd. (*E. petræum,* Sibth. & Smith. *E. olýmpicum,* Clem. *E. Sibthorpiànum,* Kotschy). Two to 8 in. tall: rhizome vertical: lvs. many, crowded at base of st., the petioles very short (st.-lvs. few and sessile), soft-hairy, oblong or triangular-ovate, obtuse or acutish, bipinnatisect; lobes linear-lanceolate, entire or dentate: peduncle 1–4 in., 2–8-fld.; fls. violet or rose (rarely white), the sepals ovate, obtuse and mucronate, the petals cuneate-obovate. Asia Minor.

E. grùinum, L'Her. Annual or biennial, 1½ ft. high, the sts. 1 or few, white-hairy: lvs. cordate-ovate, undivided or obscurely lobed, dentate: fls. violet-blue, large, the petals broadly obovate and clawed, rounded at apex. Sicily to Persia, N. Afr.—*E. Stephanidnum,* Willd. Annual or biennial, villous, branched: lvs. nearly glabrous, bipinnatifid, the lobes linear: peduncles 2–3 in. high, 2–5-fld.; fls. dark purple; petals scarcely surpassing sepals, very broad-ovate. Temp. Asia.

L. H. B.†

ERPÈTION: *Viola.*

ERÙCA (origin of name in doubt; probably from the Latin *to burn,* in allusion to the hot seeds). *Cruciferæ.* Perhaps ten or a dozen herbs of Eu. and W. Asia, annual or biennial. Allied to Brassica: differs in the shorter, more turgid silique, with keeled valves; style elongated; seeds in 2 rows in each cell. The lvs. are pinnately lobed or dentate, and the fls. rather large, yellow to purplish. **E. satîva,** Mill., ROQUETTE, TIRA or ROCKET-SALAD, is the only species cult. in this country. It is a weedy annual, resembling a mustard, 1–2 ft. high, with lyrate-pinnatifid lvs. and creamy yellow or whitish fls. in a raceme (which elongates in fr.). It is sparingly run wild in Canada, U. S., and Mex. See *Roquette.*

L. H. B.

ERÝNGIUM (a Greek name for some sort of thistle). *Umbellíferæ.* ERYNGO. SEA-HOLLY. Annual and perennial herbs, chiefly valued for the steel-blue or purplish cast of their rigid stems, prickly foliage and teasel-like heads.

Rarely shrubby: lvs. stiff or coriaceous, undivided, lobed or pinnatisect, the margin nearly always spiny: fls. small, white, greenish or blue, sessile or subsessile, bracteolate, in involucrate heads or spikes; calyx-teeth prominent, mostly rigid, sometimes ending in a spine-point; petals erect; disk expanded; styles slender: fr. ovoid or obovoid or more or less globose, scaly or tuberculate, without ribs, the carpels nearly terete and with usually 5 oil-tubes.—Wolff estimates (in Engler's Pflanzenreich, hft. 61, 1913) 220 species, widely dispersed in warm and temperate regions with the greatest extension in the Medit. region.

There are two very distinct groups of eryngoes, one with much-cut foliage, as shown in Fig. 1417, the other the "pandanus group" (of the New World), with long undivided leaves. The species are little grown in this country, but they are more used abroad. They produce striking semi-formal and often somewhat bizarre effects. They are used in subtropical bedding, particularly the large pandanus-leaved kinds. They are excellent for borders and rock-gardens, being prized particularly for their colored stems and often brilliant in-

volucre. The stiff leaves of the pandanus group are little damaged by weather. The dried stems retain their color, and are sometimes hung in living-rooms. The plants mostly grow from 2 to 3 feet high and head out in July to September. A light rich soil and sunny situation are advised. Poor drainage is to be avoided. *E. amethystinum* is probably the most popular species in this country. *E. planum* is said to be much visited by bees. They are slow to recover from the shock of division. This makes it difficult to work up a stock at home sufficient to make an effective group. The only safe way to increase them is by seed. The seed may be sown as soon as gathered. They will germinate in the spring, and should be ready to plant out the following year. Some of the species self-sow. The species described below are perennial.

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A. *The pandanus-leaved group.*

B. *Bracts of involucre long and prominent.*

1. **agavifòlium,** Griseb. Becoming 6 ft. high in its native country: st. simple below and somewhat branched above, 3-forked at top: basal lvs. rosulate, ensiform, to 5 ft. long, coarsely spinose-serrate: head cylindrical, about 2 in. long and half as thick; the involucral bracts 10–16, ovate at base and gradually narrowed, entire or sparsely spinulose; sepals round-ovate or nearly-orbicular; petals obovate or elliptic-oblong. Argentina, blooming Jan.–March. G.W. 15, p. 477.

2. **bromeliæfòlium,** Delar. Becoming 9 or 10 ft. tall, the st. about 4-forked at top: basal lvs. numerous, 1½ ft. and more long, narrow and very acute, the margins subulate-dentate, spine-pointed: head ovoid or ovoid-cylindrical, about 1 in. long; involucral bracts many, rigid, unequal, linear-subulate, pungent-pointed; sepals ovate-lanceolate, short-acuminate and mucronate. Highlands, Mex.; Dec.

3. **protæflòrum,** Delar. Plant very stout, 3 ft. and more, the st. fistulose and sulcate: st.-lvs. very stiff, the upper ones 8 in. or more long, linear-lanceolate, long-acuminate and pungent-pointed, the margin subulate-spinose: head ovoid-cylindrical, 2½ in. long; bracts of involucre very many and very rigid, in several series, lanceolate and sharp-pointed; fls. very many; sepals broad-ovate, obtuse, short-mucronate; petals white, obovate-spatulate. Mex. Sept. G.C. III. 41:248, 249. Gn. 75, p. 380.

BB. *Bracts of involucre scarcely prominent, not very stiff.*

C. *Nerves of lf. diverging.*

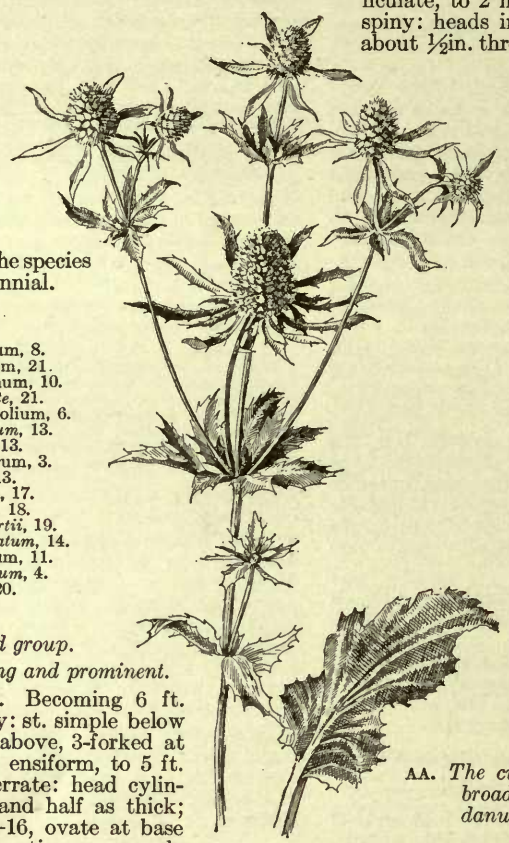
4. **aquâticum,** Linn. (*E. yuccæfòlium,* Michx.). BUTTON SNAKEROOT. RATTLESNAKE MASTER. Height 2–6 ft.: st. striate, unbranched or branched above: lvs. undivided, long and linear, rigid, mostly clasping, finely parallel-veined, lower sometimes 3 ft. long, 1½ in. wide, all bristly margined: heads globose-ovoid. Wet soil, E. U. S.

CC. *Nerves of lf. parallel, prominent.*

5. **Lassaûxii,** Decne. Height 3–6 ft., the st. fistulose, 3-forked at top: basal lvs. often slightly twisted, canaliculate, to 2 in. wide, long-acuminate, the margin spiny: heads in a broad corymb, each one small, about ½in. through, whitish green; involucre-bracts ovate-lanceolate, spinulose-ciliate; sepals nearly orbicular or 4-angled-orbicular, truncate and erose; petals rectangular-ovate. S. Brazil, Paraguay, Uruguay. G.W. 3, p. 549.

6. **pandanifòlium,** Cham. & Schlecht. St. to 8 ft. high, leafy, 3–4-forked above: basal lvs. 4–5 ft. long, spine margined above; st.-lvs. many, to 1½ ft. long, spiny: heads colored, globose-ovoid, less than ½ in. long, in large panicles; involucral bracts broad-ovate, very acute, rough on the back; sepals nearly orbicular or oval, short-mucronate; petals dark purple, ovate or orbicular-oblong. S. Brazil, Argentina. Gn. 61, p. 37. G.W. 4, p. 197.

7. **ebûrneum,** Decne. (*E. bracteòsum,* Griseb.). Height 8 ft., from a thick rhizome, the st. ivory-white: basal lvs. crowded, canaliculate, 3 ft. and more long, acuminate, very spiny, the spines being slender: heads not colored, ovoid or globose-ovoid, ¾in. long; involucral bracts triangular or lanceolate or linear; sepals ovate or oval, obtuse or short-acuminate; petals somewhat rectangular-oblong, fimbriate at apex. S. Brazil, Uruguay, Argentina.



1417. Eryngium amethystinum. (×½)

AA. *The cut-lvd. group (or lvs., at least on st., broader, more or less toothed, and not pandanus-like).*

B. *Lvs. fleshy.*

8. **marítimum,** Linn. Glaucous-blue, stiff, much-branched, about 1 ft. high: lvs. very stiff, broad, sinuate, more or less 3-lobed, handsomely veined, with coarse prickly teeth, those on the st. clasping, the radical ones petioled: heads nearly globular, pale blue; involucral bracts 5–8, much smaller and narrower than the st.-lvs.; sepals ovate-lanceolate; petals oblong. Seacoasts of Eu. Gn. W. 15:489.

BB. *Lvs. not fleshy.*

C. *Basal lvs. usually not lobed (or not prominently so).*

9. **alpìnum,** Linn. Height 12 ft., bluish above, from a thick root: radical lvs. deeply cordate-triangular, acuminate, coarsely double-crenate; st.-lvs. round-cordate, often 3-lobed at the apex or palmatifid: head globose-cylindrical, about 1 in. long; involucral bracts 12–18, lance-oblong, rigid, multifid; fls. many; sepals ovate-lanceolate; petals somewhat rectangular. Eu. B.M. 922. G.C. III. 53:139. G.M. 46:136. Gn.W. 21:278. G.W. 3:576; 15, p. 478. R.H. 1876, p. 113. Gn. 46:523.—There is a white variety. Prized for the attractive blue color of the heads and upper part of the plant.

10. **Oliverìànum,** Delar. (*E. alpìnum* var. *Oliverìànum,* Spreng.). Hybrid, perhaps of *E. planum* and *E. giganteum,* or perhaps with *E. alpinum:* plant strong,

3 ft.: lower lvs. long-petioled, broadly cordate-ovate, indistinctly 3-lobed at the apex, unequally spinulose-serrate; younger and the lower cauline lvs. 3-lobed or -parted and the lobes again more or less lobed or angled and the margins spinose-serrate: head blue, cylindrical-ovoid, or ovate, many-fld.; involucral bracts 10–15, subulate or linear, somewhat spinulose. Gn. 45, p. 223; 60, p. 425. Gn. W. 20:791. G.W. 15, p. 497.

11. **tripartìtum,** Desf. Probably a hybrid: radical lvs. unequally spinulose-serrate with a large obtuse middle lobe; st.-lvs. deeply 3-parted, the lobes lanceolate and rigid, spiny-toothed: head globular, small; involucral bracts 6–9, narrow-lanceolate, spiny margined.

12. **gigantèum,** Bieb. (*E. asperifòlium,* Delar. *E. glaùcum,* Hoffm). Stout, 6 ft., the root thick and turnip-shaped, the st. simple below and 4–5-forked above: lvs. coriaceous, the basal ones broadly cordate or cordate-triangular, toothed; st.-lvs. more or less 3-lobed, spinulose-dentate: heads cylindrical or ovoid-cylindrical, 3–4 in. long, in an ample infl., blue or pale green; involucral bracts lanceolate to obovate, very rigid, much cut; fls. very many; sepals ovate or ovate-lanceolate; petals obovate-lanceolate. Caucasus, Asia Minor. Gn. 46, p. 523; 70, p. 111. G. 34:95. R.H. 1906, p. 379. G.W. 15, p. 479.

13. **plànum,** Linn. (*E. planifòlium,* Pall. *E. latifòlium,* Gilib. *E. intermèdium,* Weinm.). Root thick turnip-shaped, very long: st. 3 ft., mostly single, 3–5-forked at top: basal lvs. cordate, oblong or oval or broadly obovate, obtuse, spinulose, usually palmately 7–9-nerved; lower st.-lvs. short-petioled, shaped like the basal lvs. or 3-lobed, the lobes deeply serrate or cut, the upper ones sessile and 3–5-parted: heads blue, ovoid or nearly globular, about ½in. long; involucral bracts mostly linear, rigid, somewhat spinulose-serrate; sepals lanceolate; petals ovate-oblong. Eu., Asia. G.L. 18:136.—A var. *ròseum* is offered.

14. **dichôtomum,** Desf. (*E. tricuspidàtum,* Tenore). Two ft. or less, glaucous-blue, the st. strong, few-lvd., branchy, 3–5-forked at top: lower lvs. long-petioled, cordate-oblong or obovate, very obtuse, serrate or crenate, reticulated; upper lvs. rigid, 5-parted: head nearly globose or ovoid-globose, about ½in. long; involucral bracts 6–7, rigid, narrow-linear or subulate, somewhat spinulose, pungent-pointed; sepals ovate or ovate-lanceolate, spine-tipped; petals ovate-oblong. Medit. region.

15. **cœrùleum,** Bieb. About 3 ft., blue, the root thick and long turnip-shaped, the st. usually solitary, 4–5-forked above, the branches long: basal lvs. all long-petioled, cordate, cordate-ovate or cordate-oblong, crenate-serrate, outer ones undivided, inner ones 3-lobed: heads small; involucral bracts 4–6, rigid and wide-spreading, linear-lanceolate, spinulose; sepals narrow-lanceolate; petals oblong. Caucasus and E.

16. **Leâvenworthii,** Torr. & Gray. Purple-violet above, 3 ft., the st. strict and full-lvd., at the top 3-forked: basal lvs. oblanceolate and mostly obtuse, spinose-dentate, the others deeply palmate-parted, the divisions cut-pinnatifid and the segms. spreading and pungent-pointed: heads ovoid-cylindrical, 2 in. or less long; involucral bracts 7–9, linear-lanceolate, spinose-pinnatifid; sepals pinnatifid. Dry soil, Kans. to Texas.

cc. *Basal lvs. on the flowering plant all lobed or divided.*

17. **sérbicum,** Panc. Height 1–1½ ft., blue above: root elongated, thick, somewhat woody: st. slender, sparsely lvd., short-branching and 3–4-forked above: basal lvs. long-petioled, fresh green, divided into 5–7 grass-like segms.; st.-lvs. more or less clasping or short-petioled, the segms. very narrow and remotely spinulose-cut: heads small, globose-ovoid; involucral bracts 5–7, rigid, narrow-linear, sharp-pointed; sepals broad-ovate, obtuse; petals broadly oblong-ovate. Servia.

18. **Spinálba,** Vill. Plant rigid, whitish green, more or less blue above: st. stout, at the top 3–4-forked: lvs. coriaceous, rigid, broadly cordate-ovate, palmately 4–5-parted, the margins undulate and spiny-toothed: head blue, ovoid-cylindrical; involucral bracts about 10 and very rigid, deeply pinnatifid, spine-pointed; sepals lanceolate or more or less ovate; petals oblong-linear. Eu., in the Alps.

19. **Bourgàtii,** Gouan (*E. Tournefòrtii,* Bub.). Low, usually about 1½ ft.: root thick, somewhat turnip-form: st. mostly solitary, simple below, sparingly branched above, apex 3-forked: lvs. somewhat coriaceous, pale green, rigid, nearly orbicular or somewhat reniform, palmately 3–5-parted and again lobed, spiny-toothed; st.-lvs. palmate, somewhat clasping: heads blue or rarely green, nearly globose or ovoid-globose; involucral bracts 9–15, spiny or not; sepals lanceolate, acute; petals spatulate. Medit. region.

20. **Zabélii,** Hort. (*E. alpinum* × *E. Bourgatii*). Plant rather robust, 1½ ft.: basal lvs. suborbicular, 3-parted; the segms. cuneate at base and deeply 3-lobed and again 3-lobed, margins strongly spinulose-serrate: head globose-cylindrical, 1 in. or more long; involucral bracts, 12–14, rigid, lanceolate, spinulose-dentate, blue or amethystine. G.W. 15, p. 496.

21. **amethýstinum,** Linn. (*E. pallescénte,* Mill.). Fig. 1417. Stout, 1½ ft. and more, blue or amethystine above or sometimes whitish: root thick, long-cylindrical: st. remotely leafy, branched, 4–5-forked at top: lvs. rigid, obovate or oblong-ovate, bipinnatifid, spinose-dentate; upper st.-lvs. clasping, pinnately parted, spinulose-dentate: heads ovoid-globose, ½in. or more long, the peduncle thick and sulcate; involucral bracts 6–9, unequal, linear-subulate or lanceolate, sharp-pointed; sepals ovate-lanceolate; petals ovate-oblong or nearly rectangular. Eu. Gn. 46, p. 522; 55, p. 454. G.L. 23:199. Variable. Var. **multífidum,** Wolff (*E. multifidum,* Smith) has much-cut lvs.

Any number of eryngiums may be expected to appear in the list, as they are likely to strike the attention of collectors. They appear to hybridize rather freely. *E. hýbridum* is a trade name for garden forms, but it has no botanical standing.—*E. Röthenbergii* is a garden hybrid of E. alpinum and E. giganteum.—*E. azùreum* and *E. cœlestìnum* are garden names without botanical standing; the latter is said to be E. amethystinum.—*E. Ebenèum*=E. eburneum (?).—*E. Wrightii* is said to be a free form of E. planum, blooming for a long period.

L. H. B.

ERÝSIMUM (probably means *blister-drawing*). *Cruciferæ.* Of this genus two brilliant yellow and orange, spring- and summer-blooming hardy "annuals," are cultivated, scarcely, if at all, inferior to the true wallflowers (Cheiranthus) for general purposes, and a few rock-garden and wild-garden plants.

Biennial, annual and perennial herbs, with long soft appressed 2-parted hairs: lvs. narrow, linear or oblong, entire or variously toothed: fls. orange or yellow, rarely purple, often fragrant; petals 4, usually large, clawed; stamens 6, free and without appendages; style persistent: pod broad-linear, strongly compressed or sometimes 4-angled; seeds many, various.—Species 80–90 in the north temperate zone, being most numerous in Eu. and Cent. Asia. Some of the species are said to hybridize with Cheiranthus. Numbers of species are likely to be mentioned as good subjects for alpine-gardening.

Although some of the popular kinds are biennials, the gardeners think of them as annuals. Their seeds can be sown in the fall and produce bloom earlier than if sown in spring. The rock-garden kinds do well also in the front row of the border and on dry banks. They like full exposure to sunlight, and in the spring months are completely covered with bright flowers. Divided plants, as well as seeds, are offered by American dealers.

In general, no special difficulty is experienced with erysimums. In Gn. 24, p. 462, it is said that *E. ochroleucum* on level ground is likely to lose its lower lvs. and to perish on heavy soils in hard winters. It thrives best when frequently divided, and may be propagated by cuttings. *E. Barbarea*, Linn., with forms having double fls. and variegated lvs., is *Barbarea vulgaris*.



1418. Erysimum asperum. (×¾)

ásperum, DC. Fig. 1418. Biennial or perennial, height 1–3 ft. in the wild, 12–18 in. in gardens, the sts. erect: lvs. lanceolate to linear, either canescent or thin and green, dentate or entire, upper ones mostly entire, the lowest sometimes pinnatifid: fls. ½in. or more across, orange or yellow, seldom purple: pods rough, 1½–5 in. long, 4-sided, nearly erect. Que. to Texas and Calif. Var. **arkansànum,** Gray (*E. arkansànum*, Nutt.). Lvs. thin, repand-dentate, lanceolate.

capitàtum, Greene (*E. grandiflòrum*, Nutt. *Cheiránthus capitàtus*, Douglas). Coast Wallflower. Biennial or perennial, probably usually perennial, erect and leafy and finely pubescent, 1 ft. or less to 2 ft. high, nearly simple or said often to make a much-branched woody plant, with lvs. oblong, oblanceolate or linear and either entire or repand-dentate: fls. light yellow or cream-colored, the petals about 1 in. long with a rounded blade: caps. to 4 in. Seacoast, Calif. to Ore.

Perofskiànum, Fisch. & Mey. Fig. 1419. Excellent hardy annual, 1–2 ft., erect: lvs. oblong, acute or nearly so, strongly toothed: fls. large, bright orange or reddish orange: pods standing out nearly at right angles, constricted below the narrower style. Caucasus, Afghanistan. B.M. 3757. P.M. 6:245.—There are compact and dwarf strains suitable for edgings (*E. Perofskianum nanum. E. nanum compactum aureum*, Gt. 46, p. 194. *E. compactum aureum*, Hort.). Seeds may be sown at different times for succession.

pulchéllum, Boiss. (*E. laciniàtum*, Boiss.). Perennial, green, often cespitose, the st. ascending 2–6 in. or more (even to 2 ft.): lower lvs. oblong-spatulate, dentate or lyrate; upper lvs. sessile, oblong or lanceolate, dentate; lvs. on the suckers lanceolate and often entire: fls. medium, deep orange: caps. erect-spreading, slender. Greece, Asia Minor.—Used as rock-garden plant. There are dwarf forms in the wild.

ochroleùcum, DC. (*E. rhæticum*, DC. *E. helvéticum*, DC.). Perennial, 4–12 in.: sts. yellowish, creeping: lvs. oblong-lanceolate, dentate, usually more or less hairy: fls. fragrant, pale yellow, the petals obovate. Eu. Gt. 2, p. 162.—Variable. Forms a turf on rocks and mountains.

E. Marschallianum, Andrz. Biennial, perennial, 6–8 in. high: lvs. lance-linear: fls. large, bright orange-yellow: used as an alpine Siberia.—*E. murale*, Desf. Spring-flowering biennial or perennial, 6–8 in., forming a tuft: lvs. deep green, narrow: fls. golden yellow. Eu.

Wilhelm Miller
L. H. B.†

ERYTHÈA (one of the Hesperides, Daughter of Evening). *Palmàceæ*, tribe *Corỳpheæ*. Palms with solitary, often robust, spineless caudices, ringed at the base, clothed above with dead leaf-sheaths.

Leaves terminal, the younger ones tomentose in some species, glabrous in others, orbicular, flabellately many-parted, the lobes lacerated at the apex, intermingled with fibers, infolded; rachis short; ligule long; petiole stout, slender and arching in some species, smooth or spiny along the margins: spadices usually paniculate, long, white tomentose; branches stout; spathes many, sheathing the peduncle, thick-coriaceous, densely tomentose; bracts and bractlets distinct; fls. pale: fr. globose or ovoid.—Species 5, Mex.

This small group of American palms includes *E. armata*, which is known locally as the "blue palm," and *E. edulis*, the latter commonly known as the "Guadaloupe palm," from the fact that it has been found in a wild state only on the island of Guadaloupe, off the coast of Lower California. Erytheas bear much resemblance to Brahea, the segments of the leaves bearing whitish filaments. In the gardens of Santa Barbara, the erytheas in a few years form very handsome trees, but in less-favored latitudes they may be cultivated in the same manner as kentias or latanias, flourishing in a night temperature of 50° to 55° when grown in a rich and open soil and abundantly supplied with water.

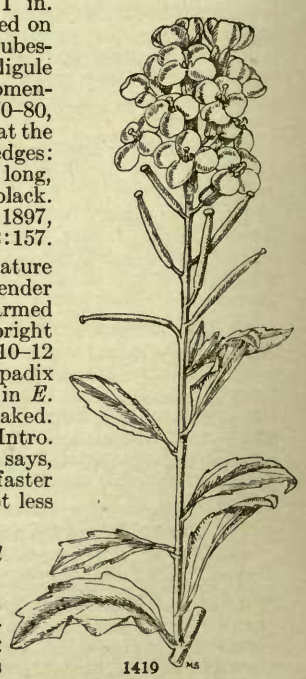
A. *Fr. more or less globose.*

B. *Lvs. distinctly glaucous.*

armàta, Wats. (*Brahèa armàta*, Wats. *B. glaùca*, Hort. *B. Roézlii*, Lindl.). Blue Palm. Tall and slender, 40 ft. high: lvs. very glaucous; petiole narrow, deeply channeled, margined with numerous stout, more or less hooked, slightly spreading spines; segms. 30–40, sublacerate at the apex, slightly filiferous: spadix 18 ft. long or somewhat less, sparingly branched: frs. reddish brown at maturity. Low. Calif. G.C. III. 20:425.

BB. *Lvs. green, not glaucous.*

edùlis, S. Wats. (*Brahèa edùlis*, Wendl.). St. 40–50 ft. high, 15 in. thick, with thick, corky bark: sheaths fibrous; petioles stout, 1 in. wide, plano-convex, unarmed on the acute margins, fibrous-pubescent or glabrate above; ligule 2–3 in. long, densely silky-tomentose; blade 3 ft.; segms. 70–80, at first tomentose, lacerate at the apex and fibrous on the edges: spadices numerous, 5–6 ft. long, branched: fr. shining black. Calif. R.H. 1893, p. 297; 1897, p. 77. G.C. III. 13:507; 22:157.



1419 Erysimum Perofskianum. (×⅓)

Brándegeei, Purpus. In nature 125 ft. high and having slender trunk: petioles slender, armed with recurved spines; lvs. bright shining green, composed of 10–12 fronded, flabellate lfts.: spadix slightly branched: frs. as in *E. armata*, but somewhat streaked. Low. Calif. Gt. 52, p. 12.—Intro. by Franceschi in 1912, who says, "Appears to grow much faster than other kinds and is not less hardy."

AA. *Fr. shaped like inverted pear.*

élegans, Franceschi. Dwarfer and slower-growing than any other kind: trunk very short: petioles slender, glaucescent, edged

with small spines; lvs. somewhat glaucescent on both sides: fl.-spadix 3–4 ft., branched: frs. about ¾in. diam., yellowish, at first waxy.—According to Franceschi it was first intro. and distributed by the late John Rock of San José, about 1880, and never found again in the wild state, while only one of the plants raised is known to have ripened. N. TAYLOR.†

ERYTHRÆA (Greek, *red;* alluding to the fls. of some species). *Gentianàceæ.* Two outdoor species are in cultivation, with bright deep rose flowers, one of which is a rockery plant from the Azores, the other a Californian annual. Centaurium is name now used.

Small or low herbs, annuals, biennials and perennials with simple and entire sessile opposite lvs., and small or medium-sized 5- or 4-merous, mostly red or pink fls.: calyx-lobes narrow and keeled; corolla salver-shaped; filaments 4 or 5, slender, the anthers becoming twisted; style filiform: caps. oblong or elongated.—About 30 species in the Old and New Worlds; interesting, but little known in cult. Three or 4 small species have been naturalized from Eu.

A light sandy loam, in a protected nook of the rockery, with partial shade, is required for *E. Massonii* (or *E. diffusa*), which is a charming little alpine plant. It must be planted in a well-sheltered position. and requires protection from sun and severe frost in winter, but the little plant is well worth all the extra care one may have to expend on it in winter. Propagated by cuttings, seeds or division. (J. B. Keller.)

Mássonii, Sweet (*E. diffùsa,* Woods). Height 4 in.: sts. ascending, tufted, not branched above, 1–3-fld.: lvs. fleshy, usually concave, shining: fls. lateral. Azores. —Annuals in Azores, biennial in W. Eu. The plant cult. under this name is considered perennial by our nurserymen.

venùsta, Gray. Height 6–10 in.: sts. erect, 4-angled, cymosely branched: lvs. ½–1 in. long, oblong or ovate-oblong, very blunt: corolla-lobes oval or obovate or oblong, ½in. or less long, deep pink; corolla-tube yellowish, about the length of the calyx. Dry hills. Calif. B.M. 6396. L. H. B.†

ERYTHRÌNA (from Greek for *red*). *Leguminòsæ.* CORAL-TREE. Herbs, shrubs or trees, with large and showy papilionaceous flowers, for planting out and for greenhouse bloom; and open-ground subjects in Florida and California.

Erect, or the herbs more or less reclining, usually spiny: lvs. alternate, pinnately 3-foliolate, with small glanduliform stipules: fls. mostly red and in dense racemes; calyx 2-lipped or oblique; standard free or very nearly so, erect or spreading; tenth stamen free, or united only half its length: fr. a slender, more or less twisted pod; seeds mostly ovoid.—Known species about 50, in tropical and warm temperate regions around the world.

Erythrinas are much prized garden plants. Some of them, particularly the herbaceous kinds, are frequently planted out in the summer. In the house they demand an intermediate temperature. Give rich soil and frequent waterings. In the woody species, aim to have well-ripened wood for flowering, for the bloom is produced on wood of the preceding year. The herbaceous species are propagated by division of the rootstock; also by cuttings from shoots springing from the old roots. Woody species are propagated by cuttings of growing wood. All species are propagated by seeds, whenever these are obtainable. Many species have been more or less grown or tried within the limits of the United States; some of them fail to bloom in southern California, probably because of insufficient summer heat. The forms more or less in cultivation are likely to be imperfectly or doubtfuly determined botanically. Some of the erythrinas are used as shade for coffee and cacao plantations.

A. *Herbaceous species (or treated as such).* These die down at the end of the season, and the roots may be stored after the manner of dahlias. It is best to start the roots before planting them out, particularly in the N. In their native countries, these species are more or less woody.

Crísta-gálli, Linn. (*E. laurifòlia,* Jacq.). COMMON CORAL-TREE. Bushy and woody, sometimes developing a very short trunk, but the flowering branches dying back after blooming, the stronger branches coming annually or periodically from near the root: st. and petioles somewhat spiny: lfts. ovate-oblong or lance-oblong, acuminate, entire: fls. large, brilliant crimson, the keel nearly as long as the down-folding standard, the wings rudimentary. Brazil. B.M. 2161. B.R. 313. L.B.C. 3:296. G. 4:451. G.W. 3, p. 437; 6, p. 281. F.E. 16:637 (var. *compacta*).—Runs into many forms, varying in the shade of red, some of them with variegated lvs. South of Washington, it stands out-of-doors if protected. In the N. the fleshy roots are taken up and stored. Valuable for summer bloom. Fls. in large, terminal racemes. Madame Belanger is a popular garden form. **E. compácta,** Bull, of very compact habit and fls. rich crimson is probably a form of this species.

speciòsa, Andr. Bush-like, reaching 8–12 ft., but usually cut back as *E. Crista-galli* is: sts. and lvs. prickly: lfts. broad and more or less 3-lobed, pointed, veiny: fls. in pubescent racemes, rich crimson. W. Indies. B.R. 750.—St. green, very prickly.

herbàcea, Linn. Perennial: sts. several and herbaceous, from a very thick root, 2–4 ft. high, the flowering ones nearly leafless: lfts. 3, ovate to hastate; petioles long, more or less prickly: fls. 2 in. long and very slender, deep scarlet, in loose racemes 1–2 ft. long: seeds scarlet. N. C. to Texas and W. Indies. Common on Gulf coast of Ala. and Miss. B.M. 877. **E. Bídwillii,** Lindl., is a beautiful hybrid of this species and *E. Crista-galli* (the latter the pollen parent), with herbaceous shoots and an ascending vexillum. B.R. 33:9. H.F. 2:48.

AA. *Woody or tree-like species.* Greenhouse plants, or planted in the open in S. Calif. and S. Fla.

Humeàna, Spreng. (*E. cáffra,* Ker-Gawl, not Thunb.). Often tree-like and 30 ft. or more, the st. and petioles very spiny: petioles long; lfts. rhomboid-ovate, acuminate: peduncles axillary and strictly erect, longer than the lvs., white-warty; fls. verticillate-spiked on the ends of the peduncles, long and slender, deflexed, brilliant scarlet fading to purple. S. Afr. B.M. 2431. B.R. 736.

Corallodéndron, Linn. CORAL-TREE. Tree, prickly: petioles not armed; lfts. ovate-rhomboid: calyx campanulate, the teeth obsolete; standard erect, linear-oblong, scarlet: seeds scarlet, usually with a black spot. W. Indies. L.D. 3:170.—The handsome deep scarlet large fls. are borne in long racemes after the lvs. fall.

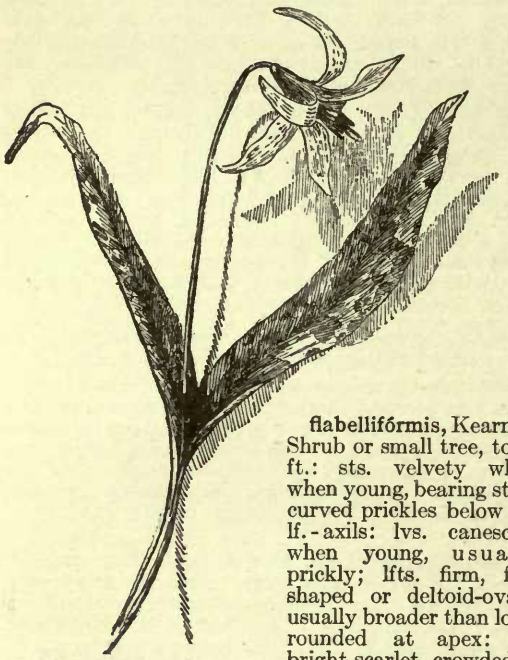
velùtina, Willd. Prickly tree: lfts. scurfy-tomentose beneath, broadly ovate, obtuse, the terminal deltoid-ovate: calyx split nearly to base, the 5 teeth minute; standard orbicular, reflexed (1–1½ in. long), the wings nearly as long as calyx, the keel-petals distinct and small: pod velvety, few-seeded. Jamaica to Brazil. B.M. 3227.

índica, Lam. (*E. cárnea,* Blanco). Tall tree with very small usually black prickles and thin gray back: lfts. rhomb-ovate, membranous and glabrous: fls. showy scarlet, in dense short racemes; calyx split nearly to base; standard ovate-oblong and blunt or nearly so, slightly recurved, 2–2½ in. long, and about half as broad, much exceeding the wings and keel; wings and keel nearly equal, not more than half so long as the calyx: pod 6–12 in. long, torulose. India, Polynesia, W. Indies. Variable. Var. **pícta,** Hort (*E. pícta,* Linn.), has variegated lvs. Var **Parcéllii,** Hort (*E. Parcéllii,* Bull), has lfts. with variable yellow varie-

gation: fls. bright cinnamon-red. G.C. II. 1874 (2): 393. G.Z. 18:64; 21, p. 2. By some, *E. picta* is accorded specific rank and *E. Parcellii* is united with it. Var. **marmoràta**, Hort. (*E. marmoràta*, Veitch), has large lvs. attractively spotted with white. G.Z. 24, p. 73.

fúsca, Lour. Tree-like, 8 ft., the bark fuscous (brownish), bearing short prickles, the branching diffuse: lvs. unarmed; lfts. lanceolate, entire, glabrous: fls. brown-red, in terminal racemes; calyx somewhat bilabiate, the lips entire and erect; standard very long, obtuse, convolute in a tube; stamens long, connate at base: pod long, terete, articulate, pilose; seeds oblong. Cochin-China.

Poeppigiàna, Cook (*Micrópteryx Poeppigiàna*, Walp. *E. Micrópteryx*, Poepp.). BUCARE. Used for shading coffee and cacao in the W. Indies: tree 40–60 ft., the prickles short: lvs. large, apparently not prickly; lfts. broad, entire, with nectaries at base of the 2 lower petiolules: fls. cinnabar-red; calyx truncate; standard plane, elliptic or narrow-oval, to 1⅞ in. long; wings small, about twice exceeding the calyx, obovate or oval-elliptic; keel scarcely shorter than standard, arctuate. Probably Peruvian.—Offered in S. Fla. The *E. umbrosa* of the W. Indies is probably this species.



1420. Erythronium americanum. (×½)

flabellifórmis, Kearney. Shrub or small tree, to 10 ft.: sts. velvety white when young, bearing stout curved prickles below the lf.-axils: lvs. canescent when young, usually prickly; lfts. firm, fan-shaped or deltoid-ovate, usually broader than long, rounded at apex: fls. bright scarlet, crowded in short terminal racemes, numerous, pedicels velvety-canescent; calyx campanulate, truncate, usually somewhat oblique, white-tomentose; standard exceeding the calyx, about 1½ in. long, linear-oblong, narrowed at both ends; wings and keel short: pod linear, torose; seeds oval, bright scarlet with whitish hilum. S. E. Ariz.—Offered in S. Calif.

E. arbòrea, Small (E. herbacea var. arborea, Chapm.). Shrub or small tree, to 20 ft., armed: lvs. with wire-like petiole and rachis; lfts. deltoid or hastately 3-lobed: fls. scarlet in racemes 4–8 in. long: pod 3–5 in. long, constricted between the seeds. Fla. Likely to be planted.—*E. bogotènsis* appears in a European trade list of greenhouse plants.—*E. constantiàna*, Mich. Tree, soft, the trunk thick and spiny: fls. large, scarlet, in racemes. Eu.—*E. insignis*, Tod. Tree, sparingly prickly: lfts. ovate, tomentose when young: fls. scarlet, in short and dense racemes. Origin unknown. Gt. 28: 988. —*E. vespertìlio*, Benth. Shrub, for a warm greenhouse: glabrous, branches prickly: lvs. not prickly; lfts. broad-cuneate at base, 3 or 4 in. broad, usually 3-lobed, and the middle lobe of various shape and sometimes absent: fls. showy (red?) and many in racemes; standard ovate, recurved at top, nearly 1½ in. long; wings small, oblong: pod long, torulose; seeds few, large and red. Austral. G.Z., 30, p. 1. —*E. viàrum*, Tod. Tree, prickly: lfts. rhombic-ovate, tomentose when young, terminal one long-stalked: fls. scarlet, in many-fld. short racemes, the standard obovate. Origin unknown.

L. H. B.

ERYTHROCHÆTE, or **ERYTHROCHÆTON**: *Ligularia japonica.*

ERYTHRÒNIUM (from the Greek word for *red*, applied to the purple-rose European species). *Liliàceæ.* DOG'S-TOOTH VIOLET (although in no sense a violet). ADDER'S-TONGUE. Small spring-flowering hardy scapose bulbous plants.

Erythroniums have bulbs standing erect and from oblong to linear in form, 2 radical lvs., which in most species are handsomely mottled: scape slender and leafless, producing from 1 to many nodding very attractive fls.; perianth of 6 similar divisions, usually recurved; stamens 6 and a single 3-lobed style: fr. an oblong or obovoid more or less 3-angled loculicidal caps.—Handsome plants of the north temperate zone. One belongs to the Old World, 4 to E. N. Amer., 2 are found in the Rocky Mts., while in the cool woods and high mountains from N. Calif. to the British possessions the genus is represented by about 9 species and a number of well-marked varieties. The species are confused or variable. The first and perhaps second year from seed, the plants bear a single lf. and do not bloom. Some of the species spread in large patches, by means of underground stolons. The bulb is scaly outside but with a solid interior, being really a corm.

The erythroniums are most interesting spring flowers. They succeed in any light soil, particularly in partial shade. In common with all herbaceous perennials, especially those that produce bulbs or corms, they profit by a winter mulch of leaves or litter.—The western erythroniums are all plants of the cool woodlands, except a few that grow at such altitudes as to reach like conditions. They thrive best in shade, a thoroughly drained soil, moist and rich in mold, a surface covering of half rotten leaves tending to equalize conditions. Any good fibrous material, as fibrous peat, coconut fiber or spent tanbark, or even well-rotted sod, will answer the purpose to lighten the soil and give that abundance of mold they delight in. Pockets in shaded rockwork give ideal situations. They will thrive naturalized on cool wooded slopes; and where the drainage is good they will thrive in grass. The leaves ripen before the grass is cut and the effect is very good. Simply planted in boxes in a loose soil, rich in mold, and left year after year in a shaded spot, they sometimes give splendid bloom. *E. Hartwegii* flowers very early, and stands more heat and dryness than any other variety. *E. purpurascens* and *E. montanum*, from high altitudes, tend to throw up their growth very late, and are on that account rather difficult to cult. All of the western species are very satisfactory garden plants. —The propagation of *E. Dens-Canis* and varieties, the eastern American species and *E. Hartwegii*, is by offsets. All of the other western species can be increased only by seeds. The eastern species should be planted at least 5 inches deep. When planting erythronium bulbs, cover with 2 inches of earth; as the bulbs themselves may be 2 inches long, this means that the holes should be 4 inches deep.

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A. OLD-WORLD ERYTHRONIUMS. *Fls. always solitary, and without a crest near base of inner petals: lvs. handsomely mottled: offsets few.*

1. **Dens-Canis,** Linn. St. 4–6 in. high: lvs. oval-acuminate, rounded at the base, blotched or patched with reddish brown: fls. drooping, rose-colored, rose-purple or lilac; segms. strongly reflexed, narrow, long-pointed. Cent. Eu., Japan, in several forms. Gn. 76, p. 649.—Variations are white, rose-colored or flesh-colored. Var. **longifòlium,** Hort., varies in its narrower lvs. and larger fls; var. **màjus,** Hort., is apparently a form of this. Var. **sibíricum,** Hort., from the Altai Mts., is taller. The species thrives in a moist open garden soil, and exposed to the sun. Often used in rock-gardens. Little known in American gardens.

AA. EAST-AMERICAN ERYTHRONIUMS.—*Fl. solitary, without a crest on inner petals: mostly producing offsets.*

2. **americànum,** Ker. COMMON ADDER'S-TONGUE. Fig. 1420. Scape 6–10 in., from an ovoid bulb that produces offshoots: lvs. elliptic- or oblong-lanceolate, mottled with purple-brown and whitish: fls. yellow, the segms. recurved, the 3 inner ones auricled at base; stigmas united. E. Canada, to Fla. and Ark., in rich low grounds, particularly in or near woods. Runs into many forms. The following names belong with it: *E. lanceolàtum,* Pursh; *E. angustàtum,* Raf.; *E. bracteàtum,* Boott.

3. **álbidum,** Nutt. WHITE ADDER'S-TONGUE. Producing offshoots: lvs. not mottled, narrow: fls. pinkish white, yellow at base; segms. recurved, not auricled; stigmas spreading. Ont. and N. Y. to Minn. and Texas.

4. **mesachòreum,** Knerr. Without basal offshoots: lvs. not mottled, narrowly oblong to linear-lanceolate: fls. lavender, the segms. not recurved; stigmas spreading; earlier than the last. Iowa to Kans. and Mo.

5. **propúllans,** Gray. Bulb ovoid: offshoots arising from near middle of the st.: lvs. small, green or slightly mottled: fls. rose-colored, with yellow base; style slender and stigmas united. S. Ont. and Minn.

AAA. WEST-AMERICAN ERYTHRONIUMS.—*Fls. 2–4, sometimes more (rarely only 1-fld.).*—The lvs. are richly mottled, except in *E. grandiflorum.* The corms do not produce offsets, except in *E. Hartwegii.* Inner petals with auricles, except in *E. Howellii.* All except *E. purpurascens* have large and showy fls.

B. *Style 3-cleft.*

6. **grandiflòrum,** Pursh (*E. gigantèum,* Lindl.). Scape 1–2 ft. high: lvs. broadly lanceolate, to 6 in. long, acute and short-cuspidate, unmottled: scape slender, 3–5-fld.; fls. very bright yellow; petals recurved; anthers yellow. E. Ore. to Brit. Col. Var. **álbum,** Hort. (*E. montànum,* Hort.). Like the type, except the fls. are white, yellowish at center, and with a slight greenish cast. Var. **minus,** Morr., is smaller.—*E. grandiflorum* grows from very high mountains to (at one point) little above the sea-level. In cult. the high mountain form starts very late and is difficult to grow, while the sea-level form (var. **robústum,** Purdy) is an easy subject. In some localities the anthers are red, as in var. **Nuttallianum,** Purdy (*E. Nuttallianum,* Schult.), in others both red and yellow, but as a rule yellow. The so-called var. *minor* is small merely from less favorable situation. By some, the *E. giganteum,* Lindl., is kept distinct. G.C. III. 43:212. J.H. III. 58:397. G.M. 53:359.

7. **parviflòrum,** Goodd. The Cent. Rocky Mt. form of *E. grandiflorum:* scape 4–12: lvs. oblong, tapering both ways: fls. usually solitary, bright yellow, greenish in the bottom; segms. lanceolate-acuminate, about 1 in. long, strongly recurved; anthers pale yellow.—A subalpine species.

8. **californicum,** Purdy. Lvs. richly mottled: fls. few to as many as 16; petals revolute and broader, creamy to light yellow, deeper at the center and often marked maroon at base. In the Coast Ranges of Calif., San Francisco Bay to Humboldt Co.—In cult. the most satisfactory East. The description of *E. revolutum* var. *Watsonii* in Cyclo. Amer. Hort., also covers *E. californicum.* G. 32:424.

9. **Hartwegii,** Wats. Bulb-bearing offsets freely on filiform stolons from the base: lvs. mottled: fls. 1–6, mostly in a sessile umbel, large, light yellow-orange at center and white or cream-color above. Foothills of the Sierra Nevada Mts. in Calif. G.C. III. 20:361; 43:215.—The plant appears to have several scapes because the umbel is sessile but each fl. is on a pedicel.

10. **revolùtum,** Smith. Lvs. 1–4, mottled in white and light brown: fls. nearly always 1 or 2; petals narrow and curved; style large and stout; filaments from subulate (awl-shaped) to deltoid, opening from white flushed with pink to pinkish purple, becoming purple. J.H. III. 35:523; 43:268. Var. *Bolanderii* is not separable from the type. *Pink Beauty* is a soft pink form found in Humboldt County, Calif. Var. **albiflòrum,** Hort. (var. *Wátsonii,* Purdy. *E. gigantèum* var. *albiflòrum,* Hort. *E. grandiflòrum* var. *albiflòrum,* Hook.). Fls. pure white with a greenish cast, often banded maroon at base; petals slender; a very beautiful plant. B.M. 5714. F.S. 20:2117. G.C. III. 3:556; 15:621. Var. **Jóhnsonii,** Purdy (*E. Jóhnsonii,* Bolander). Very similar to the type, but lvs. mottled in dark brown and looking as if coated in varnish, and fls. dark rose with orange center. Gn. 51:136. G.C. III. 19:549; 25:253. Var. **præcox,** Purdy. Lvs. mottled in mahogany, the most beautifully of any erythronium: the fls., usually 2–4, are creamy white with orange center.



1421. Erythronium Hendersonii: (×½)

11. **montànum,** Wats. Scape slender, to 18 in., 1–3-fld.: lvs. not mottled, broad-lanceolate to nearly ovate, contracted into a winged petiole; perianth pure white, orange at base. On high mountains of Ore. and Wash.—Very difficult to cult. as the bulbs start very late; one of the most beautiful.

BB. *Style not divided.*

12. **citrìnum,** Wats. Rather stout, to 10 in., 1–9-fld., the fls. close together and opening at about the same time: lvs. mottled, very broad-lanceolate, obtuse and short-apiculate, attenuate to a very short petiole: petals broad, strongly recurved, light yellow, orange at center, the tips becoming pink. S. Ore. Gn.M. 6:65.

13. **Hèndersonii,** Wats. Fig. 1421. Slender, to 12 in., 1–3-fld.: lvs. mottled in dark brown, lanceolate to oblong, obtuse and short-apiculate, narrowed to a short petiole: petals strongly recurved, pale purple, with a very dark purple, almost black, center. S. Ore. G.F.

1:317 (adapted in Fig. 1421). G.C. III. 3:653; 15:623; 43:213. Gn. M. 6:65. Gn.W. 22:375. B.M. 7017.

14. **purpuráscens,** Wats. Lvs. undulate, not mottled but shaded in dark metallic tints: fls. small, spreading, crowded in a raceme, light yellow (almost white), center orange, becoming purplish. Sierras.—A very small-fld. erythronium, with 1–8 fls. crowded together. This species grows at 5,000–7,000 ft. altitude in the Sierras. While under some conditions it is low-growing, under other conditions it equals in size and height the most robust species. At the lower altitudes of its habitat snow covers the ground until early May and this plant flowers shortly afterward; it remains very dry in summer and fall.

15. **Hówellii,** Wats. Rather slender, to 18 in., 1–3-fld.: lvs. mottled, lanceolate to oblong-lanceolate, usually acute and short-apiculate: fls. pale yellow with orange base, becoming pinkish. S. Ore.—Of the Pacific coast erythroniums, this alone is destitute of the ear-shaped appendages at inner base of petal.

CARL PURDY and L. H. B.

ERYTHRÓXYLON (Greek, *red wood;* true of some species). Written also *Erythróxylum. Erythroxylàceæ.* COCA. A genus famous for the coca plant, the leaves of which are of vast importance in medicine, yielding cocaine, grown slightly in the extreme south of Florida and California, and rarely cultivated under glass in the North for its economic interest.

Erythroxylon comprises about 90 species of shrubs or small trees widely distributed in tropical and subtropical countries but most abundant in Trop. Amer.: lvs. alternate, entire, often coriaceous: fls. small, whitish, on bracteolate pedicels, solitary or fascicled; sepals 5 (or 6); petals of same number, deciduous, appendaged on the inner face; stamens twice the number of petals, connate at base: fr. a 1-seeded drupe.

Còca, Lam. Shrub, 5–6 ft. high, with rusty brown, slender branches, on the extreme tips of which the lvs. are borne: below the lvs., on the wood of the preceding year, which is reddish, clusters of 3–5 yellow 5-lobed fls. ¼in. across spring from the protection of the small scales that line the branchlets, and which are colored like the bark: lvs. oval, obovate or elliptical, differing in different cult. strains or varieties, about 1½–2½ in. long and marked on the under side with 2 lines extending on either side of the midrib from base to apex. Native country uncertain; the earliest described form, which happens to be Peruvian, was named by Lamarck *Erythroxylum Coca,* and figured in B.M. 7334. The lvs. of this form are about 2½ in. long, oblong-obovate, tapering to a short stalk, rounded at the apex, the midrib extending beyond into a short, sharp point. Coca is grown commercially on a large scale throughout S. Amer., and also in Java and Ceylon. There are 2 leading commercial varieties, according to Kraemer,—the Bolivian or Huanco, and the Peruvian or Truxillo. The lvs. are picked when fully grown, and quickly dried in the sun. The shrub is said to require for its best development a very humid atmosphere and comparatively high elevation. Coca should not be confused with cocoa and cacao, which are discussed under Theobroma.

L. H. B.†

ESCALLÒNIA (named for Escallon, a Spanish traveler in South America). *Saxifragàceæ.* Mainly evergreen shrubs or small trees, widely dispersed in South America, especially in the mountains.

Leaves alternate, glandular-serrate (rarely entire): fls. strongly odorous, white or of a pink or red color, in terminal racemes or panicles, or axillary; calyx-lobes 5; petals 5; stamens 5; style simple, the stigma obscurely 4–5-lobed and peltate, or 2-lobed and reniform or peltate. Noteworthy in the genus are the glands, stalked or not, which may occur almost anywhere on the plant. Lvs. often with resinous dots on one or both surfaces.—About 45 or 50 species, a number of which have been intro. in the S., and in Calif. They are of easy culture; rapid growers; and often artificially trained as vines. Several will probably prove half-hardy as far north as N. Y.



1422. Escallonia langleyensis.

A. *Lvs. large, hairy, especially below, or in one variety glabrous but very shiny.*

pùlverulénta, Pers. Shrub: lvs. very thick, oval or elliptic, obtuse, serrate, rough-hairy below, with scattered hairs above: fls. white, in long densely fld. terminal racemes; stigma distinctly 2-lobed, reniform: fr. a glandular-warty caps.: branches hairy. Var. **glàbra,** Engler. Differs from the species in being almost or quite glabrous. Handsomer than the type. Not in cult. in this country.

AA. *Lvs. glabrous or nearly so.*

B. *Fls. red or pink.*

rùbra, Pers. var. **glabriúscula,** Hook. & Arn. (*E. rùbra* of many authors). Dainty fld. shrub, with numerous stalked glands: lvs. ovate, often deltoid-ovate, acute, finely and irregularly doubly-serrate, glabrous, with brown resinous dots below, rather small: fls. red, tubular, borne in 2's or 3's (or rarely singly) on lateral pedicels, grouped near the ends of the branches; calyx densely glandular; petals long-clawed; stigma obscurely 5-lobed: fr. a top-shaped caps. B.M. 2890.

macrántha, Hook. & Arn. Shrub: lvs. thickish, broadly ovate, acutish or obtuse, bluntly serrate, essentially glabrous: fls. red, long-tubular, in a stocky, often branching, terminal raceme; calyx-lobes with marginal glands; stigma peltate, obscurely 5-lobed: fr. a glabrescent caps. F.S. 6:632.—Excellent. Var. **sanguínea** is a horticultural variety with fls. more crimson.

organénsis, Gardn. Half-hardy S., 2–5 ft., glabrous throughout: lvs. thick, oblong, acutish, serrulate, with tiny resinous dots: fls. pink, in close, terminal clusters. B.M. 4274.—Excellent. Organ Mts., Brazil.

BB. *Fls. white, or, in E. langleyensis, rose-tinted.*

C. *Width of lvs. more than ½in.*

chlorophýlla, Cham. &. Schlecht. (*E. cándida,* Lem.). Shrub, to 3 ft.: lvs. oblong-ovate or obovate, obtuse, apiculate, or more rarely acute, with a few blunt teeth on upper part, or wholly entire: fls. white, in a terminal, many-fld. panicle. J.F. 403.

montevidénsis, DC. (*E. floribúnda,* Reichb. *E. floribúnda,* HBK. var. *montevidénsis,* Cham. & Schlecht.). Shrub, to 9 ft.: lvs. thick, elliptic, obtuse, finely serrate, glabrous, shiny above: fls. white, in a terminal, many-fld. panicle; petals clawed; stigma obscurely 4–5-lobed: fr. a top-shaped caps., crowned by the obviously longer style. G. 25:576; 27:465.

floribúnda, HBK. Shrub: lvs. oblong-ovate, obtuse, very minutely crenulate-serrate or entire, glabrous or nearly so: fls. white, in many-fld., compound, axillary or terminal panicles; petals clawed; stigma peltate, 2-lobed: fr. a caps., crowned by the equal or barely longer style. G.C. III. 47:53.

cc. *Width of lvs. not over ½in.*

leucántha, Remy. Densely lvd. shrub: lvs. obovate, obtuse or nearly so, finely serrate, at least on upper part, glabrous, small: fls. white, in very dense racemes; petals spatulate, clawed: fr. an obovate caps.

virgàta, Pers. (*E. Philippiàna,* Mast. *E. virgàta* var. *Philippiàna,* Engler. *E. stricta,* Gay). Densely lvd. shrub, half-hardy south of Washington: lvs. stiff, lanceolate or obovate, obtuse to acute, tapering at base, with minute rather distant teeth on upper part, glabrous or nearly so, small: fls. white, axillary, scattered, or sometimes massed near the tips of the branchlets; petals spreading, scarcely if at all clawed: fr. a globose caps. G. 27, p. 464. Gn. 66, p. 64.

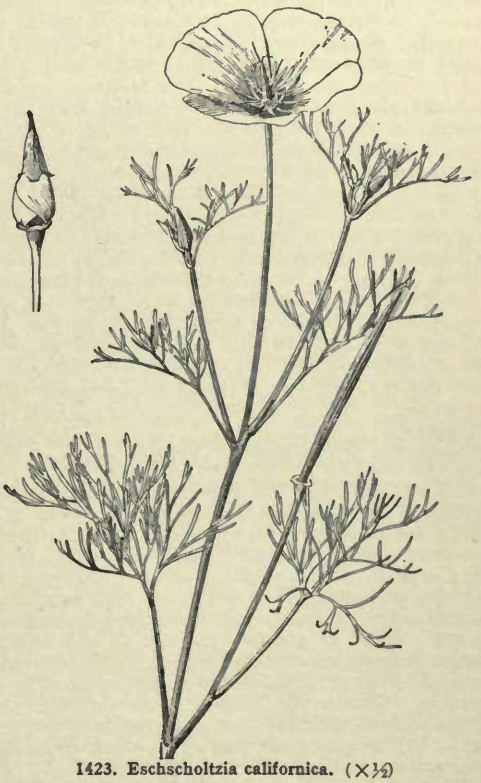
langleyénsis, Vilm. & Bois. Fig. 1422. A graceful shrub (artificial hybrid of *E. macrantha* and *E. virgata*): lvs. linear-ovate, obtuse or acutish, minutely serrulate, small, in short racemes at the ends of the branchlets.

E. álba, a name found in some of the catalogues, is not determinable.—*E. péndula,* Pers. Shrub with red fls., in narrow racemes to more than 1 ft. long, and lvs. resembling those of tobacco. Desirable.—*E. rósea.* An unidentified catalogue name which in at least one instance, certainly does not refer to E. rosea, Griseb., a very little known species. ALBERT HANFORD MOORE.

ESCHSCHÒLTZIA (J. F. Eschscholtz, of Kotzebue's scientific expedition). *Papaveràceæ.* Brilliant and popular garden flowers.

Low, pale or glaucous herbs, annual or perennial, with ternately dissected alternate lvs., and large, showy yellow or whitish long-peduncled fls.: sepals 2; petals 4; stamens numerous; stigmas 4–6: caps. long and slender like a silique, 1-loculed, elastically dehiscent at the instant it separates from the receptacle. The calyx forms a hood which is pushed off over the bud as the petals expand (see detail at the left in Fig. 1423). The torus or receptacle (from which the caps. arises) is prominently hollowed and surrounds the base of the pistil.—Few genera have been more diversely interpreted as to the limits of species. Gray accepted about a dozen species, and something like this view of the genus is commonly held. Greene, however, in Pittonia, V (1905) recognized 112 species and separated one of the described species under the new genus Petromecon. Fedde in Engler's Pflanzenreich, hft. 40 (1909), separates 123 species. These many species are segregated largely from the multifarious group to which the name *E. californica* has been applied. On this treatment Jepson writes: "This species is highly variable, especially so in trivial details of leaf-segmentation and of shape of calyptra and in habit. It is also variable in the size and color of petals and so runs into an extensive concourse of forms, many of which seem obviously seasonal or due to soil or moisture conditions. Some of these highly marked plants in the Sacramento Valley have two seasonally dimorphic forms, an erect vernal flowering form with very large golden corolla and huge torus rim, and an autumnal flowering form with small straw-yellow corolla and reduced or no torus rim. It has been found impossible thus far, after several trials, to reproduce this sequence in cultivation on the coast. The flower is not like either the vernal or autumnal form but approximates the coast form. A large number of the wild forms have been collected but probably only a small proportion of those in existence. Yet the number of specimens distributed to herbaria has been sufficient to form the basis for nearly 100 new species. It does not seem hopeful that the solving of the problem of *Eschscholtzia californica* in just this way will lead either to permanent results or afford a satisfactory basis for the kind of work most needed, namely the prosecution of combined field and cultural studies." Studies of growing plants under conditions of observation and control, both of wild and horticultural material, are awaited. Where the abundant garden material falls, in the segregations, is yet unknown. The cult. forms are derived from the old *E. californica,* and *E. tenuifolia* appears also to be in the trade. Eschscholtzia is a genus of W. N. Amer., ranging both on the coast and in the interior valleys, and in the Sierras. It occurs from Low. Calif. to the valley of the Columbia River, in New Mex., Ariz., Nev., Utah. It has run wild in parts of Cent. Eu.

californica, Cham. CALIFORNIA POPPY. Fig. 1423. Perennial, but cult. as an annual, 10–24 in. high, forming mats: lvs. long-petioled and divided into linear parts, those on the sts. smaller and shorter-petioled: fl. saucer-shaped, opening in sunshine, 2–3 in. across, yellow or orange or cream-colored: pod 3–4 in. long, strong-ribbed: torus large and funnel-shaped. Calif. and Ore., mostly along the coast.—One of the most popular garden fls. It is treated as a hardy annual, the seeds being sown where the plants are to stand, and they should be sown very early. It stands considerable cold, and blooms after the first frosts. If well protected, plants of one season's growth will pass the winter and give some bloom the following spring. It sometimes self-sows. Very attractive as an edging, because of its interesting bluish foliage. There are double-fld. forms. Very variable, and cult. under a variety of names, as *C. marítima,* Hort. (not Greene), *C. vària,* Hort. (trade name for mixed varieties), *C. aurantìaca,* Hort., *C. álba,* Hort., *C. Thórburnii,* Hort. In color forms are offered yellow, golden yellow, white, rose-white, carmine, rose. Var. **crôcea,** Hort. (*E. crôcea,* Benth.). Fls. deep orange: torus very widely expanded: calyx-bud long-attenuate. B.R. 1677. B.M. 3495. Var.



1423. Eschscholtzia californica. (×½)

Doùglasii, Gray (*E. Doùglasii,* Benth.). Rather more slender, and blooms earlier: fls. pure yellow: torus rim narrow.

tenuifòlia, Hook. Lower, with narrow lvs. in a radical tuft, the long divisions being almost capillary: fls. small (1 in. across), light yellow, overtopping the lvs.: torus less prominent: seeds muricate. Foothills of the Sierra Nevadas. B.M. 4812. L. H. B.

ESCÓNTRIA (named for Señor Don Blas Escontria, of Mexico). *Cactàceæ*. Large, much-branched cacti. Ribs few: areoles narrow, bearing pectinate clusters of spines: fls. small, yellow, diurnal: fr. and ovary covered with chartaceous, translucent, persistent scales, without hairs or spines; fr. fleshy, edible; seeds black. For cult., see *Succulents*.

chiotílla, Rose (*Cerèus chiotílla*, Web.). Sixteen ft. or more high: ribs mostly 7: radial spines 10–15; central 1–2, the upper one 2 in. long, curved downward: fr. 1 in. diam. Mex.—Rare in cult. J. N. Rose.

ESPALIER, a trellis or open support on which a tree or woody plant is trained in formal shape and to a given number of branches, usually in a vertical plane; and also the plant so trained. Apple trees and others are often trained as espaliers in Europe; the tree may be transplanted and subsequently attached against a wall or building, or it may be kept permanently on the trellis or open support. Sometimes espalier-training is employed only when the tree or bush is young, for the purpose of bringing it into shape and to prepare it for a wall or other support. Trees are trained on espaliers also to give them full exposure to the sun on all sides, to regulate the fruit-bearing and to provide easy means of controlling insects and diseases. Espalier-training is most frequent in cool and cloudy regions, in those in which space must be utilized to the utmost, and where hand-skill is obtainable or is relatively cheap.

There are many forms of training. The plant may be trained to a single shoot, or to two shoots lying in opposite directions, mostly horizontal, in which case it is called a cordon; or the top may be spread fan-shaped on the trellis, or in other forms, and it may then be called an espalier. The training is begun when the plant is very young—perhaps only a year or two from the graft or bud—and before it has produced a stiff trunk and unmanageable head. Usually the branching is started within a foot or so of the ground by heading back the main stem; and as many shoots as may be desired on the trellis are allowed to grow. These shoots are tied to the trellis or posts as they grow, and the side shoots are pinched out except such as are desired for further arms in the framework or for fruit-spurs. The trellises themselves may be of wire strung on posts, or the tree may be tied from post to post or stake to stake set close together. Espaliers are little used in this country, and then only in small gardens, and mostly when a trained gardener is employed. L. H. B.

ÉSULA: *Euphorbia*. The *E. cristata* of the trade is probably the cristate form of *Euphorbia lactea* or similar species.

ETHERIZATION OF PLANTS. Etherization, as applied to plants, means strictly the forcing of a dormant plant into growth by subjecting the plant to ether vapors at certain concentrations in a closed chamber for a definite period of time, usually twenty-four to seventy-two hours. The plant after such treatment is placed under environmental conditions favorable for growth. Since in practice the use of chloroform is similar in its application and effects, it will be discussed here. The general nature of etherization was first noted by Johannsen in 1890, and following his investigation a wide stimulus was given to the commercial forcing of flowering shrubs. For other methods of forcing a dormant plant, see *Rest-period*.

Before discussing the method of etherization, its effects and application, it is necessary first to have some idea of what is meant by the term rest-period or the condition of dormancy.

Rest-period.

Perennial plants, especially those in the temperate regions, in general have a season of growth and active metabolism followed by a period of quiescence as regards any outward manifestations of metabolism. During this period, not all of the vital processes are at a standstill and changes in the reserve food may be in progress, but the plant appears to be at rest and is dormant. The rest-period begins with the advent of the unfavorable growth conditions of the autumn, and normally continues until the favorable conditions of the spring.

One might reasonably assume that growing perennial plants removed from out-of-doors at the approach of autumn conditions to a greenhouse, would continue growth and not pass into the rest condition. One might assume, also, that if a plant in a dormant condition be brought into favorable conditions it would resume growth immediately. But experience and investigations show that many plants will not immediately continue growth, and, provided they do continue growth, it is at a slower rate. Dormant plants, that is those in the rest-period, may require considerable time before resuming growth. There are some plants that during dormancy respond quickly when brought into the greenhouse; there are others that remain dormant despite the most favorable environmental conditions. The rest-period in various species of Acer (maple), of Quercus (oak), of Fraxinus (ash), and of *Fagus sylvatica*, as well as other plants, is so well fixed as to make it almost impossible to force the dormant plants into growth by warmth and moisture alone. Special treatment is necessary, such as etherization. There are other plants in which the rest-period is not well established. These quickly respond to favorable growth conditions normally prevailing in a greenhouse. In many plants this rest-period has attained an almost habit-like character. The following table with data taken from results secured by Howard with branches brought into the greenhouse at Halle, Germany, is instructive:

Growth Response of Branches When Brought into Greenhouse.

Species	Collected Oct. 20–Nov. 4, 1905. No. of days for beginning of growth	Collected Jan. 8–10, 1906. No. of days for beginning of growth
Acer negundo var. versicolor	63	20
Acer pseudoplatanus	0*	0
Azalea mollis	26	0
Æsculus Hippocastanum	0	20
Betula nigra	62	12
Berberis vulgaris	10	3
Celastrus scandens	0	17
Cercis canadensis	0	10
Cydonia japonica	6	7
Deutzia gracilis	10	3
Fagus sylvatica	0	38
Lonicera tatarica	7	3
Magnolia acuminata	29	25
Populus canadensis	61	20
Quercus macrocarpa	59	0
Spiræa sorbifolia	1	

*0=No growth

In the investigation made by Howard, 234 species were collected from October 20 to November 4, and of these only 125 grew; and of the 125, only 18 per cent began growth within a period of nine days. Between January 8 to 10, another collection was made including practically all the species of the first lot and others in addition, so that the number totaled 283 species. Of this number 244 grew, of which 50 per cent began growth within the first nine days. The species that did not grow when brought into the greenhouse January 8 to 10 made growth when brought into the greenhouse on February 26. From these and the results of other experiments the conclusion is drawn that plants in general tend to pass out of the rest condition as the

season advances toward the spring. Dormancy is less stable in January than in November. This condition holds true not only for woody plants but also for bulbs and other herbaceous plants.

Method of breaking the rest-period.

The one method which has been largely employed for forcing dormant plants into growth is the etherization method. An air-tight chamber is provided, the size depending on the quantity or size of the material to be treated. The plants being placed in the chamber, it is tightly sealed except for a small opening through which ether may be introduced. Usually just below this opening is placed a sponge on which the ether is poured and then the opening is again sealed. If one desires to etherize a few bulbs, a wide-mouth bottle of two quarts capacity may be employed and the ether added in a small vial and the bottle then tightly stoppered. Special etherizing chambers are described for commercial work. The main desideratum is to have a chamber that will not permit of leakage of the ether vapor. The stopper must be securely fastened or weighted down.

Quantity of ether.—The quantity of ether best employed in forcing plants may vary with the nature of the plant, the season of the year, and the temperature of the etherization chamber. In general, the quantity to be added varies from 5 to 15 cubic centimeters per cubic foot of space (10 cubic centimeters equal about one-third fluid ounce). Early in the rest-period at 60° F., one should use about 15 cubic centimeters per cubic foot of space. In the middle of the rest-period, one should employ less and the amount should be further decreased toward the end of the rest-period. If the relative humidity of the chamber is high, a slight increase in the quantity of ether may be made. If chloroform is used, the quantity should be one-fourth to one-third of the quantity of ether recommended. The following figures are from Stuart:

TREATMENT RECOMMENDED FOR PLANTS AT DIFFERENT SEASONS

Cubic centimeters per cubic foot

	Ether		Chloroform	
	Cc. used	Exposure hours.	Cc. used	Exposure hours.
Lilac—				
October	15	48–24–24	4	48–24–24
November	12	48–24–24	3 ½	48–24–24
December	10	48–24–24	3	48–24–24
January	..	.. ..	..	.. ..
Astilbe—				
October	15	48–24–48	4	48–24–48
November	15	48–24–24		48–24–24
December	12	48–24–24		48–24–24
January	10	48	3	48

Time of exposure.—The time of exposure is also variable, being of greater duration in the early part and shorter in the latter part of the rest-period. In the early rest-period, a long exposure is given, varying from forty-eight to seventy-two hours to even as much as ninety-six hours. In case of long exposure, the practice is usually followed of making a forty-eight-hour exposure, after which the plant is removed from the etherization chamber for a day and then re-etherized for another twenty-four-hour period. Toward the middle and late rest-period, the time of exposure may be shortened as well as the quantity of ether.

The results.

The effect of etherization is to shorten the rest-period of the plant. Etherized plants come into bloom earlier and may be forced at lower temperature than unetherized plants. Howard found that seventy species of woody plants collected December 17 to 24 and etherized for forty-eight hours, opened their buds fully in an average of 20.3 days, while the untreated plants required an average of 28.1 days for the same development. Many experiments have been made with lilacs. Jannvek states that lilacs etherized August 24 were in bloom September 18.

The following table compiled from results secured by Stuart show conclusively the value of etherization with lilacs:

INFLUENCE OF ETHER AND CHLOROFORM ON LILACS

Date of treatment	Substance employed	Dosage cc. per cubic foot	Expos. hours	Full bloom in days	
				Charles X	Marie Legraye
Nov. 18–22....	None	..	..	51	30.5
Nov. 18–22....	Ether	12	48	31	29.5
Nov. 18–22....	Chloroform	3.6	48	31	28.5
Dec. 17–21....	None	..	..	31	29.5
Dec. 17–21....	Ether	15	48	31	29.5

In the foregoing table it is noted that treatment in the middle of December resulted in no beneficial effect. The plants at the time were in the middle rest-period, when growth-response requires no strong stimulation outside of normal growth conditions.

In general it may be stated that lilacs if etherized before December 1 will respond markedly to the influence of etherization. General results show that etherized lilacs blossom in seventeen to twenty-five days. The saving in time may be eight to twenty days.

Favorable results have been secured with flowering shrubs. Positive results have been reported frequently for *Azalea mollis*, for Viburnum and Astilbe. Negative or slight results have been reported for *Deutzia gracilis*, *Prunus triloba*, roses, and *Spiræa prunifolia*. Similar results have been reported for lily-of-the-valley.

The method of action of the ether is not understood and any discussion of the subject is yet hypothetical.

Etherization of bulbs.

On the forcing of bulbs the evidence is unsatisfactory. At the Cornell Station, positive results were reported (see Bailey, "Cyclopedia of Agriculture," Vol. II: 29), but more recently Stuart has reinvestigated the forcing of bulbs and finds conflicting results. He states that the etherization of bulbs is not commercially practicable. Some unpublished data on the etherization of bulbs at the Cornell Station sustain this conclusion. Theoretically, those results are to be expected because the bulbs in practice are gathered in the late spring or early summer and then stored for months. After planting, the bulb is allowed to remain in a cold-frame for several months so that when brought into forcing conditions it is well over the rest-period and, indeed, has probably passed through its period by the time it is first planted.

Effect on rhubarb.—Some positive results have been secured at the Vermont Agricultural Experiment Station with etherization of rhubarb. Different lots of rhubarb were etherized on December 9, January 9 and February 24. The first gave an increase over the control of 34.4 per cent, the second 89.7 per cent and the third 5.7 per cent.

General conclusions.—Certain general rules may be applied to the practice of etherization:

1. Etherization shortens the rest-period.
2. The more resistant a dormant plant is in growth-response to favorable environmental conditions, the greater will be the advantage of etherization.
3. Etherization becomes of less value as the end of the rest-period is approached.

4. It is wasted effort to etherize a plant that readily responds in growth to the normally favorable growth condition.

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LEWIS KNUDSON.

ETROG. This name is applied by the Jews to a citron (*Citrus Medica*, Linn.), which is imported and used by them for religious ceremonies connected with the Feast of the Tabernacles. The etrog and the lulab (palm leaf with myrtle and willow branches) are carried and waved during the services, especially those of thanksgiving. Since the time of the anti-Jewish demonstrations in Corfu in 1891, the etrog is imported more largely from Palestine than from that island. In addition to the use of the etrog by orthodox Jews for religious ceremonials, the natives of Palestine make salads of the fruit. See *Citron*.

WALTER T. SWINGLE.

EUCALÝPTUS (Greek, *eu*, well; *kalypto*, to cover as with a lid: the petals and usually also the calyx-limb fused and covering the flower before anthesis, then falling off in the form of a lid, or cover). *Myrtàceæ*. GUM-TREE. Plate XXXIX. Mostly trees, frequently of immense size, a few of the alpine and sub-alpine species shrubby, much grown in California and the Southwest for their ornamental value, as windbreaks and avenue trees, for fuel, and especially for their timber.

Leaves simple, entire; in the seedlings and on young shoots of many species horizontal, opposite, sessile, and cordate; in the adult mostly vertical, alternate, petiolate (rarely opposite and sessile), and varying from roundish to lanceolate-acuminate and falcate; always rigid, penniveined, glabrous except rarely on the young shoots, sometimes covered with a glaucous wax: fls. white, rarely yellowish or some shade of red, in umbels of 3 to many, rarely solitary, the umbels solitary and axillary or paniculate or corymbose; calyx-tube obconical, campanulate, ovoid, or oblong, adnate to the ovary at the base; petals and calyx-lobes connate, forming a lid, or cap, which separates from the calyx-tube by a circumscissile dehiscence; lid sometimes plainly double, the outer cap then derived from the calyx-limb, the inner cap from the petals; stamens numerous; anthers small; style undivided: fr. a caps. partially or wholly inclosed in the adherent calyx-tube, opening at the top by 3–6 valves; seeds numerous, small, mostly angular.—About 300 species, all native of Austral. and the Malayan region. Related to Angophora and to Syncarpia, but distinguished by the absence of distinct petals.

The genus Eucalyptus was monographed in part by Baron von Mueller in his Eucalyptographia (cited here as F. v. M. Eucal.), in which 100 species are illustrated (1879–84). The genus is now receiving exhaustive treatment by J. H. Maiden in his "Critical Revision of the Genus Eucalyptus," appearing in parts, with numerous plates. This author also furnishes the best information regarding the uses and timber of the various species, in his "Native Useful Plants of Australia." Bentham described 135 species in his "Flora Australiensis," vol. 3 (1866). The Australasian Association for the Advancement of Science published a very useful key by J. G. Luehmann in 1898. The most exhaustive American work on the genus is United States Forestry Bulletin No. 35, "Eucalypts Cultivated in the United States," by A. J. McClatchie. University of California Agricultural Experiment Station Bulletin No. 196, by Norman D. Ingham, is a practical guide for planters, with descriptions of the more important species. The United States Forest Service, the California Station, and the California State Board of Forestry have all issued smaller bulletins on this subject. Inflated claims have been made for eucalyptus culture, and authentic publications should be secured if one contemplates planting them extensively.

Eucalyptus is a group adapted to semi-tropical and warm temperate regions. But few species are really hardy. *E. globulus* has been very widely distributed over the globe through the persevering efforts of the late Baron von Mueller; it is frequently planted in the malarial regions of warm climates, as at the Campagna at Rome, with very beneficial effect. (Sanitarians will be interested in "Eucalyptus in Algeria and Tunisia, from an Hygienic and Climatological Point of View," by Edward Pepper, Proc. Amer. Phil. Soc. 35:39–56.) In England, the same species is grown extensively for subtropical gardening, on account of its distinctive glaucous hue and symmetrical growth, but in that climate it needs the protection of glass in winter.

This is by far the most important genus of timber trees introduced into California. The ordinary blue-gum, *E. globulus*, has been grown in large numbers and is still the favorite for general planting. Its hard and durable wood is replacing oak and hickory to some extent for insulator pins, wheel-wrights' work, flooring, tool-handles, and furniture. Although pale in color, it takes a good polish, possesses a beautiful grain, and is readily stained. Furniture made from blue-gum wood and properly stained has every appearance of mahogany. The chief drawback to the use of eucalyptus for lumber is the tendency of its logs to end-check while curing, thus involving considerable waste. As a windbreak and fuel tree it is unsurpassed, since it is of rapid, erect growth and the timber is easily split. Its foliage has been distilled in large quantities for the oil it contains, practically all of the eucalyptus oil now sold in the United States coming from home-grown trees.

In addition to the blue-gum, *E. rostrata* and especially *E. tereticornis* are grown for railroad ties, piling, interior finish and furniture. *E. resinifera* is a hardy eucalypt yielding a good timber not so liable to check as that of some others; it has been but little grown in America thus far. *E. corynocalyx* is a good drought-resistant species for districts with mild winters, and its wood is of the best. *E. crebra* will grow under a greater range of conditions than perhaps any other and is especially suited to the hot and dry interior valleys. Other drought-resistant eucalypts are *E. microtheca* and *E. polyanthemos*, while the most resistant to frost are *E. crebra*, *E. rostrata*, *E. tereticornis*, *E. globulus*, *E. viminalis*, *E. rudis*, *E. robusta*, and *E. resinifera*. The species most cultivated as ornamentals are *E. ficifolia*, *E. leucoxylon*, *E. sideroxylon* var. *rosea*, *E. Risdonii*, *E. erythronema* and *E. polyanthemos*. Persistently repeated accounts of heights ranging from 325 to 500 feet for certain eucalypts are erroneous, as indicated under *E. amygdalina* var. *regnans*.

Although the eucalypti are not exclusively, and some species not even prominently horticultural, yet because of the great general interest attached to them and because of their varied uses, it is thought best to discuss them rather fully in this Cyclopedia.

Culture of eucalyptus in California.

The following directions for the propagation of Eucalyptus are adapted very largely from Bulletin No. 196 of the California Experiment Station, entitled "Eucalyptus in California," by Norman D. Ingham (1908).

The necessary conveniences for the propagation of



XXXIX. Eucalyptus viminalis in California.

the seedlings are: seed-boxes or flats, a good soil, seed true to name, plenty of convenient water, and in most localities shade for the young plants. The seeds of most species may be gathered at all times of the year, although the greater amount mature during the summer and fall. The seed-cases should be gathered from the trees when the valves begin to open and placed on sheets of canvas in the direct rays of the sun, which will open the valves, allowing the seed and chaff to fall out. The number of fertile seed to the pound is very high; the average number of transplanted plants raised to the pound is 12,000. Eucalyptus seed will germinate and grow in nearly any soil but the best results are secured when the seeds are sown in a light loam, while a medium loam mixed with about one-quarter well-rotted horse-manure should be used in the transplanting flats.

The time to sow the seed varies somewhat with the locality, but as a general rule the seed should be sown in May or June and the seedlings from these sowings will be large enough to be set out in the field the following spring, if they receive proper care while young. The seed is usually sown broadcast in the seed-flats



1424. Eucalpytus ficifolia (×⅛). No. 2.

and the young plants transplanted once before being set in the field. Some persons take the trouble to sow one seed in a place and space them in the flats; by this method transplanting is unnecessary. Others sow the seeds in hills and practise thinning, instead of transplanting before setting out in the field. This last method is used in the warmer districts with good success, because of the great trouble experienced in transplanting during the hot summer months. Whichever method is used, fill the flats to a depth of 3 or 4 inches with the prepared soil, pressing it down firmly in the boxes, then sow the seeds and cover them to a depth of about ⅛ inch with the same soil, sand, or sawdust, pressing this covering firmly over them. The seed-flats should be kept damp through the heat of the day, until the young plants break the ground, then care must be taken not to use too much water and that there is a good circulation of air over the flats, or damping-off is liable to occur. This disease can be prevented by using practically no water on cloudy days and only in the mornings on clear days. If the seeds are sown broadcast in the flats, when the young plants have reached a height of 2 to 3 inches, they can be transplanted to other flats of prepared soil and spaced from 1¼ to 2 inches apart. The best results in transplanting are secured if the plants are hardened-off for a few days beforehand by checking the water supply, allowing them to become quite dry. The soil into which the young plants are tranplanted should be kept damp, and the plants should be protected from the direct rays of the sun for a few days. The lath-house or the screens are necessary to supply shade for the young plants and will also protect the seeds in flats from the ravages of birds and the young plants from the frosts during winter months, before the time for setting in the field.

The time to set the plants in the field varies with the climatic conditions or localities and whether the plants are to receive irrigation or not. In localities in which frosts are common through the winter months, it is advisable to set the trees out as early in the spring as possible without endangering them to a late frost and still have them receive the benefit of the late rains, so that they will have a full season's growth to withstand the frosts of the following winter. If the trees are to be irrigated, they may be set out later in the season without danger of loss from want of moisture. To insure a good stand, the plants should not be under 6 or over 20 inches in height when set in the field; to a certain extent, the smaller the plants when set out, the better the results afterward, although the size varies somewhat with the species and the locality. In many species the roots are as long if not longer than the plant's own height above ground. This is a family of plants that will not stand a large amount of mutilation to the root-system; consequently better results are secured from setting out small plants.

If the soil is heavy rich loam, the trees may be planted as close as 6 by 6 feet apart unless irrigation is to be practised. In the latter case, 4 by 8 feet would be the right distance, thus leaving an 8-foot space for plowing out the irrigating-ditches each year. If it is a lighter soil on which the planting is to be made, 8 by 8 feet is the proper distance, or 6 by 10 feet, if irrigation is to be practised. The close planting has a tendency to sacrifice the diameter growth in favor of the height, also making more erect trees and forming a perfect canopy with their crowns that will shade the soil, nearly preventing evaporation, as well as any vegetable growth on the forest floor. Close planting matures a greater number of perfect trees, and is especially recommended when straight poles are desired. The plants should be blocked out in the flats before being brought into the field, by drawing a sharp knife between the rows. If care is taken to set out the young plants with this small amount of soil around the rootlets, the shock caused in transplanting is reduced to a minimum. Each planter should carry a trowel, to make the holes that are to receive the young plants at the intersection of the marked lines. These holes should be of such a depth that the plants can be set from ½ to 1 inch lower in the soil than they originally were in the flats. Each plant should have the soil pressed firmly about it and receive a small amount of water, unless the soil is moist from recent rains.

In order to provide a mulch, thus checking evaporation and also to kill the weeds, cultivation should be conducted in the new plantation as long as possible without danger of injuring the young trees by driving a horse between them. The plantings generally may be cultivated for the first season and part of the second before the limbs of the trees spread out and interlap so that it is impossible to drive between the rows. It is an acknowledged fact that the only way to secure a good stand, and give the trees a start, is to cultivate and take care of the plantings from the time of setting out. However, a number of groves have been set out on land that is too hilly or rocky to cultivate and the trees have made fair growths.

Thinning of the young trees is an important practice, as it is not good management to set out just the number of trees that one expects to mature. A planting upon any good soil may with advantage be set out 6 by 6 feet apart (1,210 trees to the acre), and at the end of the first year a rigid thinning should be started, removing with a grub-hoe all weak, inferior, or injured trees. This thinning should be conducted until only the strong and healthy trees, or a certain number,

remain to the acre. By this method some trees will stand at the original distance that they were planted, while others will stand at multiples of that distance. The extra cost of close planting will never be noticed when the largest possible stand of healthy trees is guaranteed, which is practically the case under this method. If thinning is carried out by a set plan, removing every other one or two trees, many strong and healthy trees will be sacrificed. All limbs that have a tendency to deform the trees should be removed each year. After the third or fourth year, the trees will have grown to such a height that to remove the limbs may prove impractical in most cases. At this period (the fourth or fifth year) there enters a new problem: the removal of the poorer trees for wood and stakes to allow the remainder a larger area of soil to draw upon and a greater space above ground to extend their branches. At this time the trees on an acre can be reduced to a certain number, leaving these to grow for telephone poles, ties, and lumber, or the entire grove may be cut for stakes and wood.

Second-growth eucalyptus. — In three to six weeks after the trees have been felled, the sprouts will start out from the stumps. These sprouts are produced in abundance and if properly thinned will soon replace the cut forest, thus providing a second growth of fuel or timber in much less time than was required with the original grove. These remarks apply probably to all species of eucalyptus, certainly to all sorts experimented with in California up to the present time.

Taxonomy of the cultivated eucalypti.

All of the keys used for the identification of species are more or less artificial. No satisfactory natural classification has yet been devised. While the following key is designed to aid in the making of determinations rather than to express relationships, species known to be closely related are placed near each other in the text so far as this can be conveniently done. For the ready determination of species in this critical genus, it is necessary to have adult leaves, buds, flowers, and mature fruit; immature fruits are often very misleading. Allowance should always be made for extreme forms, since only normal specimens are here described. This applies particularly to size of leaves. Unless otherwise stated, the leaf description is drawn from foliage on mature stems. The juvenile foliage, i.e., on young seedlings and on suckers, is usually very different, the leaves often broader, blunt, sessile, and of a different color.

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KEY TO THE SPECIES.

A. *Fls. mostly in panicles or corymbs, not simple umbels (occasionally the infl. appears to be paniculate in section* AAA *also, owing to dropping of lvs., so that it is well to look for lf.-scars in doubtful cases).*
- B. *Fr. 1½–2 in. long; valves inclosed: fls. large.*
  - C. *Seeds black, not winged: fls. white or pink* ..... 1. **calophylla**
  - CC. *Seeds brown or red, winged: fls. red (pink to crimson or scarlet)* ..... 2. **ficifolia**
- BB. *Fr. ½–1 in. long (¼–½in. in E. maculata); valves inclosed: fls. medium.*
  - C. *Lvs. paler beneath: fls. in terminal corymbs* ..... 3. **corymbosa**
  - CC. *Lvs. of nearly equal color on both sides: fls. in lateral and terminal panicles.*
    - D. *Caps. slightly ribbed: fls. nearly or quite sessile in the clusters* ... 4. **eximia**
    - DD. *Caps. smooth: fls. distinctly stalked* ..... 5. **maculata**
- BBB. *Fr. ¼in. or less long (nearly ½in. in var. of No. 16); valves various: fls. small.*
  - C. *Shape of lvs. orbicular to ovate, often nearly as broad as long.*
    - D. *Petioles slender; lvs. alternate.*
      - E. *Fls. stalked: lvs. dull grayish green* ..... 6. **polyanthemos**
      - EE. *Fls. nearly sessile: lvs. lustrous and dark green* ..... 7. **populifolia**
    - DD. *Petioles none; lvs. opposite* ..... 8. **melanophloia**
  - CC. *Shape of lvs. lanceolate or oblong, elongated.*
    - D. *Lvs. distinctly paler beneath than above.*
      - E. *Fr.-valves included in the calyx-tube* ..... 10. **paniculata**
      - EE. *Fr.-valves exserted* ..... 11. **Raveretiana**
    - DD. *Lvs. of equal color on both sides.*
      - E. *Lid ¼in. or more long, beak-like* ..... 9. **siderophloia**
      - EE. *Lid shorter, not beak-like.*
        - F. *Fr.-valves much exserted, spreading* ..... 12. **microtheca**
        - FF. *Fr.-valves about reaching the rim: lf.-veins very diverging* ..... 13. **crebra**
          14. **leptophleba**
        - FFF. *Fr.-valves wholly included in calyx-tube: lf.-veins very oblique.*
          - G. *Lid hemispheric* ..... 15. **bicolor**
          - GG. *Lid conic* ..... 16. **hemiphloia**

AA. *Fls. solitary in the lf.-axils, or in strictly sessile umbels, large.*
- B. *Lvs. all opposite, cordate at base: shrub.* 17. **macrocarpa**
- BB. *Lvs. mostly alternate, not cordate.*
  - C. *Peduncles ascending, or fls. entirely sessile; lid warty.*
    - D. *Plant a tree: lvs. acute* ..... 18. **globulus**
    - DD. *Plant a shrub: lvs. obtuse, very oblique at base* ..... 19. **alpina**
  - CC. *Peduncles recurved, flat; lid smooth: shrub* ..... 20. **tetraptera**

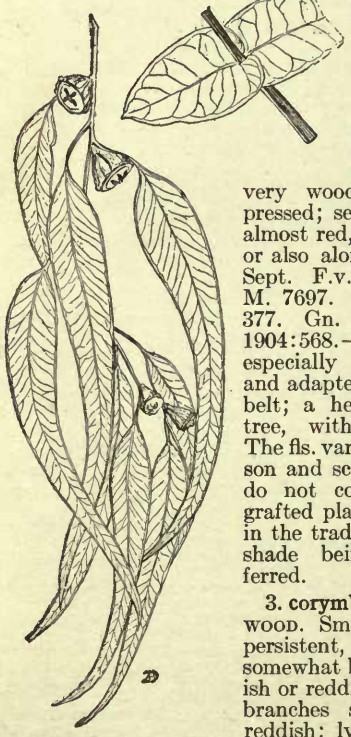
AAA. *Fls. in stalked umbels.*
- B. *Fl.-stalks (either pedicels or peduncles) flattened.*
  - C. *Fr.-valves with teeth projecting well beyond calyx-rim.*
    - D. *Teeth connivent into a cone: lid 1–1½ in. long.*
      - E. *Fr. not embedded in receptacle.* 24. **cornuta**
      - EE. *Fr. partly embedded in receptacle* ..... 25. **Lehmannii**

DD. *Teeth distinct: lid ¾in. or less long.*
E. *Fr. ½–¾in. long: lid about ½in. long.*
F. *The fls. sessile in the umbels: lvs. obtuse*.....26. **platypus**
FF. *The fls. pedicellate: lvs. acute*.....27. **occidentalis**
EE. *Fr. smaller: lid shorter.*
F. *The fls. more than 3 in each umbel.*
G. *Lid much longer than calyx-tube*.....43. **resinifera**
GG. *Lid about as long as calyx-tube*.....41. **punctata**
42. **saligna**
GGG. *Lid much shorter than calyx-tube: fls. sessile*....33. **Cambagei**
FF. *The fls. usually 3 in each umbel*.....52. **viminalis**
CC. *Fr.-valves included or scarcely exserted beyond the calyx-rim (exserted but closely incurved in E. megacarpa and E. gomphocephala).*
D. *Breadth of fr. less than ½in.*
E. *Lid less than half as long as calyx-tube, depressed-hemispheric, blunt.*
F. *Lvs. mostly 2–4 in. long: lid very short.*
G. *Fr. 3–6 lines diam.: lid granular*.....28. **coccifera**
29. **virgata**
GG. *Fr. about 2 lines diam*....40. **microcorys**
FF. *Lvs. mostly 4–8 in. long.*
G. *Veins very oblique; lvs. mostly under 1 in. wide.*
H. *Calyx not angular; outer stamens sterile*.30. **hæmastoma**
31. **Sieberiana**
HH. *Calyx very angular in bud; stamens all perfect*.....32. **goniocalyx**
GG. *Veins at nearly a right-angle to midrib; lvs. thick, more than 1 in. wide*.....34. **botryoides**
EE. *Lid at least half as long as calyx-tube, mostly conic and acute.*
F. *Lvs. ovate-lanceolate, 1½–3 in. wide; lateral veins widely spreading*.....35. **robusta**
FF. *Lvs. lanceolate, ½–1½in. wide; lateral veins oblique.*
G. *The fls. short-stalked.*
H. *Arrangement of lvs. opposite: umbels bent downward*.....70. **doratoxylon**
HH. *Arrangement of lvs. alternate.*
I. *The lid narrowly conic, twice as long as calyx*.....36. **redunca**
II. *The lid broader, not so long*.....37. **pilularis**
38. **Muelleriana**
39. **acmenioides**
41. **punctata**
GG. *The fls. sessile in the umbel: lvs. paler beneath.*42. **saligna**
DD. *Breadth of fr. over ½in.*
E. *Lid not or scarcely broader than calyx-tube.*
F. *Lvs. roundish, obtuse*.....26. **platypus**
FF. *Lvs. lanceolate, acute.*
G. *Calyx-tube and lid very warty*.....18. **globulus**
GG. *Calyx-tube and lid ridged or nearly smooth.*
H. *Caps. sunk in the calyx-tube*.....46. **incrassata**
47. **Planchoniana**
21. **cosmophylla**
HH. *Caps. protruding from calyx-tube*.....48. **megacarpa**
EE. *Lid much broader than calyx-tube*.....49. **gompho-**
BB. *Fl.-stalks cylindric or angular but not flattened.* **[cephala**
C. *Caps. sessile or nearly so in the umbels.*
D. *Fr.-valves with conspicuous projecting teeth.*
E. *Lid 1–1½ in. long, cylindric*....24. **cornuta**
EE. *Lid mostly ¼–½in., conic.*
F. *The fr.-valves merely acute*....50. **rudis**
FF. *The fr.-valves ending in needle-like points*.....51. **decipiens**
EEE. *Lid short, rarely ¼in. long.*
F. *Buds ovoid, smooth.*
G. *Fr. mostly 4-celled: fls. usually 3*.....52. **viminalis**
GG. *Fr. mostly 3-celled: fls. usually more than 3*....53. **Stuartiana**
54. **Macarthuri**
FF. *Buds club-shaped, slender, often rough*.....55. **amygdalina**
DD. *Fr.-valves included, or barely exceeding the rim.*
E. *The fls. 4 or more.*
F. *Lvs. of equal color on both sides.*
G. *Venation of lvs. feathered.*
H. *Fr. ¾–1in. wide: shrub.*61. **buprestium**
HH. *Fr. ¼–½in. wide: trees.*
I. *Buds club-shaped (i.e. widest above the middle), obtuse*.....55. **amygdalina**
56. **Risdonii**
57. **obliqua**
II. *Buds ovoid, acute: fr. contracted at orifice.*44. **piperita**
45. **eugenioides**
GG. *Venation of lvs. longitudinal and almost parallel*.....58. **stellulata**
59. **coriacea**
FF. *Lvs. paler beneath.*
G. *Lid broader than calyx: fr. streaked lengthwise*...60. **corynocalyx**
GG. *Lid not broader than calyx: fr. not streaked*...62. **diversicolor**
EE. *The fls. 1–3 in each umbel.*
F. *Lvs. opposite, heart-shaped at base.*
G. *Calyx obtuse at base: lvs. crenate*.....22. **cordata**
GG. *Calyx tapering at base: lvs. entire*.....23. **pulverulenta**
FF. *Lvs. scattered, narrowed at base.*
G. *Fr. scarcely contracted at orifice*.....21. **cosmophylla**
GG. *Fr. much contracted at orifice*.....61. **buprestium**
CC. *Caps. plainly stalked in the umbels.*
D. *Umbels with more than 3 fls.*
E. *Fr.-valves plainly exserted.*
F. *Fr. flat-topped; valves awl-shaped*.....63. **salmono-**
FF. *Fr. rounded to the valves;* **[phloia**
valves triangular, acute.
G. *Diam. of fr. 2–3 lines*....64. **rostrata**
65. **tereticornis**
GG. *Diam. of fr. 4–6 lines.*
H. *Anthers reniform*.....66. **macrorhyn-**
HH. *Anthers oblong*.....50. **rudis** **[cha**
EE. *Fr.-valves included.*
F. *Fr. scarcely or not at all contracted at orifice.*
G. *Lvs. thick, odorless: fr. ¼in. across*.....67. **Gunnii**
GG. *Lvs. thin: fr. slightly smaller*.....68. **melliodora**
69. **odorata**
FF. *Fr. contracted at orifice.*
G. *Lvs. opposite*.....70. **doratoxylon**
GG. *Lvs. mostly alternate.*
H. *Breadth of fr. about ½in.*

I. *Lid as long as calyx-tube: lf.-veins diverging*.....71. **marginata**
II. *Lid shorter than tube: veins oblique*.....72. **Baileyana**
HH. *Breadth of fr. about ¼in*.....44. **piperita**
45. **eugenioides**
DD. *Umbels only 2- or 3-fld., rarely 4- or 5-fld. (Ironbarks.)*
E. *Peduncles becoming deflexed: fr. pendent*.....73. **erythronema**
EE. *Peduncles not deflexed.*
F. *Bark smooth, light-colored*..74. **leucoxylon**
FF. *Bark rough, persistent.*
G. *Lf.-veins very oblique: bark red*.....75. **sideroxylon**
GG. *Lf.-veins widely spreading: bark grayish*.....76. **longifolia**

1. calophýlla, R. Br. Medium-sized umbrageous tree, with dense foliage: bark dark, corky, deeply furrowed: lvs. ovate-lanceolate, firm and thick; veins nearly parallel and very spreading: fls. large, white or cream-color, rarely pink, in large clusters; lid thin, nearly flat: fr. 1–1½ in. wide, ovate-urnshaped, very thick and woody; seeds large, black, the edges acute but scarcely winged. July–Oct. B.M. 4036 (as *E. splachnicarpa*). F. v. M. Eucal. 10:2. G.C. III. 20:661.—Ornamental tree of rather slow growth, not enduring frost or dry atmosphere. Good shade tree for avenues in the coast districts. The fall bloom is valuable for bees. Bark rich in kino. The wood is tough, useful for wheelwrights' work and for building, but not durable underground. The frs. of this and the next have been polished and used for pipe-bowls.

2. ficifòlia, F. v. M. Crimson-flowered Eucalypt. Fig. 1424. Handsome small tree, rarely to 50 ft.: bark dark, furrowed: lvs. ovate-lanceolate, firm and thick; veins almost transverse: fls. red, large and in large clusters; lid thin, nearly flat: fr. 1–1½ in. wide, broadly urn-shaped, the walls very woody; border compressed; seeds pale brown or almost red, winged on one end or also along one side. Aug., Sept. F.v.M. Eucal. 7:3. B. M. 7697. G.C. III. 42:376, 377. Gn. 71, p. 441. R.H. 1904:568.—Very ornamental, especially in bloom. Tender and adapted only to the lemon belt; a heat-resisting avenue tree, withstanding drought. The fls. vary from pink to crimson and scarlet and the forms do not come true to seed; grafted plants are now offered in the trade, the bright scarlet shade being generally preferred.



1425. Eucalyptus globulus, showing spray of mature foliage (×⅙) and two leaves of sucker foliage. No. 18.

3. corymbòsa, Smith. Bloodwood. Small tree: outer bark persistent, gray and turning somewhat black; inner yellowish or reddish brown; of upper branches smooth and often reddish: lvs. lanceolate, somewhat leathery; lateral veins very numerous, fine, parallel and nearly transverse: fls. yellowish white, fragrant, in large corymbs, the peduncles and pedicels long; lid depressed-hemispherical, short-pointed; stamens becoming 5 or 6 lines long: fr. somewhat urn-shaped, about ½in. wide. Aug.–Dec. F.v.M. Eucal. 5:2.—Tree suitable only for the coast districts. Wood brown or red, durable, and serviceable underground or in water, but rendered inferior by the many gum veins. (Ingham.)

4. exímia, Schau. Mountain Bloodwood. Large tree: bark scaly, brownish or yellowish, smooth only on the younger branches: lvs. falcate-lanceolate, thick; lateral veins parallel and widely spreading but scarcely visible: fls. sessile, in small heads of a panicle, the peduncles angular or flattened; lid nearly hemispherical, pointed; stamens 3–4 lines long: fr. urn-shaped, with thin rim, about ½in. wide through the middle. Oct.–June. F.v.M. Eucal. 9:2.—A stately species with abundant showy bloom. Wood soft; useful only for fuel.

5. maculàta, Hook. Spotted Gum. Handsome tree, to 150 ft., the foliage mostly near the summit: bark smooth, whitish or reddish gray, deciduous in patches, thus exposing lighter areas and giving the trunk a spotted appearance: lvs. lanceolate; veins parallel, rather oblique to the midrib: lid hemispheric, double; fls. short-stalked; stamens 4–5 lines long: fr. globular-urnshaped, thin-rimmed, scarcely ½in. thick. May–July. F.v.M. Eucal. 3:4. Hook. Icon. 619. Maiden, For. Fl. N.S.W. 7:27.—Timber valuable for shipbuilders and used especially in coach factories and for handles; wood hard, light-colored, close-grained: growth fairly rapid.

Var. **citriodòra,** Bailey (*E. citriodòra,* Hook.). Lemon-scented Gum. Like the species but foliage strongly lemon-scented.—A favorite ornamental tree in the warmer parts of Calif.: subject to frost: young plants useful for window or cool greenhouse cult. The oil is clear white and of a pleasing, penetrating odor, used especially as a perfume for soap.

6. polyánthemos, Schau. Red Box. Australian Beech. Well-branched often irregular and picturesque tree, 40–150 ft.: bark brown or gray, persistent, rough on old trees: lvs. orbicular to ovate, mostly 2–4 in. long by 1½–3 in. wide, rarely oval-lanceolate and scarcely 1 in. wide, dull and grayish green on both sides: fls. small, white, stalked, in close panicles; stamens 1 or 2 lines long, the outer ones sterile: fr. goblet-shaped, not contracted at orifice, 2–3 lines across, the valves not exserted. Jan.–April. F.v.M. Eucal. 3:9. Maiden, Crit. Rev. Eucal. 58, 59 (figs. 1–3).—Useful for ornamental planting, because of its spreading habit, characteristic silvery foliage, and profuse bloom; also for windbreaks, for fuel, and for bees: timber exceedingly hard and durable, but sts. become hollow in age in Austral. A drought- and heat-resistant species: endures minimum temperatures of 15–20°: of only fairly rapid growth.

7. populifòlia, Hook. Poplar Box. Compact straight-growing tree: bark rough to the branchlets: lvs. ovate or roundish, rarely lanceolate, 4 in. or less long, very lustrous and intensely green on both sides: fls. small, white, on very short stalks, the umbels paniculate; stamens 1–2 lines long, all fertile: fr. very small, semi-ovate, the valves inclosed. Hook. Icon. 879. Maiden, Crit. Rev. Eucal. 58 (figs. 11–18).—Probably as useful and adapted to as wide a variety of conditions as the closely related *E. polyanthemos.*

8. melanophlòia, F. v. M. Silver-leaved Ironbark. Small tree: bark persistent, dark, furrowed: lvs. sessile, orbicular to ovate-lanceolate, glaucous or white-mealy: fls. small, in terminal or axillary corymbs: fr. truncate-globular, 2–3 lines across; rim thin; valves included or slightly exserted.

9. siderophlòia, Benth. Broad-leaved Ironbark. Tall tree: bark wholly persistent on old trunks, rough and deeply furrowed; furrows yellowish or dark brown;

ridges broader than in other ironbarks: lvs. 4–7 in. long: lid beak-like, very acute, ¼–½in. long; stamens about 3 lines long; anthers minute, globular, opening by oblong slits: fr. obovoid, truncate, about ¼in. across, the valves slightly protruding. Oct., Nov. F.v.M. Eucal. 4:8. Maiden, Crit. Rev. Eucal. 47 (figs. 19–33).—Wood heavy, strong, and durable, useful for wagon work, tool-handles, building, posts, poles, and the like. Fls. provide honey for bees. Tree of rapid growth and resistant to extremes of temperature: grown in the San Joaquin Valley.

10. **paniculàta,** Smith. White Ironbark. Red Ironbark. Tall or medium-sized tree: bark hard, persistent, deeply furrowed, of a grayish brown color: lvs. lanceolate, acuminate, 3–5 in. long: fls. in panicles or sometimes in axillary umbels; lid variable; stamens 2–4 lines long, the outer ones sterile; stigma dilated: fr. truncate-ovate, pedicelled, 2–4 lines wide, with thin rim. Summer. F.v.M. Eucal. 5:8. Maiden, Crit. Rev. Eucal. 57 (figs. 8–21).—Wood usually very pale, but variable; the hardest of ironbarks; "cuts almost like horn:" valuable for railroad-ties, fencing, and building purposes. Does not endure heat and drought: much prized in Austral., but trees in Calif. are not promising.

11. **Raveretiàna,** F. v. M. Tall tree with thin angular branchlets: bark deciduous, leaving the branches smooth and gray, but often persistent on the trunk: lvs. lanceolate, opaque, 3–5 in. long: fls. exceedingly small, white, short-stalked; lid slenderly conic, under 2 lines long; stamens not 2 lines long; anthers reniform, opening by longitudinal slits: fr. little over 1 line wide, low-cup-shaped, the protruding valves forming a hemispheric summit. F.v.M. Eucal. 1:8. Maiden, Crit. Rev. Eucal. 53 (figs. 1–3).

12. **microthèca,** F. v. M. Tree, becoming 80 ft. high: bark rough, gray, persistent, or the outer layers deciduous, leaving the trunk smooth: lvs. narrowly lanceolate, 4–6 in. long: lid broad-conic; stamens very short; anthers minute, roundish, opening by longitudinal slits: fr. scarcely ¼in. wide; valves fully half-protruding. F.v.M. Eucal. 10:6. Maiden, Crit. Rev. Eucal. 52 (figs. 16–22).—Not yet fully tested in Amer.: endures frost and heat: recommended as a forest cover for the hot dry region of the S. W.: the roots yield water to natives and travelers on the Australian deserts. Wood beautifully colored but perhaps too hard for cabinet work.

13. **crèbra,** F. v. M. Narrow-leaved Ironbark. Small to large tree, with slender drooping branchlets: bark persistent throughout, hard, dark, ridged and deeply furrowed: lvs. pale, narrow, linear-lanceolate; lateral veins fine, nearly parallel, widely diverging from the midrib: lid conical or nearly hemispheric, not over 2 lines long; stamens 1 or 2 lines long, inflexed in bud; anthers globular, opening by longitudinal slits: fr. obovoid-truncate, not over 2 lines wide, the tips of the valves not or scarcely exserted. F.v.M. Eucal. 5:3. Maiden, Crit. Rev. Eucal. 53 (figs. 4–9).—A rapidly growing frost-resistant tree of picturesque habit: endures minimum temperatures of 18–20° and maximum temperatures of 110–118° (McClatchie), not very resistant to alkali (Loughridge). Grown in Calif. for its hard durable wood, of a reddish color. Bark sometimes described as grayish and deciduous.

14. **leptophlèba,** F. v. M. Characters as in *E. crebra,* but fls. somewhat larger and fr. 3 or 4 lines wide: lvs. of a silky sheen.—This has been classed as a var. of *E. drepanophylla,* F.v.M., but the two are now known to be identical and *E. leptophleba* is the older name.

15. **bícolor,** A. Cunn. (*E. largiflòrens,* F. v. M.). Black Box. Shrub or small tree, with drooping branches: bark persistent, rough and hard: lvs. lanceolate, 5 in. or less long; lateral veins at an acute angle to midrib: lid double, the inner one hemispheric; stamens 1 or 2 lines long; anthers opening by lateral pores: fr. truncate-ovate, about 2 lines wide, the valves inclosed but not distant from the thin rim. F.v.M. Eucal. 5:7. Maiden, Crit. Rev. Eucal. 49 (figs. 5–13), 51 (figs. 9–19).—Timber hard, tough, and durable, rather



1426. Eucalyptus globulus. Shoots on a young plant. (×⅓) No. 18.

easily worked: suitable for ties, piles, shafts, poles, cogs, and the like.

16. **hemiphlòia,** F. v. M. Australian Gray Box. Tree, 90 ft. or less high: bark of trunk persistent, solid, grayish and somewhat wrinkled; of branches deciduous in flakes or long strips: lvs. lanceolate-falcate to ovate-lanceolate, 3–5 in. long, thick and rigid, often ashy gray; lateral veins distant, diverging at a very acute angle: lid conical; stamens pale, about 2 lines long; anthers globular, opening by lateral pores: fr. ovoid-oblong, truncate and slightly contracted at orifice, about 3 lines wide. F.v.M. Eucal. 5:5. Maiden, Crit. Rev. Eucal. 50 (figs. 1–6).—Useful as a shade tree because of its dense foliage; also for fuel and as pasturage for bees. Wood hard, tough, and durable.

Var. **álbens,** F. v. M. (*E. álbens,* Miq.). White Box. Bark dull green, persistent: lvs. glaucous or white-mealy: buds chalk-white: fr. larger.

17. **macrocárpa,** Hook. Stout shrub, 6–15 ft., usually white-mealy: lvs. all opposite, sessile, cordate-ovate: fls. orange-colored to crimson, very large, solitary; calyx-tube smooth or obscurely ridged; lid conical, longer than the tube; stamens about 1 in. long: fr. depressed-hemispherical, 1¼–3 in. across, with raised rim and broad protruding valves. Hook. Icon. 405–407. B.M. 4333. F.v.M. Eucal. 8:4. Maiden, Crit. Rev. Eucal. 77 (figs. 1–3).—Desirable ornamental because of its glaucous foliage and brilliant bloom: grown sparingly in S. Calif.

18. **glóbulus,** Labill. Blue Gum. Figs. 1425–1427. Tree, 300 ft. or less high: bark deciduous in long thin strips or sheets, leaving the trunk smooth and grayish or bluish white except at base: lvs. lanceolate, thick, often ½–1 ft. long; those on young shoots and seedlings opposite, sessile, broad, and white-mealy: fls. solitary or 2 or 3 together, closely sessile or on a short peduncle; calyx-tube and lid warty, covered with bluish white wax; stamens above ½in. long: fr. angular, ¾–1 in. across, the flat valves not pro-

truding. Dec.–May. F.v.M. Eucal. 6:2. G.C. II. 15:601; III. 2:777, 784; 10:737. Gn. 71, p. 18; 75, p. 606. Maiden, Crit. Rev. Eucal. 79 (figs. 1–12).—The best species for general planting: extensively used in Calif. Its combination of rapidity of growth, straightness of trunk, great strength of wood, and its known ability to flourish under a wide range of conditions in Calif., give it a great advantage over any other species (Ingham). Wood stronger than that of *E. rostrata* and *E. tereticornis*, yellowish white, easily stained, not durable in the soil in Calif.: used there for insulator pins, spokes, felloes, whiffle-trees, handles, flooring and interior finish; a good species for fuel: logs check badly in curing, this much less in the so-called "San José blue-gum" or "re-enforced gum" which, however, is thought by some to be only a selection of the best trees of ordinary blue-gum. Lvs. distilled for oil: fls. yield much honey to bees, but because of its pronounced flavor there is little or no demand for it in retail trade (Richter). Endures minimum temperatures of 25° and high temperatures of the San Joaquin and Sacramento Valleys but not of the desert districts: resists considerable drought when once established but best development is attained only on good and fairly deep soil. Fig. 1427 shows the stamens and the structure of the bud. Nos. 1–4 are half natural size; 5 is on a larger scale. No. 4 is a section of a bud.



1427. Eucalyptus globulus. No. 18.

Var. **compácta,** Hort. DWARF BLUE GUM. Densely branched from the ground, forming a symmetrical rounded compact tree: lower foliage as in young growth of *E. globulus* but smaller with the longer narrower lvs. only near the top.—Said to have originated near Niles, Calif., from seed of the ordinary blue-gum (Calif. Nursery Co.).

The specific name *globulus* is sometimes written with a capital G, because it is a noun rather than an adjective; but the initial letter is here written in lower case in accordance with a recommendation of the International Botanical Congress.

19. **alpìna,** Lindl. Shrub, 12 ft. high: lvs. inequilaterally semi-ovate, blunt, acute on young shoots, 2–4 in. long, thick and leathery: fls. sessile in the lf.-axils, solitary or few: fr. hemispherical, ¾–1 in. wide, not angular; rim broad; valves protruding. Sept.–Nov. F.v.M. Eucal. 2:1.

20. **tetráptera,** Turcz. Shrub or small tree: branches often sharply angled: lvs. very thick, oblong-lanceolate: fls. solitary, on flat recurved peduncles; lid 4-angled, much shorter than calyx; stamens not over ½in. long: fr. prominently 4-angled, 2–3 in. long, ¾–1 in. wide, the valves well inclosed. F.v.M. Eucal. 2:10.—Highly ornamental; once grown at Santa Monica, according to Kinney who says that the calyx-tube and stalk just before the lid falls become a brilliant crimson and are by far the most striking part of the fl.

21. **cosmophýlla,** F.v.M. Tall shrub or small tree: bark smooth, ash-colored: lvs. broad-lanceolate, 3–5 in. long, very thick and rigid: peduncles almost 0; lid hard, low-hemispheric, blunt or short-pointed; stamens 4–6 lines long; anthers ovate, opening by distinct parallel slits: fr. globose-truncate, not contracted at orifice, smooth, 7–8 lines across; rim thick. F.v.M. Eucal. 7:2.

22. **cordàta,** Labill. Small tree, to 50 ft.: lvs. opposite, sessile, orbicular to ovate, somewhat crenate, rarely over 3 in. long, usually white-mealy, as also the infl.: calyx broadly campanulate, obtuse at base, smooth; lid low-hemispherical, obtuse or with sharp tip, shorter than tube; stamens 3–4 lines long; anthers opening by parallel slits: fr. globular-truncate, hard, 4–6 lines thick; valves rarely protruding. F.v.M. Eucal. 8:1. B.M. 7835. G.C. III. 3:803; 30:456; 47:168.—Useful mainly as an ornamental.

23. **pulverulènta,** Sims. Lvs. always entire: calyx-tube turbinate, tapering to the base; lid variable, mostly conical: otherwise about as in *E. cordata.* F.v.M. Eucal. 8:7. B.M. 2087. Gn. 75, p. 140.—The very blue foliage supplies a pleasing contrast for ornamental planting.

24. **cornùta,** Labill. YATE TREE. Moderate-sized or large tree, usually low-branched and spreading: bark either deciduous in irregular sheets or persistent and rough: lvs. oblong or broad-lanceolate, often obtuse, 2–5 in. long: fls. greenish yellow, numerous, in dense heads; lid cylindric, horn-like, 1–1½ in. long; stamens 1½–2 in. long: fr. short-cylindric, 4–5 lines wide; valves much exserted and connivent into a beak-like projection. June–Oct. F.v.M. Eucal. 9:1. B.M. 6140 (lid too highly colored).—Used successfully as a roadside tree in S. Calif.: especially good as a shade tree: adapted to the lemon belt, and tolerating alkaline and saline soils (Franceschi). Timber hard, heavy, tough, and elastic.

25. **Lêhmannii,** Preiss (*E. cornùta* var. *symphiocárpa,* Auct. *E. macrocèra,* Turcz.). Perhaps only a form of *E. cornuta:* lvs. more often short and obtuse: fr. half immersed in the receptacle, forming a solid woody mass. June–Oct.

26. **plátypus,** Hook. (*E. obcordàta,* Turcz.). Tall shrub or small tree: bark smooth, grayish: lvs. petioled, oval to obcordate, very obtuse, 1–2½ in. long, leathery and shining: peduncles winged, recurved; fls. dull red or yellowish white, not conspicuous; lid conic-cylindric, much narrower than the prominently angled calyx-tube; stamens ½–¾in. long: fr. truncate-ovate, very angular, 4–7 lines thick. F.v.M. Eucal. 7:6. Hook. Icon. 849.

27. **occidentàlis,** Endl. FLAT-TOPPED YATE. Spreading shrub or medium-sized tree: bark deciduous, smooth, or somewhat persistent and rough: lvs. lanceolate, acuminate, 1½–5 in. long: lid cylindric-conic, ½–¾in. long; stamens yellowish or orange, ½–¾in. long: fr. bell-shaped, with spreading rim, 5 lines wide; valves exserted, sharp. Oct.–May. F.v.M. Eucal. 6:5.—Suited to the coast districts; subject to frost.

28. **coccífera,** Hook. Small glaucous tree with smooth white bark: lvs. lanceolate, thick and shining, often tipped by a slender curved mucro: fls. nearly sessile, in close terminal clusters; calyx prominently angled; lid very short and flat, rugose; stamens about 3 lines long, all perfect; anthers reniform, opening by divergent slits: fr. obovoid-truncate, 4–6 lines across. B.M. 4637. G.C. II. 12:113; 13:395; III. 2:787, 789; 3:799, 801; 9:169. Gn. 71 p. 591. Maiden, Crit. Rev. Eucal. 28 (figs. 3–5).—A high-mountain form compared by some to *E. amygdalina* but recognized by the depressed lid and longer calyx. Of value as an ornamental: a very hardy species suitable for the foothill districts.

29. **virgàta,** Sieb. Shrub or small tree with stringy bark: lvs. lanceolate, thick and shining: calyx not angled; lid conical, granular-roughened, as also the tube; stamens scarcely 2 lines long; anthers reniform, opening by pores which extend into oblong slits: fr. globose-truncate, smooth, 3–6 lines across. Maiden, Crit. Rev. Eucal. 43 (figs. 1, 2).

Var. **stricta,** Maiden (*E. stricta,* Sieb.). Lvs. linear or linear-lanceolate: lid often shortly pointed. Maiden, Crit. Rev. Eucal. 43 (figs. 12–17). F.v.M. Eucal. 10:9. B.M. 7074.

Var. **obtusiflòra,** Maiden (*E. obtusiflòra*, DC.). Lvs. rather broad: lid depressed-hemispheric, very obtuse. Maiden, Crit. Rev. Eucal. 43 (figs. 3–11).

30. **hæmástoma,** Smith. Large tree: bark smooth, mottled, with a few ribbony flakes near the butt: lvs. lanceolate, usually oblique at base, falcate, coriaceous: fls. pedicelled, clavate in bud; lid very short; stamens 2–3 lines long; anthers of the perfect ones reniform, opening by short divergent slits: fr. ovate-truncate, with reddish rim, 3–4 lines across; valves sometimes slightly protruding, but soon deciduous. F.v.M. Eucal. 2:3. Maiden, Crit. Rev. Eucal. 46 (figs. 10–17), 47 (figs. 1–18).—Said to thrive on poor, sandy soil: perhaps not suited to dry interior valleys. Timber of inferior quality.

31. **Sieberiàna,** F. v. M. Scarcely distinguishable from *E. hæmastoma* save by the bark, which on the trunk is furrowed, becoming dark, rugged, and stringy: foliage emits a slight peppermint-like odor when crushed in the warm hand. F.v.M. Eucal. 2:9. Maiden, Crit. Rev. Eucal. 45 (figs. 10–15).—Bark yields a very soluble kino.

32. **goniocàlyx,** F. v. M. Mountain Gum. Bastard Box Tree. Tall tree: bark rough, tardily deciduous: lvs. lanceolate, usually falcate, of pale color: pedicels very short and angular, or fls. usually sessile; lid conical or hemispherical; stamens about 3 lines long, inflexed in bud; anthers ovate, opening by parallel slits: fr. ovoid-truncate, 3–4 lines across; valves about on a level with the rim. July, Aug. F.v.M. Eucal. 1:3. Maiden, For. Fl. N.S.W. 19.—Timber especially esteemed for wheelwrights' work: also used for house-building, fence-rails, railroad-ties, and so on: excellent for fuel. Grows well in the coast districts of S. Calif. A promising species for the mountains of the S. W., at moderate altitudes.

33. **Cambàgei,** Deane & Maiden. Bundy. Small or medium-sized tree: bark fibrous and matted throughout: lvs. lanceolate, elongated: fls. sessile; calyx-tube with 2–4 prominent angles; lid shortly pointed or hemispherical; stamens about 3 lines long: fr. ovoid-truncate. —A recently intro. species related to *E. goniocalyx* but with plainly exserted valves and thicker, flatter peduncles. Aside from shape of buds and peduncles it resembles *E. Stuartiana*.

34. **botryoìdes,** Smith. Tall handsome tree: bark rough, furrowed, persistent on trunks: lvs. lanceolate, acuminate with very diverging parallel veins, paler beneath: fls. sessile or nearly so; lid variable; stamens about 3 lines long, inflected in the bud; anthers ovoid-oblong, with parallel cells: fr. obovoid-oblong, slightly contracted at orifice, 4–5 lines long, 3–4 lines wide; valves wholly inclosed. Sept., Oct. F.v.M. Eucal. 4:2.—This tree has beautiful dark green horizontal foliage. Useful for windbreaks and as a shade tree. Suited to the coast districts only. Timber hard, tough, and durable; used in Austral. especially for felloes.

35. **robústa,** Smith. Swamp Mahogany. Handsome symmetrically branched tree of moderate height: bark of trunk persistent, rough, dark brown; of the branches reddish: lvs. oval-lanceolate, long-pointed, 3–7 in. long, 1½–3 in. wide, dark green, coriaceous; veins spreading almost at right angles to midrib: lid acute, about as long as calyx-tube; stamens 4–6 lines long; anthers with parallel cells: fr. goblet-shaped, becoming nearly ½in. across, the rim thin and caps. much sunk. Oct.–March. F.v.M. Eucal. 7:8.—Formerly much planted in Calif. as a street tree, but the tops break down in strong winds, due to the heavy foliage and brittle wood; now almost discarded for this purpose: a profuse bloomer, especially valuable for bees: wood brittle but durable. Best adapted to moist coast districts but also flourishes in the interior valleys when given sufficient water: suggested for the coast of the Gulf of Mexico in districts free from heavy frosts.

36. **redúnca,** Schau. Shrub or small tree, to 120 ft.: bark smooth, white: lvs. oblong-lanceolate, rather obtuse, 3 in. or less long, not paler beneath: lid conical, acuminate, about twice as long as calyx-tube; stamens 3–4 lines long; anthers opening by parallel slits: fr. obovoid, about 3 lines thick. F.v.M. Eucal. 10:7.—Grows on cold flats of comparatively poor soil in Austral. Timber tough, heavy, and durable; prized for wheelwrights' work.

37. **pilulàris,** Smith. Blackbutt. Slender tree, averaging 100–150 ft.: bark of trunk persistent, or flaking off above, blackish gray outside, somewhat fibrous and brownish inside; of branches smooth, gray or whitish: lvs. mostly lanceolate, falcate, acuminate, 3–6 in. long, rather less shining below than above: lid broadly conical at base, attenuate; stamens 2–3 lines long; anthers reniform, opening by divergent slits: fr. subglobose, truncate, 4–5 lines thick; valves completely inclosed to slightly exserted. F.v.M. Eucal. 3:7. Maiden, Crit. Rev. Eucal. 1, 3, 4.—Timber strong and durable: useful for general building and especially for telegraph poles, posts, and the like: reported as a good honey-producer. Does not thrive in the hot dry interior valleys: subject to extremes of temperature.

38. **Muelleriàna,** Howitt. Yellow Stringybark. Perhaps only a var. of *E. pilularis:* bark more fibrous or stringy, the inner bark yellow and imparting a yellow stain to the wood: juvenile lvs. often with tufts of hairs; adult lvs. glossy above: lid blunt or slightly pointed: fr. typically 6 lines thick. Maiden, Crit. Rev. Eucal. 2, 38 (in part).—Forms with scarcely flattened peduncles approach *E. eugenioides*.

39. **acmenioìdes,** Schau. (*E. triántha*, Linn. *E. pilulàris* var. *acmenioìdes*, Benth.). White Mahogany Gum. Tall tree: bark persistent and fibrous on trunk and branches: lvs. paler beneath, sinuate: peduncles not much compressed, slender; pedicels sometimes 2 or 3 lines long: fr. not exceeding 3 or 4 lines in diam.; rim thin: otherwise as in *E. pilularis*. F.v.M. Eucal. 10:1. Maiden, Crit. Rev. Eucal. 42.—Grows in poor, well-drained soil in Austral. Timber heavy, strong, and durable; good for palings, rails and floor-boards.

40. **microcòrys,** F. v. M. Tallow-wood Gum. Tall tree: bark persistent, wrinkled: lvs. broadly lanceolate, acuminate, thin, copiously dotted with oil-glands, much paler and opaque beneath: fls. distinctly pedicelled, the buds club-shaped; lid depressed-hemispherical; stamens about 3 lines long, outer ones sterile; anthers minute, almost heart-shaped, opening by divergent slits: fr. scarcely 2 lines across. F.v.M. Eucal. 2:6. Maiden, Crit. Rev. Eucal. 41 (figs. 6–9).—Timber yellowish; one of the most valuable after ironbark: strong and durable, under or above ground; used by wheelwrights and for flooring, especially for ballrooms; suitable for this latter purpose because of its greasy nature.

41. **punctàta,** DC. Leather-Jacket. Hickory Gum. Beautiful spreading tree, 100 ft. or more high: bark smooth and dark, thick, the outer deciduous in flakes: lvs. thin, narrowly lanceolate, acuminate, lustrous above, slightly paler and marked with oil-dots beneath; lateral veins moderately spreading: peduncles broad, much compressed; pedicels evident, angular, thick; lid ovate-conical; stamens about 3 lines long; anthers opening by parallel slits: fr. 3 or 4 lines wide, not contracted at orifice; valves barely exserted. Aug.–Oct. F.v.M. Eucal. 6:7.—Timber remarkable for its extreme hardness and durability. Grown in S. Calif.; too tender for the San Joaquin Valley.

42. **salígna,** Smith. Tall tree: bark gray and smooth: lvs. lanceolate, with close parallel transverse veins,

much paler beneath: pedicels very short or fls. usually sessile; lid hemispherical, short, pointed; stamens 2–3 lines long, all fertile; anthers ovate, opening by parallel slits: fr. subglobose-truncate, not contracted at orifice; rim narrow; valves more or less protruding, separated from the rim by a narrow groove. F.v.M. Eucal. 2:8. Maiden, For. Fl. N.S.W. 13.—Timber of the best, usually pale red, straight-grained, comparatively easy to work. Prefers rich alluvial soil: probably will not endure severe conditions.

43. **resinífera,** Smith. KINO EUCALYPT. RED MAHOGANY. Erect symmetrical tree: bark of trunk persistent, rough, and fibrous; of branches deciduous: lvs. lanceolate, thick, and almost leathery; oil-dots quite obscure; veins widely spreading from midrib: lid conical; stamens 4–6 lines long; anthers ovate, opening by parallel slits: fr. about 4 lines wide, not contracted at orifice; valves acute, well exserted. F.v.M. Eucal. 1:9.—Apparently endures both cold and drought better than *E. globulus;* requires a rather moist climate. Wood strong and durable, red, but bears no real resemblance to true mahogany; not liable to shrink; lasts well underground.

Var. **grandiflòra,** Benth. Fls. larger, the ovoid buds about 4 lines diam.: fr. 4–6 lines wide, with a raised rim.



1428. Eucalyptus corynocalyx. (×½) No. 60.

44. **piperìta,** Smith. PEPPERMINT STRINGYBARK. Tall tree: bark of the trunk persistent, gray, rough and fibrous; of the branches smooth: lvs. oblique, 2–6 in. long, thin; veins very oblique but obscure; oil-dots copious, transparent: lid broad-conical, acute, about as long as calyx-tube; stamens about 2 lines long; anthers kidney-shaped, opening by divergent slits: fr. globular, ovoid, or urceolate, contracted at orifice, ¼in. across; rim thin, depressed. F.v.M. Eucal. 3:8. Maiden, Crit. Rev. Eucal. 45 (figs. 1–9).—The young foliage emits a strong odor of peppermint when bruised.

45. **eugenioìdes,** Sieb. Closely related to *E. piperita* but seedlings rough-pubescent: lvs. thicker, with more divergent veins and not peppermint-scented: bark strongly fibrous even on the small branches: rim of fr. flat or raised. July, Aug. F.v.M. Eucal. 3:8. Maiden, Crit. Rev. Eucal. 39 (figs. 1, 2), 40 (figs. 2–22).

46. **incrassàta,** Labill. Shrub or small tree, to 25 ft.: lvs. lanceolate or ovate-lanceolate, rather obtuse, mostly 2–4 in. long; veins inconspicuous: calyx-tube ribbed in the common forms; lid thick, hemispheric or short-conic, often abruptly beaked; stamens all inflected in the bud; anthers ovate-oblong, opening by parallel slits: fr. ovoid-cylindric, about ¾in. across; valves often slightly exserted. F.v.M. Eucal. 5:6. Maiden, Crit. Rev. Eucal. 13, 15.—Australian deserts: one of the "mallee."

Var. **angulòsa,** Benth. (*E. angulòsa,* Schau.). Calyx-tube and lid prominently angled or ribbed, but varying much in this respect as well as in size of fls. and frs. Maiden, Crit. Rev. Eucal. 14.

47. **Planchoniàna,** F. v. M. Tree, to 100 ft., with angular branchlets: lvs. lanceolate, acuminate, elongated: lid conical, about as long as the tube, both longitudinally streaked; outer stamens flexuous in bud but only the inner ones incurved; anthers broadly ovate, opening by parallel slits: fr. ovoid-cylindric, truncate, about ¾in. across, the caps. sunk and valves well inclosed. F.v.M. Eucal. 4:6.—A profuse bloomer. Timber heavy, hard, and durable; well adapted for sawing but not easily split.

48. **megacárpa,** F. v. M. Tree, 100 ft. or less high: bark deciduous, smooth, grayish white: lvs. lanceolate, falcate, mostly 4–6 in. long: fls. only 1–3 and sessile in the umbels; lid shortly conical; stamens about ½in. long; anthers ovate-oblong, opening by parallel slits: fr. depressed-globular, thick and hard, ¾–1 in. across; rim convex, continuous with the thick obtuse incurved valves. F.v.M. Eucal. 6:3. Maiden Crit. Rev. Eucal. 78 (figs. 4–8).

49. **gomphocéphala,** DC. TOOART TREE. Tree, 120 ft. or less high: bark persistent, rough but not stringy, becoming dark: lvs. thick, narrowly acuminate, pale green: fls. usually 3–5, sessile; lid globose, very hard and thick; stamens 3–4 lines long; anthers opening by parallel slits: fr. turbinate; rim broad and convex, rounded to the incurved valves. F.v.M. Eucal. 7:4.—Easily distinguishable by the broad lid. Wood of a pale yellowish color: remarkable for hardness and strength, heavy, the grain close and twisted: shrinks but little and does not check while seasoning: suitable for large scantlings and for use where exposed to great heat, as in engine-rooms: one of the strongest woods known. Grows both along the coast and in the dry interior valleys: one of the most alkali-resistant species.

50. **rùdis,** Endl. DESERT GUM. Tree, 100 ft. or less: bark gray, persistent, rough, but not deeply furrowed: lvs. broadly to narrowly lanceolate, mostly ¾–2¼ in. wide: peduncles ⅓–1 in. long; pedicels short; lid conical, not beaked, about as long as calyx-tube; stamens 3–4 lines long; anthers opening by parallel slits: fr. broadly turbinate, 4–5 lines across; rim only slightly ascending. F.v.M. Eucal. 10:8.—Stands drought and extremes of temperature better than most other species: endures minimum temperatures of 15–18°: suitable for most situations in the S. W.: successfully used as an avenue tree and for windbreaks at Fresno, Calif. Timber probably of value only for posts and for fuel.

51. **decípiens,** Endl. Straggly shrub, or tree to 70 ft.: bark rough, persistent, fragile: lvs. ovate to lanceolate, 2¼–4½ in. long, seldom over ¾in. wide: peduncles ¼–½in. long; pedicels 0; lid conical, often twice as long as calyx-tube; anthers very small, globular, opening by pores which become longitudinal slits: fr. broadly turbinate or globose, 3–4 lines across; valves awl-shaped. F.v.M. Eucal. 10:3. Maiden, Crit. Rev. Eucal. 63 (figs. 1–12).

52. **viminàlis,** Labill. MANNA GUM. Plate XXXIX. Graceful tree, to 300 ft., the branchlets pendulous: bark either persistent, roughish, and dark-colored (never fibrous), or deciduous, very smooth, and grayish white: seedling lvs. lanceolate; mature lvs. lanceolate, acuminate, somewhat falcate: fls. usually 3, rarely 6–8, sessile or on very short pedicels; lid semi-ovate, mostly short-pointed; stamens about 3 lines

long; anthers ovate, opening by parallel slits: fr. subglobose-truncate, 3–5 lines across; rim flat or rounded; valves triangular, acute. May–Aug. F.v.M. Eucal. 10:10. G.C. III. 4:597.—A hardy species, grown as far north as Chico, Calif.: ranks next to *E. globulus* in rapidity of growth. Timber not so strong as that of many other sorts but of average value for fuel, and can be grown under conditions in which more valuable species would not survive or would make only an inferior growth. A good bee tree.

53. **Stuartiàna,** F. v. M. Apple-scented Gum. Tall branching tree, with dense drooping foliage: closely related to *E. viminalis,* and distinguishable from the latter, when this has more than 3 fls. in an umbel, by the fibrous bark, roundish seedling lvs. and somewhat smaller fls.: pedicels almost 0; buds angular; lid almost hemispherical, or shortly and bluntly conical. Feb.–May. F.v.M. Eucal. 4:9.

54. **Macárthuri,** Deane & Maiden. Bark rough, "very woolly:" seedling lvs. linear-lanceolate, slightly cordate, strictly opposite; mature lvs. narrow, lanceolate: fls. 4–8, distinctly pedicelled; buds ovoid, smooth, very small: fr. semi-ovate, scarcely 3 lines across.—Related to *E. viminalis* and to *E. Stuartiana:* distinguished from the latter by the smooth slender-pedicelled buds and from both by the smaller fls. and frs.

55. **amygdálina,** Labill. Peppermint Gum. Tree, the tallest of the genus (var *regnans*): bark persistent on trunk and lower branches, fibrous: lvs. lanceolate, not noticeably oblique at base, 2–4 in. long; veins oblique; oil-dots large, not very numerous: fls. many and crowded in the umbels; buds clavate, often rough; lid hemispherical, very obtuse, shorter than the calyx-tube; stamens under 2 lines long; anthers kidney-shaped, opening by divergent slits: fr. hemispheric or shortly ovate, truncate, about ¼in. across; rim flat or slightly concave; valves flat or slightly protruding. F.v.M. Eucal. 5:1. B.M. 3260. B.R. 947 (as *E. longifolia*). G.C. III. 6:16. R.H. 1902, p. 83.—Timber of inferior durability and strength. Foliage with odor of peppermint; far richer in oil than any other eucalypt.

Var. **numerôsa,** Maiden (*E. Andreàna,* Naudin). Fls. very numerous, often over 20 in the umbel.

Var. **régnans,** F. v. M. (*E. régnans,* F. v. M.). Giant Gum. Very tall tree (325 ft. or less high): bark usually smooth, whitish, fibrous only near the base: lvs. large, broad-lanceolate, especially those on seedlings broader than in typical *E. amygdalina;* oil-dots very fine, numerous: fr. usually conoid. Maiden, Crit. Rev. Eucal. 33.—Earlier reports of 400–500 ft. for this tree were erroneous (see Melbourne Argus for March 23, 1904, Maiden, Crit. Rev. Eucal. p. 183, and G.C. III. 47, p. 69).

Var. **angustifòlia,** F. v. M. (*E. lineàris,* Dehnh.). Graceful, spreading tree: branchlets drooping: lvs. very narrow: fls. numerous in the umbel. Jan.–Apr., and more or less throughout the year. Maiden, Crit. Rev. Eucal. 30 (fig. 5).

56. **Rísdonii,** Hook. f. A beautiful glaucous-foliaged tree 20–50 ft. high, the branches somewhat pendulous: bark flaking off, smooth, not fibrous: early lvs. cordate, connate in pairs; later lvs. either opposite and ovate or alternate and broadly lanceolate, not very oblique at base; veins oblique: buds, fls., and fr. as in *E. amygdalina* but slightly larger. Maiden, Crit. Rev. Eucal. 32 (fig. 1).—A valuable ornamental: all the lvs. commonly opposite and connate.

57. **oblìqua,** L'Her. (*E. fissilis,* F. v. M.). Tall tree: bark persistent even on the branches, grayish, very stringy but rather soft and fragile: lvs. thick, very oblique at base, 4–6 in. long; veins very oblique: lid hemispherical, depressed or somewhat pointed, shorter than the tube; stamens fully 3 lines long, opening by diverging slits: fr. somewhat pear-shaped, truncate, slightly contracted at orifice, ¼–½in. across; rim broad and concave: caps. well sunk. March–Aug. F.v.M. Eucal. 3:5. Maiden, Crit. Rev. Eucal. 5–8.—Will grow on poor soil but does not endure severe drought. Much valued in Austral. for bees: wood used only for cheap, rough work.

58. **stellulàta,** Sieb. Small tree: bark becoming black and furrowed, deciduous in layers, smooth above: lvs. elliptic or lanceolate, 2–4 in. long; principal veins almost parallel to the midrib: fls. very small, numerous; buds ovoid, in star-like nearly sessile umbels; lid conic, acute, about equaling the tube; stamens under 2 lines long; anthers reniform, opening by divergent slits: fr. nearly globose, about 2 lines thick. F. v.M. Eucal. 6:9. Maiden, Crit. Rev. Eucal. 25.—Timber of but little value; scarcely used except for fuel.



1429.
Eucalyptus diversicolor. (×½)
No. 62.

59. **coriàcea,** A. Cunn. (*E. pauciflòra,* Sieb.). Tree, often tall, with spreading branches and slender somewhat pendulous twigs: outer bark deciduous; inner bark smooth, pale gray: lvs. ovate-lanceolate or lanceolate, 4–8 in. long, thick, smooth; lateral veins almost parallel to the midrib: fls. 5–10; buds club-shaped; umbels distinctly peduncled; lid hemispheric, obtuse or with a short point, twice or thrice shorter than the tube; stamens 2–3 lines long; anthers reniform, opening by divergent slits: fr. pear-shaped, truncate, 3–4 lines thick. Nov.–Feb. F.v.M. Eucal. 3:6 (as *E. pauciflora*). Maiden, Crit. Rev. Eucal. 26, 27, 28 (figs. 1, 2).—A high-mountain tree and one of the hardiest species. Cattle browse on the foliage in seasons of drought: timber used for fuel and fences; warps badly. Trees sometimes badly affected with scale.

60. **corynocàlyx,** F. v. M. Sugar Gum. Fig. 1428. Tree, to 120 ft.: bark smooth: lvs. elongate-lanceolate; veins oblique: lid almost hemispheric, projecting beyond the calyx-tube; stamens 2–3 lines long; anthers short-oblong, opening by distinct parallel slits: fr. almost egg-shaped, nearly ½in. long by 3–4 lines thick; rim thin; caps. deeply sunk. June–Nov. F.v.M. Eucal. 2:2. G.C. II. 12:593.—A valuable drought-resistant species but does not endure temperatures below 20–25°. Timber close-grained and hard, of a yellowish white color: very durable underground: grown in Calif. for railway ties. An ornamental tree used for roadside planting in S. Calif.: affords much bee pasturage.

61. **bupréstium,** F. v. M. Shrub, to 20 ft.: lvs. narrow, acute, 2–3 in. long: lid hemispherical, obtuse, shorter than calyx-tube; stamens 2–3 lines long; anthers opening by short divergent slits: fr. nearly globular, the orifice much contracted, ¾–1 in. across; rim depressed. July–Oct. F.v.M. Eucal. 6:1.—Valuable for bees.

62. **diversícolor,** F. v. M. (*E. collòsea,* F. v. M. *E. diversícolor* var. *collòsea,* Hort.). Karri. Fig. 1429. Very tall symmetric tree: bark smooth, white: lvs. dark green and shining above; veins very diverging: lid obtusely conical, not wider than calyx-tube; stamens 4 lines long; anthers ovate, opening by parallel slits: fr. ovoid-truncate, about ½in. long by 4–5 lines thick;

rim rather thick; caps. deeply sunk. Feb.–May, and again in Nov. F.v.M. Eucal. 5:4.—Thrives near the coast but does not endure well the dry heat of the interior: too tender for the San Joaquin Valley. A rapid grower, profuse bloomer, and considered a good tree for bees. Timber very hard, durable, of a light red color, and takes a fine polish: suitable for furniture, wagon work, ties, and general construction.

63. **salmonophlòia,** F. v. M. Finally tall: lvs. narrowly lanceolate, 2–5 in. long, shining; oil-dots copious: lid broadly conical, slightly longer than the tube; anthers roundish, opening by parallel slits: fr. semi-ovate, narrowed at base, 2 lines thick; valves much exserted, long-pointed. F.v.M. Eucal. 9:6.

64. **rostràta,** Schlecht. Red Gum, Fig. 1430. Tree, to 200 ft.: bark of mature trunks dark gray, either smooth and deciduous or somewhat persistent near the base and then checking into thick scales or even furrowed; bark of seedlings and twigs reddish: lvs. narrowly lanceolate, acuminate, 4–6 in. or more long: calyx-tube hemispheric; lid usually hemispheric and provided with a narrowed point or beak, sometimes merely conical and not beaked, rarely over 3 lines long; stamens 2–4 lines long; anthers oblong, opening by parallel slits: fr. nearly globular, rarely above 3 lines thick; rim broad, prominent; valves entirely protruding, even before they open. April–July. F.v.M. Eucal. 4:7.—One of the most valuable species; next to the sugar gum and forest gray-gum perhaps the most drought-resistant; withstands frosts better than blue-gum; endures the intense heat of Imperial Valley, on the Colorado Desert; grows where the ground is inundated for a considerable time; makes a good growth in alkali soils, yet best results are secured only on good soil, especially if moist and with a clayey subsoil. A slow-growing species in regard to height, but one of the first in regard to diam.-growth (Ingham). Timber



1430. Eucalyptus rostrata (×½). No. 64.

very durable, both above and below ground: heavy, takes a good polish: light red to deep red in color: not so strong as sugar and blue-gums and trees more irregular in growth: suitable for railroad-ties, piles, fence-posts, and the like: difficult to work when dry, therefore scarcely suitable for furniture. Blossoms supply honey to bees.

65. **tereticórnis,** Smith. Forest Gray Gum. Flooded Gum. Bark and the general characters as in *E. rostrata:* lvs. rather broadly lanceolate: calyx-tube turbinate; lid slenderly conical, acuminate, rarely abruptly beaked, 3–6 lines long, always much longer than the tube; stamens 3–6 lines long: fr. obovoid or nearly globular, 3–4 lines thick; rim very broad and prominent; valves protruding. April–July. F.v.M. Eucal. 9:8.—Closely related to *E. rostrata;* usually coarser, the lvs. broader, peduncles and pedicels stouter, and fr. larger; yet variable in all these characters. According to Ingham, this species has an erect habit of growth, while *E. rostrata* grows very crookedly. Withstands fully as wide a range in temperature, moisture, and soil conditions as does *E. rostrata:* timber similar but usually paler in color; more valuable because of its more regular growth. *E. amplifòlia,* Naudin, known in Calif. as the "Cooper" or "round-leaf tereticornis," is a form with large roundish lvs. when young.

66. **macrorhýncha,** F. v. M. Tall tree: bark dark gray, furrowed and fibrous: lvs. lanceolate, acuminate, 3–5 in. long; lower ones broader, thick, and coriaceous; veins very oblique, prominent: calyx-tube turbinate, the edge forming a prominent ring with the conical lid; anthers reniform, opening by divergent slits: fr. depressed-globose, 4–6 lines thick; rim broad, convex. F.v.M. Eucal. 1:5. Maiden, Crit. Rev. Eucal. 39 (figs. 3–21).

67. **Gúnnii,** Hook. f. Cider Gum. Small, often scrubby tree: lvs. thick, shining, less than 3 in. long: lid shining, hemispherical, short-pointed; stamens 2–3 lines long; anthers nearly oval, opening by parallel slits: fr. pear-shaped, truncate, 3–4 lines across; rim thin; valves sometimes slightly protruding. April–July. B.M. 7808. G.C. II. 19:437; III. 2:781; 11:787. —A very hardy species: càttle readily browse on the foliage, as it lacks the peculiarly pungent eucalyptus odor. Fls. only 3 in the typical form, but this apparently not cult. in Amer.

Var. **acérvula,** Deane & Maiden. Buds and foliage often of a yellowish cast: fls. usually 4–8 in the umbel: fr. ¼–½in. across. F.v.M. Eucal. 4:5 (main fig.).—The form commonly grown in Calif. Sapwood yellowish.

Var. **undulàta,** Auct. (*E. undulàta,* Luehm., not of F. v. M.). Swamp Gum. Tall tree: lvs. longer (over 3 in.), often 2 in. broad, somewhat undulate or plane: fr. top-shaped.—Yields much nectar: flowers earlier than *E. viminalis.* Timber strong and useful.

Var. **montàna,** Auct. A mountain form of *E. Gunnii,* the only species which withstands the climate of the east of England.

68. **melliodòra,** Cunn. Honey-scented Gum. Yellow Box. Spreading tree with somewhat drooping habit, to 150 ft. high: bark somewhat persistent below, roughish, brownish gray without, yellowish within, flaking off above, leaving the branches smooth: lvs. narrow, acuminate, 3–5 in. long: fls. small, the calyx about 2 lines across; lid conic-hemispherical; stamens 2–3 lines long; outer ones sterile; anthers minute, truncate, opening by terminal pores or short slits: fr. distinctly stalked, truncate-globular, under 3 lines thick. Feb.–Aug. F.v.M. Eucal. 2:5. Maiden, Crit. Rev. Eucal. 61 (figs. 1–14).—Will grow on poor hillside soil but best growth is made in the valleys. Timber used in Austral. by wheelwrights and shipbuilders: makes excellent fuel: fls. particularly rich in nectar and much sought by bees.

69. **odoràta,** Behr. (*E. cajupùtea,* Miq.). Differs from *E. melliodora* chiefly in the more erect habit and fr. which is often nearly sessile, obconic, not or scarcely contracted at orifice. F.v.M. Eucal. 2:7. Maiden, Crit. Rev. Eucal. 51 (figs. 9–19).—Grown at Fresno, Calif.: may be of value for its oil.

70. **doratóxylon,** F. v. M. Spear-Wood. Beautiful shrub or small tree: bark smooth, greenish white: lvs. all opposite or nearly so, narrowly lanceolate, acumi-

nate, mostly under 3 in. long: fls. 4–7 on each recurved nearly terete peduncle; lid terminating in a rather long beak; stamens 2–3 lines long; anthers ovate-oblong, opening by parallel slits: fr. ovoid, about 3 lines long, scarcely as wide. F.v.M. Eucal. 4:4. Maiden, Crit. Rev. Eucal. 70 (figs. 3–5).—Of ornamental value because of its slender, graceful habit.

71. **marginàta,** Smith (*E. floribúnda,* Hueg.). JARRAH. Tall tree under favorable conditions, often low: bark persistent and somewhat fibrous or flaking off in strips: lvs. lanceolate, 3–6 in. long; veins widely spreading: peduncles sometimes a little flattened; lid oblong-conical, longer than calyx-tube; stamens 3–4 lines long, all fertile, the outer not inflexed in bud; anthers cordate-reniform, opening by divergent slits: fr. subglobose, narrowed to the stalk, ½in. or more thick, hard, and smooth. April, May. F.v.M. Eucal. 7:5.—Valuable hardwood tree requiring a warm climate: not yet a success in Amer. Timber easily worked, takes a fine polish, not attacked by teredo, almost incombustible: used in England for street-paving and in Austral. for piles, underground work, telegraph-poles, ties, flooring, shingles, and general construction.

72. **Baileyàna,** F. v. M. Tall tree: bark persistent throughout, fibrous: foliage dense and shady: lid hemispheric; anthers cordate, opening by divergent slits: fr. globular-urnshaped, scarcely ½in. thick, 3-celled. F.v.M. Eucal. 3:1.—A "stringybark:" will grow well on sandy soil. Timber very tough: suitable for tool-handles: little known.

73. **erythronèma,** Turcz. (*E. conoídea,* Benth.). Small tree: bark rough, reddish: lvs. lanceolate, 1–3 in. long, thick and shining; veins very oblique, obscure: fls. 2–3, red, distinctly stalked in the usually recurved umbels; lid hemispheric, acute; stamens about ½in. long, raised above the border of the calyx by the thick disk; anthers oblong, opening by longitudinal slits: fr. top-shaped, truncate, 4–6 lines across; rim raised above the calyx-border, showing externally as a smooth ring. Spring. F.v.M. Eucal. 8:2.—A highly ornamental species of recent intro.

74. **leucóxylon,** F. v. M. (*E. gracílipes,* Naudin). WHITE IRONBARK. Fig. 1431. Tall tree, usually branching below: bark mostly deciduous in irregular strips, smooth, pale: juvenile lvs. ovate-lanceolate, sessile; adult lvs. narrow-lanceolate, grayish or dull green: fls. 2–5, mostly 3, long-stalked, white or rarely pink; lid semi-ovate, pointed, about as long as calyx-tube; stamens very unequal, outer ones often ½in. long and usually sterile; anthers truncate, opening by apical pores; stigma much dilated: fr. obovoid, truncate, scarcely contracted at orifice, 4–5 lines across; rim thick. Nov.–April. F.v.M. Eucal. 1:4. Maiden, Crit. Rev. Eucal. 56 (figs. 1–12). R.H. 1901, p. 500.—Grows best near the coast and where there is plenty of rain but will endure considerable drought and poor soil: withstands minimum temperatures of 15–20°. Valuable bee tree, yielding an excellent honey. Timber superior to that of almost any other eucalypt for certain purposes: hard and durable, pale brown or white: used in carpentry and wheelwrights' work; also for ax-handles, railroad-ties, and underground work. The form with pink fls. is highly ornamental. Var. **purpùrea,** Hort., has bright purple fls.

75. **sideróxylon,** Cunn. (*E. leucóxylon* var. *sideróxylon,* Auct.). RED IRONBARK. Characters mostly as in *E. leucoxylon:* usually not branched below: bark persistent, rough, dark red or black: juvenile lvs. linear-lanceolate; adult lvs. green: fls. white or yellowish except in the vars. Maiden, Crit. Rev. Eucal. 55 (figs. 5–13).—Wood dark brown or reddish, otherwise similar to that of *E. leucoxylon* and climatic requirements the same.

Var. **ròsea,** Hort. (*E. leucóxylon* var. *ròsea,* Hort.). Lvs. green: fls. rose-colored. Dec.–June.—A handsome form and profuse bloomer, distinguished from the pink form of *E. leucoxylon* by the rough dark-colored bark.

Var. **pállens,** Auct. (*E. leucóxylon* var. *pállens,* Benth. *E. leucóxylon* var. *pállida,* Hort.). Lvs. silvery gray, not very coriaceous: fls. red.—A profuse bloomer.



1431. **Eucalyptus leucoxylon** (×½). No. 74.

76. **longifòlia,** Link & Otto. WOLLYBUTT. Medium-sized or tall tree: bark of old trunks persistent, gray, rough or wrinkled, somewhat fibrous: lvs. elongated-lanceolate: fls. long-stalked; lid broadly conical, acute, pale; stamens fully ½in. long, inflected in the bud, all perfect; anthers ovate-oblong, opening by parallel slits; stigma not dilated: fr. bell-shaped or turbinate, truncate, angular, about ½in. thick; rim prominent, ascending. F.v.M. Eucal. 2:4.—Flowering almost continuously: valuable for bees.

E. annulàta, Benth. Shrub or small tree with characters of E. cornuta, except as follows: lvs. narrow-lanceolate, acuminate: lid 6–8 lines long, usually incurved: fr. depressed-globose, 4–5 lines thick, the convex rim protruding as a thick rim.—*E. Bosistoàna,* F. v. M. Next to E. pilularis in the key but perhaps related to E. melliodora. Lvs. narrow-lanceolate, copiously dotted, of equal color on both sides; veins very divergent: fls. few and pedicelled in the umbels; peduncles somewhat compressed; lid fully as long as tube, narrow-hemispheric: fr. small, with narrow rim; valves inclosed. Maiden, Crit. Rev. Eucal. 49 (figs. 1–4).—*E. califórnica,* used by Abbot Kinney in his book entitled "Eucalyptus," has not been recognized by botanists: also listed as E. occidentalis var. californica, Kinney.—*E. cinèrea,* F. v. M. Related to E. viminalis. Bark persistent, fibrous: lvs. oppsite, sessile, cordate, more or less white-mealy: fls. 3–7, pedicellate: fr. 3 lines thick, with protruding valves.—*E. dealbàta,* A. Cunn. Small tree, near E. viminalis: lvs. glaucous, often broad and obtuse: fls. 3–6, small: fr.-rim flat; valves protruding even before they open. Cult. in Cuba.—*E. Deànei,* Maiden. Very close to E. saligna; distinguished chiefly by its broad sucker lvs.—*E. Fæld Bay* (?), Naudin, is a horticultural form either of E. rostrata or of E. tereticornis: branchlets pendulous.—*E. jugàlis,* Naudin, is a cult. form not yet identified.—*E. Màidenii,* F.v.M. Appearance and bark of E. goniocalyx but peculiar warty buds and caps of E. globulus: branchlets quadrangular.—*E. McClátchie,* Kinney, is a horticultural name for the large-fld. form of E. Gunnii var. acervula.—*E. miniàta,* A. Cunn. Placed after E. ficifolia in the key: fls. sessile in simple umbels, brilliant orange-color: fr. truncate-ovate, nearly 2 in. long. F.v.M. Eucal. 6:4.—*E. Mortoniàna,* Kinney, is a horticultural species probably referable to E. Maideni. Maiden, Crit. Rev. Eucal. 79 (figs. 13–14); 80 (figs. 1–12).—*E. pátens,* Benth. Next to E. pilularis in the key: peduncles only slightly flattened, bearing 3–7 fls.; lid hemispherical, short-pointed, about half as long as tube: fr. truncate-ovate, 5 lines wide; rim narrow; caps. sunk. F.v.M. Eucal. 9:5.—*E. phaceafòlia,* listed by Richter in Calif. Exp. Sta. Bull. No. 217, p. 1011, is probably a misprint for E. ficifolia.—*E. pinnàta,* a garden name. J. H. Maiden suggests that Californian specimens under this name may be E. coccifera (Crit. Rev. Eucal., p. 143).—*E. ràbida,* Deane & Maiden. Characters of E. viminalis, but bark always smooth and white, often with reddish patches, and the sucker lvs. broad.—*E. uncinàta,* Turcz. Near E. decipiens in the key and, like it, a shrub: bark deciduous, smooth: lvs. very light green, narrow, copiously dark-dotted; veins fine, widely divergent: filaments kinked; anthers opening by terminal pores: fr. 2–3 lines across; valves little if at all exserted. F.v.M. Eucal. 4:10. Maiden, Crit. Rev. Eucal. 62.—*E. urnígera,* Hook. f. Shapely tree with drooping branchlets and glaucous bluish foliage: bark smooth, pale brown: lvs. 2–4 in. long, obtuse: fls. mostly 3 in each umbel; peduncles often recurved: fr. nearly globose but somewhat urn-shaped, 4–5 lines wide; caps. much sunk and valves inclosed. Maiden Crit. Rev. Eucal. 80 (Figs. 13–15).

Other names offered in foreign catalogues are: *E. capitellata, E. consideneana, E. delegatensis, E. divas, E. gonipho-cornuta, E. loxophleba, E. paludosa, E. Smithii.*

HARVEY MONROE HALL.

EUCHARÍDIUM (from the Greek for *charming*). *Onagràceæ*. Pretty small annuals, one of which (*E. concinnum*) is well known in gardens.

Three Californian herbs allied to Clarkia (and often referred to it), but differing in the calyx-tube being much prolonged beyond the ovary, and the stamens 4 and opposite the sepals and not appendaged at the base; petals lobed. Cult. simple, as for Clarkia.

concínnum, Fisch. & Mey. (*Clárkia concínna,* Greene), is a graceful garden annual, growing 1–2 ft. high, simple or very nearly so, pubescent or glabrous: lvs. small, oblong, petioled, entire: fls. regular, rose-colored, nearly or quite an inch across; calyx-tube filiform, an inch or more long; filaments filiform; petals 3-lobed, the middle lobe not much exceeding the others. B.R. 1962. B.M 3589.—Of easy cult. in any garden soil; a useful annual.

grandiflòrum, Fisch. & Mey. (*Clárkia grandiflòra,* Greene). Differs from above in being diffusely branched from the base, corolla larger, irregular, 3 upper petals approximate and the other separate and declined, all the middle lobes long-clawed. There is a var. *álba* advertised.

Brêweri, Gray (*Clárkia Bréweri,* Greene. *C. Saxeàna,* Greene). 1–2 ft. high: lvs. 1 in. or more long, lanceolate, entire, short-petioled: corolla irregular; petals broadly obcordate with the middle lobe narrow-spatulate and much exceeding the other lobes; filaments club-shaped: has a honeysuckle fragrance. L. H. B.

EÙCHARIS (*very graceful,* from the Greek). *Amaryllidàceæ*. Amazon Lily. Hothouse bulbous plants of great beauty and delightful fragrance, blooming in late winter and spring and at other times if the requisite treatment is given.



1432. Eucharis. Leaf of E. grandiflora, and fls. of *a*, E. subedentata; *b*, E. Sanderi; *c*, E. grandiflora; *d*, E. candida.

Bulb tunicated, 1–2 in. diam.: lvs. broad-ovate, narrowed into distinct petioles, prominently parallel-ribbed, radical: fls. white, in umbels, very showy, standing on long stout scapes; perianth-tube straight or curved, the throat dilated; segms. broad and spreading; perianth-cup either entire or toothed between the filaments: ovules 2 to many in each of the 3 locules.—Six or 8 handsome species from Colombia. The species are confused. *E. grandiflora* (known to gardeners as *E. amazonica*), *E. candida* and *E. subedentata* are the well-marked types. The fls. in Fig. 1432, adapted from authentic plates, will distinguish the types. Hybridizes with Urceolina (see *Urceocharis*).

The Amazon lilies, as eucharis are popularly called, are among the most desirable of warmhouse bulbous plants, being not only very beautiful but also very free in the production of flowers. When grown in pots, they require a coarse fibrous soil, composed chiefly of rotted sod, and enriched with about one-fourth of dry cow-manure and a sprinkling of bone-dust. The pots should be well drained, for much water is needed during the growing season, but frequent potting should be avoided as the roots are impatient of disturbance. Shading from full sunshine is required, except during the winter months, and a night temperature of 65° to 70° is best for these plants. By drying off the eucharis to some extent for a few weeks, a crop of flowers may be had at almost any season, providing the bulbs are strong and healthy, but they should never be dried to such a degree that all the foliage is lost, else the bulbs will be much weakened. Good results are also had from planting out the eucharis on a bench in a warmhouse, the soil and treatment being much the same as for pot-grown specimens. The only insects liable to give much trouble in connection with these plants are mealy-bugs and thrips, and these may be controlled by thorough syringing. (W. H. Taplin.)

grandiflòra, Planch. (*E. amazónica,* Lind.). Amazon Lily. Star of Bethelhem (a name also applied to Ornithogalum). Fig. 1432. Bulb globular, 2 in. diam.: lvs. 2–4 to each stem, the petiole about 12 in. long; lf.-blade 1 ft. or more long and 5–6 in. broad, oblong: scape 1–2½ ft., bearing an umbel of 3–6 large (4 in. across), very fragrant star-like fls. on pedicels nearly or quite 1 in. long; segms. spreading, oblong and obtuse; tube of perianth cylindrical and curved, 2 in. long; cup forming a distinct projecting tube. B.M. 4971. F.S. 9:957; 12:1216–17. Gn. 48, p. 217; 59, p. 25; 61, p. 125; 63, pp. 71, 131; 66, p. 412; 76, p. 67; 77, p. 418. G.C. III. 7:193; 16:665; 28:115; 35:117; 41:71; 51:141. R.H. 1912, p. 115. G. 3:407; 9:301 (*E. amazonica* var. *grandiflora*); 10:5. G.L. 21:476. G.M. 46:83. G.W. 2, p. 87. G.Z. 2:1. A.F. 5:363; 8:445. F.E. 8:1000. F.R. 1:11; 2:364. Var. **Moòrei,** Baker, has smaller, rounder and thicker lvs., and smaller fls. with the cup lined with yellow.—Of all warm greenhouse bulbous flowering plants, *E. grandiflora* (*E. amazonica* of the gardener) stands without a rival in the purity and beauty of its bloom.—Prop. by offsets, but one must always bear in mind that these plants do not like to be disturbed much at the roots, and it will be some time before they recover from the operation of being divided. The spring is the best time to separate the bulbs. Turn the plant out of its pot, and take a hose with a gentle pressure on it and wash all the loam carefully away from the roots, care being taken to break as few as possible.—It thrives well in a good turfy loam. Add about a third of dried cow-manure, with as much sand and charcoal to keep the whole porous. The pots should be well drained with crocks, as these plants will never do well if the soil gets into a "sour" condition. Three bulbs to a 6-inch pot are enough, but if large specimens are desired for exhibitions, increase the number and the size of pot, having in view what is desired. Do not give much water after plants are divided, until growth has begun. When they are growing vigorously, a copious supply of water is required. A temperature of 65° by night should be maintained, and during the day it may run to 80° or 85°. The air should never be allowed to become "stagnant." This applies, of course, to all kinds of plants grown in glass structures. It must be remembered that in their native place the plants grow outdoors, and in heating greenhouses allowance should be made for the free admission of fresh air at all times. Eucharis like a light shade over them during the brightest part of the day, but from about the end of Sept. until March they will stand all the sun possible. *E. grandiflora* can be flowered 2 or 3 times during the year.—When the lvs. are fully matured, cease watering until signs of flagging of the

foliage is noticed, then water again to freshen them up. Keep this treatment up for a month, that is alternately drying and watering. The temperature may be lowered 5° during this resting-period. Start the plants by giving them a thorough soaking of water, and raise the temperature again to not less than 65° by night. The fl.-sts. will soon appear, and they may be watered with manure water, as advised for Dipladenia, until they begin to open, when it should be withheld until they have finished flowering. When the fl.-sts. have all been removed, a new set of lvs. will be meanwhile pushing up, and they may be again fed as advised above, until they are fully developed; and again treat them in every way as before. All the insect pests are liable to thrive on Eucharis, and the plants may be fumigated as advised for other greenhouse plants. Red-spider may be kept down by the syringe. (George F. Stewart.)

Mástersii, Baker. Bulb globose, often smaller: lf.-blade 8–9 in. long and 4–5 in. broad, oblong, rounded at the base, exceeding the petiole: scape 1 ft. high, bearing 2 nearly sessile fls. (2½–3 in. across) in the umbel, the perianth-segms. ovate and spreading and shorter than in *E. grandiflora;* tube slightly curved, 2 in. long; cup forming a shallow frilled or notched collar. B.M. 6831. G.C. II. 24:721. G.Z. 31, p. 217.—Possibly a hybrid of *E. grandiflora* and *E. Sanderi.*

cándida, Planch. Fig. 1432 *d.* Bulb globose, bearing stolons 2 in. diam.: lf.-blade 9–15 in. long, 4–5 in. broad at the middle, oblong, gradually narrowed both ways, about as long as petiole: scape somewhat flattened, glaucous, 1–1½ ft. high, bearing 6–10 short-pedicelled fls. in an umbel; segms. oblong, acute, more or less reflexed; tube 1½–2 in. long, curved; winged yellow filaments projecting, united at the base only. F.S. 8:788. G. 6:5; 15:289. J.H. III. 61:443. G.Z. 21, p. 194.—Smaller-fld. than *E. grandiflora.*

Sánderi, Baker. Fig. 1432 *b.* Bulb ovoid, 1–2 in. diam.: lf.-blade 10–12 in. long and 5–6 in. broad, oblong, cordate at base, twice longer than petiole: scape terete, 1 ft., bearing 2–3 nearly sessile fls.; segms. ovate, 1 in. or more long; tube curved, 2 in. long; yellowish cup, very narrow, like a collar or rim, and bearing the short, curved filaments on its edge. B.M. 6676. G.C. II. 19:349. G. 6:277. J.H. III. 52:9. G.Z. 28, p. 145.—By some thought to be a hybrid of *E. grandiflora* and *E. candida.* Var. **multiflòra,** Baker. Fls. smaller, 4–6, striped green. B.M. 6831.

subedentàta, Benth. (*Calliphrùria subedentàta,* Baker). Fig. 1432 *a.* Bulb ovoid, 1½ in. diam.: lf.-blade 6–8 in. long, 3–4 in. broad, oblong, triangular at base, about as long as the channeled petiole: scape slender, 1 ft.; fls. 6–8 on pedicels 1 in. or less long; tube 1 in. long, funnel-shaped above; segms. oblong, ascending, 1 in. long; cup wanting or represented only by obscure teeth on the filaments. B.M. 6289. I.H. 28:415.—A small-fld. species.

E. Bakerìana, N. E. Br. Has the perianth of E. grandiflora and stamens of E. candida: fls. 4–6 in the umbel, 2½ in. across, pure white; tube not enlarging emphatically at the top; cup projecting from the bases of the segms., not toothed: lvs. 4 or 5, elliptic, 10–18 in. long, very dark green and closely striate: scape 12–18 in. B.M. 7144. G.C. III. 7:417; 12:209.—*E. burfordénsis,* Hort. Supposed hybrid between E. Mastersii and E. Stevensii: fls. bell-shaped, over 3 in. across, about 2 in. long.—*E. Elmetàna,* Sander. Hybrid of E. Sanderi and E. grandiflora. Easier to grow than E. Sanderi. G.C. III. 26:345.—*E. Lèhmannii,* Regel. Fls. about 4 in an umbel, 1½ in. across, the spreading corona with 12 long, narrow teeth, the perianth-segms. spreading or reflexed: lvs. 2, elliptic-oblong. Gt. 38:1300.—*E. Lòwii,* Baker. Robust: fls. 4 in. across, the spreading outer segms. 1 in. wide and the 3 inner ones incurved: lvs. larger than those of E. candida, long-stalked. Perhaps a natural hybrid of E. grandiflora and E. Sanderi. G.C. III. 13:539. J.H. III. 28:111; 43:276. Gn.W. 10:7.—*E. Stèvensii,* N. E. Br. Free-flowering: fls. 3–3½ in. across, about 7 in the umbel, pure white with yellow on the outside of the cup or corona: lvs. 12–14 in. long: very like E. Sanderi, and a garden hybrid of that species and E. candida. J.H. III. 30:253. Gn. 46:128. G.C. III. 17:365.

L. H. B.

EUCHLÆNA (Greek *eu,* well, *chlaina,* covering). *Gramìneæ.* Annual or perennial grasses, with stout stems, broad blades and monœcious inflorescence, occasionally grown in the South for forage and sometimes for ornament.

Staminate infl. in a tassel at the top, the pistillate in small ears in the axils of the lvs.; spikelets 1-fld.; pistillate spike slender, the several joints producing 1-seeded frs. trapezoidal in shape, the surface smooth and hard. The aspect is that of Indian corn (Zea) from which it differs in having free slender-jointed pistillate spikes that are not united into a cob.—Only one species is generally recognized, but there are probably others, all Mexican or Cent. American.

mexicàna, Schrad. (*E. luxùrians,* Dur. & Aschers. *Reàna luxùrians,* Dur.). TEOSINTE. Annual: sts. strongly cespitose, decumbent and spreading at base, erect above, 5–10 ft. or even more, leafy. Dept. Agric., Div. Agrost. 20:11.—Occasionally cult. for forage in the Gulf states. The seed rarely matures north of S. Fla. See Cyclo. Amer. Agric., Vol. II, pp. 638–9.

A. S. HITCHCOCK.

EUCNÌDE (Greek-made word, referring to the sharp nettle-like hairs). *Loasàceæ.* Several N. American annual or biennial herbs, by some authors referred to Mentzelia. Plants with stinging hairs: lvs. alternate or the lower ones opposite, cordate or ovate, more or less lobed: fls. yellow or white; calyx-tube oblong, the limb persistent, 5-lobed; petals 5, united at the base and inserted on the throat of the calyx; stamens numerous, the filaments filiform; ovary 1-loculed, bearing a 5-cleft style. **E. bartonioìdes,** Zucc. (*Mentzèlia bartonioìdes,* Benth. and Hook.), is sometimes cult. It is a pretty summer-flowering annual, thriving in warm garden soil. Sts. about 1 ft., somewhat succulent, more or less decumbent, hispid-hairy: lvs. alternate, petioled, broad-ovate and toothed-lobed: fls. large, on long pedicels, opening in sunshine, the petals ovate-pointed, the numerous yellow hair-like stamens projecting and brush-like. Mex., New Mex., and Texas. B.M. 4491 (as *Microsperma bartonioìdes*). Gt. 5:320. L. H. B.

EUCODÒNIA is referred to *Achimenes. E. Éherenbergii,* Hanst.=*A. lanàta,* Hanst (See p. 208, Vol. I). It is offered abroad. *E. nægelioìdes,* Hort.=*Eucodonópsis nagelioìdes,* Van Houtte, being a hybrid between *Eucodonia Ehrenbergii* and *Nægelia zebrina splendens.* Fls. single on the summits of the peduncles, declined, rose-purple. F.S. 16:1608. Var. *lilacinélla,* Van Houtte, has large fls. white at the throat and striped and pointed with purple, and lilac-marbled on the limb. F.S. 18:1858–9.

EÙCOMIS (Greek, *beautiful hair* or *topknot*). *Liliàceæ.* Cape bulbs, half-hardy, producing radical rosettes of long leaves and a strong peduncle or scape bearing a raceme of greenish or whitish flowers more or less tinged with color, the cluster crowned or topped with a coma of leafy bracts (it is from this coma or crest that the generic name is taken).

Bulb tunicated: peduncle simple: lvs. lorate or oblong, often tinged or spotted with purple: fls. regular, 6-parted, rotate; stamens 6; ovary broad and short; style cylindrical and stigma capitate: caps. 3-valved.—Species about 12, African, nearly all from S. Afr. Prop. by offsets. The bulbs may remain in the open if in a warm place and well protected; some of them stand considerable frost, and bloom in spring. Of easy cult. Let the bulbs remain where planted. In the N. treated as glasshouse plants.

A. *Scape club-shaped.*

règia, Ait. Bulb globose, 2–3 in. diam.: lvs. 6–8, obtuse, not undulate toward the edge, to 1½ ft. long and 3–4 in. broad: scape 3–6 in. long, bearing a dense

oblong raceme 3–6 in. long; fls. green, ½in. long, the segms. oblong, and stamens half as long as perianth: crown of 12–20 oblong, acute, crisped lvs. S. Afr.

nàna, Ait. Bulb 2 in. diam.: lvs. about 8, obtuse, firm, purplish on back toward the base, to 2 ft. long, 3–4 in. broad above the middle: scape short, 1 in. thick at top, spotted purple; raceme with more or less purple, 3–4 in. long, dense, the fls. nearly sessile: perianth green, ½in. long, the segms. oblong; crown of 12–20 oblong acute lvs. S. Afr.

Jácquinii, C. H. Wright. Differs from the above, with which it has been confused, in broader and shorter lvs. less tapering at base, and no purple in the infl. S. Afr.

AA. *Scape cylindrical.*

B. *Pedicels short.*

undulàta, Ait. Bulb globose, 2–3 in. diam.: lvs. 6–9, strap-shaped, to 1½ ft. long, 2–3 in. broad, thin, not spotted on back, spreading or recurving, undulate: scape 1 ft. or less, bearing a dense raceme 3–6 in. long; perianth green, ½in. long, the segms. oblong or oblanceolate: crown of 12–30 crisped lvs. S. Afr. B.M. 1083. G.W. 15, p. 305.

BB. *Pedicels long, erect-spreading.*

punctàta, L'Her. PINEAPPLE FLOWER. Bulb globose, 2–3 in. diam.: lvs. 6–9, erect-spreading, long and narrow, to 2 ft. long and 2–3 in. broad, channeled, not undulate, brown-spotted beneath: scape 1 ft., spotted; raceme lax, cylindrical, to 1 ft. long; fls. green, ½in. long, the ovary brown: crown of 12–20 oblong acute lvs. S. Afr. B.M. 913. F.S. 22:2307. G.W. 5, p. 121; 9, p. 5. J.H. III. 52:141. Gn. 70, p. 295. G. 19:291; 22:520; 27:409; 32:675. F.E. 31:1080.—A form with lvs. striped beneath with brown is var. *striàta,* Sims. B.M. 1539.

bícolor, Baker. Bulb large and globose: lvs. 5–6, strap-shaped, thin, not spotted, undulate, to 2 ft. long by 3–4 in. broad: scape 1–1½ ft. long; raceme to 1 ft. long, dense at top; stamens and margins of perianth-segms. bright purple, otherwise close to *E. punctata:* crown of 12–20 oblong acute lvs. usually margined with red-purple. S. Afr. B.M. 6816. G.W. 14, p. 468.

L. H. B.

EUCÓMMIA (Greek, *eu,* well, and *kommi,* gum; alluding to the fact that the plant contains rubber). *Eucommiàceæ.* Deciduous tree grown for its handsome foliage and also for its possibility as a hardy rubber-producing tree.

Branches with laminate pith: winter-buds conspicuous, with imbricate scales: lvs. alternate, petioled, serrate, without stipules: fls. dicœcious, without perianth, solitary in the axils of bracts at the base of the young shoots and precocious; staminate fls. pedicelled; stamens 6–10 with very short filaments and elongated linear anthers; pistillate fls. short-pedicelled with a 1-celled, 2-ovuled stipitate ovary, bifid at the apex, the lobes stigmatic on the inside: fr. a compressed winged nutlet.—One species in Cent. China, not closely related to any other genus; it was first placed with the Trochodendraceæ or Magnoliaceæ and afterward with the Hamamelidaceæ, but is now generally considered as representing a distinct family allied to the last named.

Eucommia is an upright-growing vigorous tree with rather large elliptic dark green foliage, inconspicuous precocious flowers and winged fruits; in habit and foliage it resembles somewhat an elm tree. In China the bark is a most valued medicine. The tree contains rubber in all its parts, particularly in the young growth and in the bark. Though the rubber has proved to be of good quality, it is apparently difficult of extraction and not present in sufficient quantity to make the commercial exploitation of the tree pay; therefore the hopes which have been set in this "hardy rubber tree" will probably never realize. The tree has proved perfectly hardy as far north as Massachusetts and grows well in a loamy humid soil. Propagation is by seeds and by greenwood cuttings under glass.

ulmoìdes, Oliver. Tree, to 60 ft.: lvs. elliptic to elliptic-ovate, acuminate, broadly cuneate at the base, serrate, glabrous, glossy and dark green above, pubescent below when young, 3–7 in. long: samara oblong, bifid at the apex, 1¼–1½ in. long. April; fr. in Oct. Cent. China. H.I. 20:1950. R.H. 1909, p. 226. M.D.G. 1912:11, 613.

ALFRED REHDER.

EUCRŸPHIA (Greek for *well covered*). *Eucryphiàceæ;* formerly referred to *Rosàceæ.* A very few southern hemisphere resinous trees or shrubs, with opposite evergreen simple or pinnate lvs. and showy white fls.: sepals 4, free; petals 4, broad; stamens very many; ovary free, 5–18-celled: fr. a hard dehiscent caps. *E. pinnatifòlia,* Gay, is a shrub or small tree, hardy in parts of England, with large white hypericum-like 4-petaled fls. and rose-like foliage, from Chile. B.M. 7067. G.C. II. 14:337; III. 9:613; 10:217; 15:109; 23:15 (fr.); 30:351. Gn. 63, p. 281; 77, p. 423. G. 29:96; 33:25. F.S.R. 1, p. 41. Gn.W. 9:821. G.M. 53:203. *E. cordifòlia,* Cav., has simple serrate lvs. B.M. 8209. G. 33:607. G.C. III. 22:247; 42:259; 44:129. Gn. 70, p. 190; 73, p. 471.—Neither of these is in the American trade. Worthy of trial in the S. There are 2 species (*E. Billardieri,* Spach, and *E. Moorei,* Muell.) in Tasmania and New S. Wales.

Plants of *E. pinnatifolia* give much satisfaction in the open in England although not much known, the pure white fls. 3 in. diam., and borne more or less in pairs, being produced in great profusion in late summer; it grows 8–10 ft. high.

EUGÈNIA (named in honor of Prince Eugene of Savoy). *Myrtàceæ.* A large group of trees and shrubs, grown chiefly for their ornamental foliage and berries. Many tropical species yield edible fruits which are both eaten out of hand and made into jellies or confections. A number of these have been recently introduced into the warmer parts of the United States, where they give promise of attaining much importance. The clove of commerce belongs to this genus.

Evergreen trees and shrubs: lvs. opposite, mostly entire and finely penniveined: fls. white or creamy or the numerous stamens yellowish: fr. a drupe-like berry, usually globular or pear-shaped, 1–5-seeded. Habit and infl. of *Myrtus,* which see for cult. and prop.

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A. *Fls. solitary on axillary peduncles; petals not united.* (*Eugenia proper.*)

1. brasiliénsis, Lam. (*E. Dómbeyi,* Skeels). GRUMIXAMEIRA of Brazil. Tree, to 50 ft., glabrous or the infl. obscurely puberulent: lvs. oval or obovate-oblong, tapering at base, obtuse, 2½–5 in. long, 1–2½ in. broad: peduncles 1–2 in. long, much exceeding the scales which subtend them: fr. edible, scarlet, black at maturity, the size of a cherry. Brazil. B.M. 4526. R.H. 1845:425.—Cult. in S. Calif. The frs. are candied and eaten in the tropics.

2. uniflòra, Linn., not Berg. (*E. Michèlii,* Lam.). PITANGA. SURINAM CHERRY. Shrub, 5–20 ft., glabrous: lvs. ovate-lanceolate, obtuse at base, glossy, 1–2 in. long, exceeding the peduncles: berry ½–1 in. diam., ribbed, resembling a miniature tomato, edible, with a spicy acid flavor. Trop. Brazil. R.H. 1889, p. 532.—Hardy in S. Fla. and in S. Calif. Much esteemed for

jellies. Useful also as a pot-plant, producing an abundance of showy red frs.

3. **Pitánga,** Kiaersk. PITANGA. Low shrub, young foliage and branchlets reddish pubescent: lvs. elliptic-oblong, acute at base, 1½–3 in. long: berry red, subglobose, obscurely 8-nerved, about ½in. diam. S. Brazil and adjacent Argentine.—Intro. into S. Calif. by Franceschi.

4. **microphýlla,** A. Rich., not Bedd. nor Rich. ex Berger (*E asperifòlia,* Berg). Branchlets and infl. pilose: lvs. small, oval, acute, glabrous, longer than the peduncles: fr. unknown. Cuba.—Species other than the true *E. microphylla* apparently have been intro. under this name.

AA. *Fls. in cymes or panicles; petals spreading, not united.* (*Jambosa. Caryophyllus.*)

5. **myrtifòlia,** Sims (*E. austràlis,* Wendl. *Jambòsa myrtifòlia,* Ndz.). AUSTRALIAN BRUSH CHERRY. Tree, attaining 80 ft., glabrous: lvs. oval or oblong-lanceolate, mostly acute, 1½–3 in. long: fls. white: fr. red, ovoid, nearly 1 in. long, with an acid taste. Austral. B.M. 2230. Univ. Calif. Pub. Bot. 4:8.—Hardy in the S. Much used in Calif. as an ornamental tree and for clipped hedges. The foliage is dense and glossy, green when mature, tinged with wine-red on the gracefully spreading young shoots. Frs. sometimes used in jelly-making.



1433. Flower of rose-apple, Eugenia Jambos. (Natural size.)

6. **Jámbos,** Linn. (*Jambòsa vulgàris,* DC. *Jambòsa Jámbos,* Millsp.). ROSE-APPLE. JAMROSADE. JAMBOS. Fig. 1433. Tree, 20–30 ft., glabrous: lvs. lanceolate, very acuminate, 5–8 in. long, 1–2 in. broad, thick and shining: fls. greenish white: fr. pyriform, 1½–2 in. thick, white or yellowish, tinged with rose-color, edible but rather insipid, fragrant. E. Indies. B.M. 1696. Gn. 75, p. 616.—Hardy in Calif. as far north as San Francisco. Grown for its rich foliage and showy fls. Frs. much used in the tropics for jelly-making and in confectionery.

7. **malaccénsis,** Linn. (*E. macrophýlla,* Lam., not Berg. *Jambòsa malaccénsis,* DC.). LARGE-FRUITED ROSE APPLE. JAMBOS. Glabrous tree: lvs. oblong to elliptic, acute, 5–10 in. long, 2–4 in. wide: fls. purple: fr. fragrant, red, obovoid, about 2 in. diam., with apple-like flavor. Polynesia.—More tender than *E. Jambos,* but the foliage more luxuriant and the frs. larger.

8. **aromática,** Baill., not Berg (*Caryophýllus aromáticus,* Linn. *E. caryophyllàta,* Thunb. *Jambòsa Caryophýllus,* Ndz.). CLOVE TREE. Lvs. ovate-oblong, acute, strongly tapering to the conspicuous petiole, 2–5 in. long, coriaceous, dotted; lateral veins numerous, parallel, the cross-veinlets obscure: fls. in terminal trichotomous cymes, pale purple, only ¼in. across. Moluccas.—Widely cult. in the tropics. Apparently not suited to even the warmer parts of U. S. The fls. are the cloves of commerce. See *Cloves.*

AAA. *Fls. in cymes or panicles; petals united into a calyptra.* (*Syzygium.*)

9. **jambolàna,** Lam. (*Syzýgium jambolàna,* DC.). JAMBOLAN, or JAMBOLAN PLUM. Tall shrub or tree: lvs. broadly oblong, very broad at summit but often shortly apiculate, 2½–5 in. long, 1¾–4 in. wide, thick and shining: berry edible, varying from the size of a cherry to that of a pigeon's egg. E. Indies.—Grown at Santa Barbara, Calif., where, according to Franceschi, the trees become large and flower profusely but never ripen fr.

E. álba, Roxbg., Malaya, may be known by its sessile ovate-oblong lvs. and branched peduncles. Intro. into S. Calif. by Franceschi.—*E. apiculàta,* DC., Chile, has oval apiculate lvs. shorter than the mostly 1-fld. peduncles, and a pubescent infl. Gt. 890. Perhaps not now grown in N. Amer.—*E. cauliflòra,* DC., bears fls. and frs. in sessile clusters along the woody branches and the main trunk down nearly to the ground: fr. about ¾in. diam., purple. Brazil. Intro. by Franceschi, and by U. S. Dept. Agric. (as Myrciaria cauliflora, Berg).—*E. costaricénsis,* Berg., Lvs. oblong. 2–3 in. long: fls. in sessile axillary umbels; pedicels ¼in. long: fr. obovoid, glabrous, small. Cent. Amer.—*E. edùlis,* Vell. Branchlets, petioles, and young foliage ferrugineous-pubescent: lvs. willow-like, slenderly acuminate: fr. orange-color or yellow, downy, the size of an apple. Brazil. Intro. by Franceschi, and by the U. S. Dept. Agric. (as Myrciaria edulis, Skeels). Stands drought well.—*E. littoràlis,* Panch. Lvs. spatulate, obtuse, subcordate at base: fls. sessile, fasciculate-congested; infl. pubescent: fr. puberulent, subglobose, about ½in. diam., fragrant, sweet to the taste. New Caledonia. Intro. into Calif. by Franceschi.—*E. Lùma,* Berg=E. apiculata.—*E. Mato,* Griseb. Lvs. ovate, obtuse, about 1½ in. long: fls. solitary on peduncles much shorter than lvs. Argentine. Intro. by Franceschi, who describes the fr. as orange-colored, ribbed, and about 1 in. diam., and by the U. S. Dept. Agric.—*E. myriophýlla,* Casar. Growing parts pubescent: lvs. mostly ternate, very narrowly linear, ¾–1½ in. long, much exceeding the solitary peduncles. Brazil.—*E. púngens,* Berger. Young parts pilose: lvs. elliptic-oblong, spine-tipped, 2–3 in. long, ¾–1 in. broad, much exceeding the simple peduncles in their axils: fr. depressed-globose, puberulent, small. Brazil. Intro. by Franceschi, and by the U. S. Dept. Agric.—*E. pyriformis,* Camb. Lvs. myrtle-like but white tomentose beneath, about equaled by the branched peduncles: fr. pear-shaped, yellow, puberulent, edible. Brazil. Intro. in Calif. by Franceschi.—*E. Ugni,* Hook & Arn.=Myrtus Ugni.—*E. Uvàlha,* Camb., not Miq. Growing parts and infl. pubescent: lvs. oblong, narrowed at base, obtuse, 1–2 in. long, much exceeding the simple peduncles: fr. yellow, size and shape of a small pear, edible. Brazil. Intro. by Franceschi.

HARVEY MONROE HALL.

EULÀLIA: *Miscanthus.*

EULÒPHIA (Greek, *handsome crest*). *Orchidàceæ.* Terrestrial orchids, requiring warmhouse conditions.

Rather small plants with membranaceous lvs. and conspicuous pseudobulbs: scape basal, several-fld.; sepals and petals spreading, similar, ascending; labellum 3-lobed; pollinia 2.—About 50–60 species, in the tropics of both hemispheres. The cult. of Calanthe will apply to this genus.

maculàta, Reichb. f. Pseudobulbs ovate, compressed: lvs. ovate, spotted or blotched: fls. small; upper sepal hood-shaped, lateral ones acuminate, reddish brown; petals broader, white or pale rose; labellum cordate, with 2 crimson spots, triangular in outline, near the base, otherwise white. Brazil. B.R. 618 (as Angræcum).

scrípta, Lindl. Lvs. linear, subdistichous: fls. purple and yellow; sepals and petals linear-oblong; labellum 3-lobed, lateral lobes rotund at the apices. Madagascar.

E. Còleæ, Rolfe. A slender-growing species with aloe-like lvs.—*E. Lubbersiàna*, Laurent & Th. Dur. Allied to E. maculata: lvs. dark green, marbled with white. Afr.—*E. nùda*, Lindl. Scape about 2 ft. tall, many-fld.; fls. ranging from rose-purple to pink, or yellowish green; lip nearly entire, recurved. India and China. B.M. 8057.—*E. paniculàta*, Rolfe. Pseudobulbs tufted, bearing 2 strap-shaped lvs.: fls. numerous; petals and lip yellowish green dotted with purple. Madagascar.—*E. undulàta*, Rolfe. Scape about 1 ft. high, of slender growth; petals and lip pale green, the latter with 3 prominent keels on the disk. Rhodesia.—*E. Woodfórdii*, Rolfe. With tall many-fld. infl.; fls. green with dull claret-purple lip. Old Calabar.

GEORGE V. NASH.†

EULOPHIÉLLA (a diminutive of *Eulophia*). *Orchidàceæ*. Orchids in habit resembling a small cyrtopodium. Flowers in many-fld. racemes; sepals and petals similar, concave; lip 3-lobed, spurless; column with a curved foot; pollinia 2.—Species 2. They require the conditions and treatment given Cyrtopodium.

Elísabethæ, Hook. Lvs. nearly 2 ft. long, plicate: scape stout; raceme many-fld.; fls. about 1½ in. across; sepals and petals white, the former marked with rose on the outside; lip white with a golden disk. Madagascar. B.M. 7387. G.C. III. 45:407. C.O. 1. O.R. 6: 177; 20:137.

Peetersiàna, Kränzl. Bulbs 1 ft. long: raceme dense; fls. nearly 3 in. across, rose-purple; lip with a golden blotch. Madagascar. G.M. 51:267. C.O. 2. O.R. 6: frontispiece; 20:138.

E. Hámelinii, Rolfe. Resembling E. Peetersiana in habit but lvs. narrower and fls. smaller. Madagascar.

GEORGE V. NASH.

EUÓNYMUS: *Evonymus*.

EUPATÒRIUM (named for an ancient king of Pontus said by Pliny to have employed one of this group of plants in medicine). *Compósitæ*. JOE-PYE WEED. THOROUGHWORT. BONESET. HEMP AGRIMONY. MIST-FLOWER. Chiefly perennial herbs, a few species annual, many of the tropical ones shrubby or even arborescent; some of them hardy border plants, others grown in coolhouses as florists' plants, and others in warmhouses for the attractive foliage.

Heads rayless, mostly in dense flat-topped or rounded clusters, less frequently in open panicles, the florets (rarely 1–4) mostly 5 or more in each head, perfect, the 2 style-branches long, threadlike or club-shaped, protruding far out of the tube of the floret; involucre cylindrical to hemispherical, its scales in 2 to many overlapping ranks: achenes 5-angled, crowned with a well-developed pappus of hair-like mostly white bristles: lvs. mostly opposite: fls. purple, rose-colored or white, more rarely lilac or bluish violet, never yellow. —At least 600 species, chiefly of Mex., the W. Indies, and Trop. S. Amer. Certain species, now botanically placed in Eupatorium, still appear in trade catalogues and seed-lists under the names Hebeclinium and Conoclinium. Others have been confused with Ageratum.

Of this large and varied genus relatively few species have been brought into cultivation. Of these, there are two classes, namely certain warm-country species adapted only to glasshouse culture, and on the other hand a few native North American species (as well as the hemp agrimony of Europe), more or less tractable in cultivation, especially as components in making up mixed hardy borders. The glasshouse species are seen only in the larger or amateur collections, as a rule, although a few have been long in European cultivation. Of the hardy species, some, reputed medicinal, are found in old gardens. The glasshouse species demand the general treatment of Piqueria (Stevia of florists)—a cool or intermediate temperature and pot culture. They are easy to grow, and propagate readily by cuttings. They are useful for winter bloom, the heads, though individually small, being aggregated in showy masses.

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KEY TO THE SPECIES.

A. *Glasshouse or warm-country species.*
  B. *Florets pink, purple, lilac, or violet.*
    C. *Involucral scales not ending in hairy tails.*
      D. *Shape of lvs. ovate; lf.-stalks long.*
        E. *Lvs. heart-shaped.*
          F. *Sts. covered with dense reddish wool* ..... 1. atrorubens
          FF. *Sts. green.*
            G. *Panicle dense, terminal: lvs. mucronate-toothed* .. 2. megalophyllum
            GG. *Infl. lax, partly axillary: lvs. crenate-toothed* ..... 3. Purpusii
        EE. *Lvs. pointed or blunt at base* ... 4. ianthinum
      DD. *Shape of lvs. lanceolate or oblong; lf.-stalks short.*
        E. *Lvs. alternate: heads many-fld.* .. 5. Lasseauxii
        EE. *Lvs. opposite: heads 5–12-fld.* .. 6. serrulatum
    CC. *Involucral scales ending in hairy, colored tails* ..... 7. hecatanthum
  BB. *Florets white or nearly so (the pappus sometimes colored).*
    C. *Lvs. leathery, lance-oblong, glabrous, entire* ..... 8. araliæfolium
    CC. *Lvs. not leathery, usually somewhat toothed and hairy.*
      D. *Lf.-blade elliptic-lanceolate, decurrent and crisped on short stalk* ..... 9. micranthum
      DD. *Lf.-blade round-ovate, toothed even to the decurrent base* ..... 10. conspicuum
      DDD. *Lf.-blade not decurrent on petiole.*
        E. *Plant glandular-sticky.*
          F. *Heads about ¼in. diam* ..... 11. glandulosum
          FF. *Heads about ½in. diam* .... 12. probum
        EE. *Plant not glandular-sticky.*
          F. *Lvs. velvety beneath: infl. broad rounded corymb* .... 13. vernale
          FF. *Lvs. sparingly hairy or soon glabrate.*
            G. *Shape of lvs. round- or triangular-ovate; margins toothed.*
              H. *Lf.-blade small, ½–1½ in. long* ..... 14. glechonophyllum
              HH. *Lf.-blade larger, 2–4 in. long* ..... 15. pazcuarense
            GG. *Shape of lvs. elliptic-ovate; margins nearly or quite entire* ..... 16. glabratum
            GGG. *Shape of lvs. narrowly lanceolate* ..... 17. riparium
AA. *Hardy or border plants.*
  B. *Florets flesh-colored, reddish or bluish-purple.*
    C. *Lvs. lance-oblong, merely toothed, mostly whorled* ..... 18. purpureum
    CC. *Lvs. deeply 3-parted, opposite* ..... 19. cannabinum
    CCC. *Lvs. broadly ovate, opposite, merely toothed* ..... 20. cœlestinum
  BB. *Florets white or nearly so.*
    C. *Lvs. perfoliate (united around the st.)* ..... 21. perfoliatum
    CC. *Lvs. not perfoliate.*
      D. *Lf.-blade lanceolate, the base narrowed and scarcely stalked.*

E. *Scales of involucre blunt, gray-velvety*.....22. **altissimum**
EE. *Scales sharp, smoothish, with thin white edge*.....23. **album**
DD. *Lf.-blade ovate-lanceolate, sessile by a rounded base*.....24. **sessilifolium**
DDD. *Lf.-blade broadly ovate, usually well stalked.*
E. *The lvs. taper-pointed, sharply toothed*.....25. **urticæfolium**
EE. *The lvs. mostly blunt and bluntly toothed*.....26. **aromaticum**

1. **atrórubens,** Nichols. (*Hebeclínium atrórubens,* Lem.). Lvs. large, ovate, short-stalked, heart-shaped at base, opposite, toothed, covered on the edge and veins with long reddish or claret-colored hair: heads red or purple, in a very large red-rayed truss. S. Mex. I.H. 9:310.—A stately species with fine foliage and richly colored fls., but said to be difficult to grow. Rare in cult. Closely related, if not identical, is *E. grandiflorum,* André, though figured with smaller heads of redder color. R.H. 1882:384.

2. **megalophýllum,** Klatt (*Hebeclínium macrophýllum,* Lem., not DC. *H. megalophýllum,* Lem.). Half-shrub, robust: lvs. opposite, round, more or less heart-shaped, very large, the lower sometimes more than a foot in diam., veiny: heads in large clusters (1–1½ ft. broad); florets rose, the long hairlike styles conspicuous, bluish. S. Mex. R.H. 1866, p. 351. Gt. 16:548.—Fine showy species with rich foliage, but apparently rare and not recently in trade. Needs richly manured soil, much light, and frequent replanting.

3. **Purpûsii,** Brandegee (*E. petiolâre,* Hort., not Moc. & Sessé). Smoothish or (var. **montícolum,** Brandegee) sticky-hairy, loosely branched: lvs. round-ovate, commonly heart-shaped, shortly taper-pointed, bluntly and rather coarsely toothed: heads slender-stalked, ½in. diam.; florets at first white, changing rapidly to pinkish lilac. Low. Calif. G.C. III. 35:163.—Attractive, rapid-growing, herbaceous, tender. Weak and needing support.

4. **iánthinum,** Hemsl. (*Conoclínium iánthinum,* Morr. *Hebeclínium iánthinum,* Hook.). Somewhat shrubby, the thickish round sts. at first covered with a rusty purplish pubescence: lvs. large, ovate, long-stalked, opposite, pointed or blunt (but not heart-shaped) at base, somewhat hairy on both surfaces, serrate: fls. light violet, in a large compound terminal corymb. S. Mex. B.M. 4574.—A luxuriant species with heavy foliage, of easy pot cult. in a warmhouse.

5. **Lasseâuxii,** Carr. (*Agératum Lasseâuxii,* Carr. *Conoclínium Lasseâuxii,* Dur.). Habit of Ageratum, densely covered with short glandular hairs: lvs. alternate, oblong-lanceolate, narrowed at each end, bluntly toothed: heads in small compact unequally stalked clusters; florets very numerous, at first white, at maturity a vivid rose-color. Temp. S. Amer. R.H. 1870:90.—Intro. to European hort. in 1870. Attractive bedding plant, but apparently rare. Probably not fully hardy though less tender than most of the glasshouse species. Prop. easily and flowers continuously; 1–2 ft. high.

6. **serrulâtum,** Hort. Shrub with lance-shaped, pointed, sharply and unevenly toothed, short-stalked lvs., very unequal involucral scales, and showy reddish lilac heads in large dense flat-topped clusters; florets 5 in each head. In European hort., and said to come from S. Brazil. R.H. 1894:304. Gt. 44, p. 570. G.C. III. 18:265.—Three to 6 ft. tall. Choice, but certainly not the true *E. serrulatum,* DC., which has much narrower finely and evenly serrulate lvs. and 11–12-fld. heads.

7. **hecatânthum,** Baker (*Hebeclínium Urólepis,* DC.). Robust annual, like a large ageratum: lvs. opposite, stalked, round-heartshaped: heads showy, bluish purple; florets numerous (about 75); involucral scales ending in similarly colored hairy appendages. Temp. S. Amer.—Promising species, worthy of trial as a bedding plant.

8. **araliæfôlium,** Less. (*E. omphaliæfôlium,* Kunth & Bouché). Soft-wooded shrub with thick and shining oblong-lanceolate lvs. 3–8 in. long: heads loosely panicled; involucral scales conspicuously unequal, the outer short and calyx-like, the inner 3–4 times as long; florets white. S. Mex. and Guatemala. Gt. 2, p. 4, t. 39.—From low and moist tropical habitat and presumably very tender. Rare in cult. and not noticed recently in trade. Needs rich leaf-mold, moist air, and high temperature. Prop. by cuttings. Flowers in March.



1434. Leaves of glasshouse Eupatoriums. *a*, E. riparium; *b*, E. vernale; *c*, E. glandulosum; *d*, E. glabratum. (×⅓)

9. **micránthum,** Less. (*E. ligustrìnum,* DC. *E. Mórisii,* Hort. *E. Weinmanniânum,* Regel & Koern. Many other hort. names, for which see Gt. 22, p. 36). Lvs. opposite, elliptic-lanceolate, pinnately veined, the blade somewhat toothed and slightly decurrent in narrow crisped wings upon the short lf.-stalk: heads small and few-fld. but very numerous in large round-topped terminal corymb; florets white, but pappus pink-tinged to deep rose. Mex. Gt. 16, p. 260, t. 555, figs. 1–3. Gn. 47, p. 444. G.C. II. 5, p. 53.—Upright shrub rather widely cult. since about 1830 under a great variety of names, but chiefly as *E. Weinmannianum.*

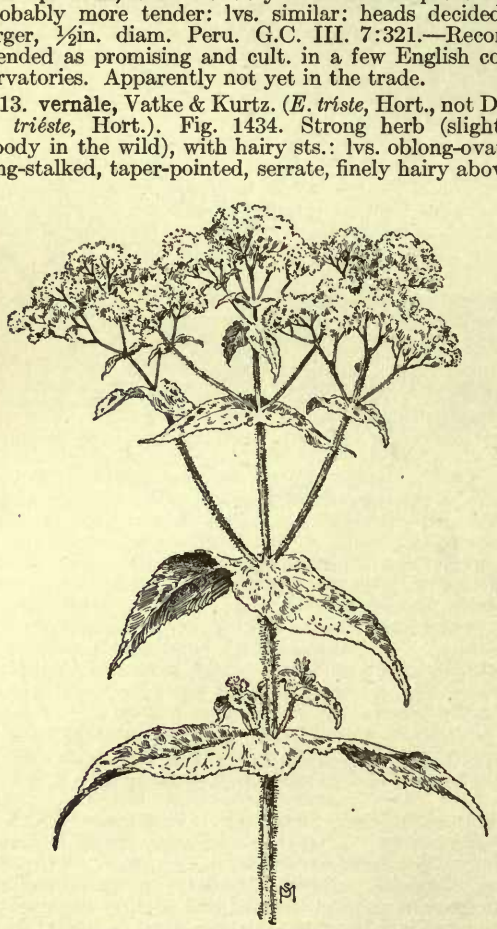
10. **conspícuum,** Kunth & Bouché (*E. grandifôlium,* Regel). Shrubby: lvs. opposite, large, thin, triangular-ovate, finely and sharply toothed to the very base, which is somewhat decurrent upon the long lf.-stalk: fls. white, in ample lax panicles, almond-scented. Guatemala. Gt. 1, p. 102, t. 12.—Planted out in summer forms a luxuriant shrub, attractive on account of its excellent foliage. Best prop. by cuttings placed in warm bed about the end of August. Winter-bloomer in glasshouse.

11. **glandulôsum,** HBK. (*E. adenóphorum,* Spreng. *E. adenánthum,* Hort., not DC. *E. trapezoídeum,* Kunth.

E. americànum, Hort.). Fig. 1434. Diffuse and often decumbent herb, the slender round branches, petioles, and pedicels finely glandular-puberulent: lvs. triangular-ovate or rhombic-ovate, thinnish, slender-stalked, taper-pointed, coarsely and sometimes unevenly crenate-dentate, sparingly puberulent beneath: heads pure white, ageratum-like, in close clusters. Mex. B.R. 1723.—Easy in pot cult. and not very tender, flowering in late autumn or early winter. Cuttings strike root readily. Var. **fòliis variegàtis**, Hort. Lvs. variegated.

12. **prôbum**, N. E. Br. Very viscid like the preceding, probably more tender: lvs. similar: heads decidedly larger, ½in. diam. Peru. G.C. III. 7:321.—Recommended as promising and cult. in a few English conservatories. Apparently not yet in the trade.

13. **vernàle**, Vatke & Kurtz. (*E. tríste*, Hort., not DC. *E. triéste*, Hort.). Fig. 1434. Strong herb (slightly woody in the wild), with hairy sts.: lvs. oblong-ovate, long-stalked, taper-pointed, serrate, finely hairy above,



1435. Eupatorium perfoliatum. (×⅓)

paler and grayish velvety beneath, veiny, 3–5 in. long: fls. bright white, the heads in an ample terminal corymb; involucral scales long, narrow, green. Mex. Gt. 22:750.—Easy in pot cult. becoming popular for cut-fls.

14. **glechonophýllum**, Less. (*Agératum conspícuum*, Hort.). Low, branching half-shrub, very leafy: lvs. small, ½–1 (rarely 2) in. long, triangular-ovate, sharp-pointed, bluntly few-toothed, thin and nearly glabrous, on slender stalks: heads borne on threadlike pedicels in small or medium-sized flattish clusters. Chile.—Tender greenhouse perennial, but flowering in the open the first year if seeds are sown early. Closely related, if not actually identical was the *E. Haageanum*, Regel & Koern. intro. into European hort. in the middle of the 19th century (see Gt. 16, p. 260, t. 555, figs. 4–6).

15. **pazcuarénse**, HBK. Puberulent but not glandular: lvs. opposite, stalked, round-ovate, light green, 2–4 in. long, taper-pointed, sharply or bluntly toothed: heads very numerous in a wide (3–10 in.) flattish corymb. Uplands of Mex.—Essentially herbaceous, 1–3 ft. high. Recently intro. in cult. in S. Calif. Promising for cut-fls. and as a window plant.

16. **glabràtum**, HBK. (*E. élegans*, Hort. *E. latifòlium*, Hort.). Fig. 1434. Shrubby, erect, with slender hard glabrous brown sts.: lvs. of firm texture though scarcely leathery, small, lance-oblong or ovate-oblong, tapering into a strong rather short petiole, blunt or pointed, wavy-margined or small-toothed: fls. (sometimes blush) in ascending cymose clusters, together forming a long terminal leafy panicle. Uplands of Mex.

17. **ripàrium**, Regel. Fig. 1434. Diffuse, becoming woody at base, 2 ft., the sts. slender, puberulent and usually reddish: lvs. opposite, long-lance-shaped, taper-pointed and at base narrowed to a long petiole, prominently 3-ribbed, toothed: heads in rather compact long-stalked clusters. Mex. Gt. 15:525. Gn. 40, p. 134.—Good winter bloomer. Best for florists. Readily cult. in coldhouse.

18. **purpùreum**, Linn. Joe-Pye Weed. Lvs. whorled, commonly in 5's and 6's, oblong or lanceolate, taper-pointed, coarsely serrate: heads in large compound clusters, pale purple or flesh-colored, rarely almost white. N. Amer.—Common and variable. Tall, rank plant of low grounds (reaching 8–9 ft.), good for bold effects in border or against shrubbery. Var. **maculàtum**, Darl. Of lower growth: lvs. commonly in 4's, ovate-oblong, roughish-pubescent: heads in smaller clusters, more deeply colored. Var. **foliôsum**, Fern. Similar but with the infl. surpassed by the long upper lvs. Var. **amœnum**, Gray. Still lower (2 ft. high), smoothish: lvs. sometimes merely opposite.

19. **cannabìnum**, Linn. Hemp Agrimony. Resembling Joe-Pye weed in general habit and with similar pale purple heads in terminal clusters: lvs. opposite, but deeply 3-parted in a manner to suggest verticillate lvs. Eu.—Common. May be used like the preceding species but less desirable. Thrives best in limy alluvial soil. Eng. Bot. 6:428.—The Asiatic *E. Kirilòwi*, Turcz., is a very nearly related plant of lower growth (1–3 ft.), with narrower (linear-oblong) coarsely toothed lf.-segms., the lateral often much reduced. Strict herb with dense terminal corymb of dull greenish purple heads. Gt. 24:850.

20. **cœlestînum**, Linn. (*Conoclínium cœlestînum*, DC.). Mist-Flower. Somewhat pubescent: lvs. opposite, stalked, triangular-ovate, somewhat cordate, thin, coarsely toothed: heads as in Ageratum in compact clusters, many-fld., light blue to violet. N. J. to Mich., Kans., and southward.—Perennial herb, late-blooming, heliotrope-fld. Appropriate to low borders.

21. **perfoliàtum**, Linn. Boneset. Thoroughwort. Fig. 1435. Hairy: lvs. lance-oblong, the pairs united at base about the st., wrinkled, remotely toothed or entire, taper-pointed: heads in dense terminal compound cymes. N. Amer., common in low rich soil.—Stout, slightly rank-smelling plant, 2–3 ft. high, long used in domestic medicine and found in old gardens. Excellent for striking effects, especially in low grounds. Fls. grayish white or in a comparatively rare variety (forma **purpùreum**, Brit.) bluish purple. In var. **truncàtum**, Gray, the lvs. (at least the upper ones) are rounded or truncate at the sessile base, not united about the st. A peculiar form apt to be encountered occasionally in large cultures.

22. **altíssimum**, Linn. Grayish green, downy, much branched: lvs. opposite, narrowly lance-shaped, tapering to both ends, short-stalked, remotely toothed or entire: heads only 5-fld. Pa. to Minn., Neb., and southward.—Tall, vigorous herb, 4–8 ft. high, in open places and dry soil. Not very ornamental. See page 3568.

23. **álbum,** Linn. Rough-hairy: lvs. opposite, lance-oblong, coarsely serrate, essentially sessile, veiny: involucral scales scarious-margined: florets white. L. I., southward near the coast.—Somewhat attractive for border planting and specially suited to poor sandy soil.

24. **sessilifòlium,** Linn. Upland Boneset. Lvs. oblong-lanceolate, gradually tapering almost from the rounded sessile or nearly sessile base to the apex: heads 5-fld., white. Vt. to Mo. and southward.—A trim, smooth highly attractive hardy species. Thrives best in limy alluvial soil.



1436. Eupatorium urticæfolium (×⅓)

25. **urticæfòlium,** Reichard (*E. ageratoìdes,* Linn. f.). White Snakeroot. Fig. 1436. Lvs. opposite, thin, long-stalked, ovate with broad base, acuminate, coarsely and sharply serrate, green on both sides: heads small in loose but ample clusters; florets bright white. E. N. Amer. Mixed woods, common.—Neat, smoothish, branching herb, 2–4 ft. high. One of the best of the perfectly hardy summer-blooming species.

26. **aromáticum,** Linn. Much like the preceding but usually hairy: lvs. thickish and blunt or scarcely pointed, blunt-toothed: later-flowering, not aromatic. Mass. and southward near the coast.—Suited to very sandy soil. Var. **melissoìdes,** Gray (*E. Fràseri* and *E. cordifòlium,* Hort.). Slender, roughish, strict: heads 5–12-fld.: lvs. subcordate, ovate or oblong, obtuse, the petioles often very short. S. E. U. S.—Also suited to poor and sandy soil, but more tender than the typical form.

The following species are said to have been recently intro. into European horticulture and to promise well: *E. deltoìdeum,* Jacq. A soft-wooded half-shrub with opposite triangular-hastate crenately toothed lvs. 3–5 in. long and somewhat pale and slightly velvety beneath, the basal lobes widely spreading acute: lf.-stalks 1–3 in. long: heads of rosy purple fls. in thyrsoid panicles; involucral scales linear, very sharp, scarcely imbricated. S. Mex. A glasshouse species with striking foliage.—*E. herbàceum,* Greene (*E. arizonicum,* Hort.). An erect smooth or merely pulverulent perennial 1–3 ft. high, with opposite triangular-ovate pale green lvs. 1–3 in. long with rounded basal lobes, toothed sides, and rather short but slender stalks: fls. white; heads in broad rounded terminal clusters. S. W. U. S. Half-hardy and suited to dry places. *E. japónicum,* Thunb. Erect perennial resembling E. cannabinum, with dull purplish to greenish white fls. in flat clusters: lower lvs. deeply 3-parted, the upper simple: not very attractive.

B. L. Robinson.

EUPHÓRBIA (classical name; said by Pliny to be in honor of King Juba's physician; possibly from the Greek for *fat*). *Euphorbiàceæ.* Milkweed (improperly) Wolfs-milk. Spurge. The last name, most often applied to the genus as a whole, belongs more properly to the common herbaceous species and especially to *E. Lathyris.* Of very diverse habit, from succulent cactus-like trees to low or prostrate herbaceous weeds; planted mostly in the open, but some kinds grown under glass as oddities and some as florist's plants.

The genus is characterized by the single pedicellate, pistilate fl. without floral envelopes, or with only a rudimentary calyx, surrounded by numerous staminate fls., each consisting of a single stamen separated from its pedicel only by a joint; the whole infl. surrounded by a more or less cup-shaped involucre with 5 lobes and 1–5 glands is called a cyathium. The involucre is regular or nearly so; the glands free from one another: the fr. an explosive caps., with 3 carunculate seeds; the staminate fls. are usually subtended by minute bracts.—One of the largest plant genera, of not less than 700 and probably over 1,000 species, occurring in most temperate and tropical regions. Many are desert plants and the greater number grow in dry and sterile places. Euphorbia is distinguished from the nearest related genera, Pedilanthus and Synadenium, by its regular or nearly regular involucre, which in Pedilanthus is protuberant on one side of the base and contains the glands, and by the free involucral glands which in Synadenium are united into a ring. Some of the fleshy species are very similar to succulent cacti and Asclepiadaceæ. One long grown under the name of *E. pendula,* Boiss., is a Sarcostemma according to N. E. Brown. For *E. tithymaloìdes,* see *Pedilanthus;* for *E. Grantii,* Hort., and *E. arborea,* Hort., see *Synadenium.*

Monographed by Boissier in DeCandolle's Prodromus, 15, pt. 2 (1862). See local floras and Norton, Rept. Mo. Bot. Gard. 11, for native species. See also Fobe, in Monatsschrift für Kakteenkunde, 8:42 (1898) and Berger, Sukkulente Euphorbien, a manual of the cactus-like species in cultivation. The recent work of N. E. Brown of Kew in Flora of Tropical Africa and Flora Capensis describes and gives keys to practically all the African species, which include nearly all the succulent ones, both wild and cultivated. Although the vegetative form varies remarkably, so that the various sections of the genus are considered of generic rank by many authors, the floral characters are very similar and so inconspicuous as to be of little importance generally in a horticultural work.

Most of the species have abundant milky juice, and the cactiform kinds have been thus distinguished from cacti, but many cacti also have milky juice. The juice of many species is acrid-poisonous, especially if it comes in contact with mucous membranes or open sores. The juice from some of the species is used in medicine as a purgative.

Many of the fleshy species are cultivated by lovers of succulents for their curious shapes; and a few are valuable for their ornamental foliage. The flowers are usually too minute to be noticeable. Some, like *E. corollata* (Fig. 1437), *E. maculata, E. Cyparissias* and *E. marginata,* are weeds in America, but not troublesome. The great majority of the species are insignificant herbs. The species are remarkably free from injurious insects, and are rarely attacked by a few fungi.

The fleshy species are grown much the same as cacti, but the culture is less difficult, and they do well with warmer treatment. In winter they are kept in a dry and cool house, 50° to 55° F., with good light and little water. Drips must be carefully avoided. In summer the pots should be plunged outdoors in hot dry situations, with a moderate supply of water and especially good drainage. It is better to protect them from continued rain, but most species do well without this. The more fleshy species, like *E. Caput-Medusæ, E. mammillaris,* and *E. meloformis,* require more heat and better care than the others. They have to be watered with great care in winter. The air of most greenhouses is too damp for them if the requisite low temperature is maintained. The winter conditions of air and temperature in ordinary living-rooms make them ideal for the succulent euphorbias. Species like *E. neriifolia* need water in the growing season and dry conditions after the



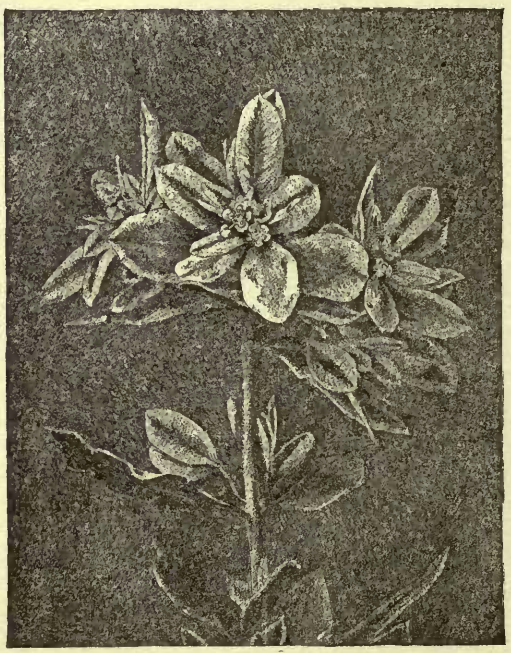
1437. Cyathium of Euphorbia corollata (×2). The pistillate flower is at 8, surrounded by several staminate flowers arising above the involucral glands with their five oblong spreading petaloid appendages. No. 3.

leaves fall. The shrubby species, like *E. atropurpurea* and *E. dendroides*, do well with the treatment of the more fleshy kinds. See D. A. W. and F. S. Curtis, in Sharon Cactus Guide, March and May, 1897.

The few hardy species of ornamental value make good border plants or are suitable for the rockery. *E. epithymoides* usually known in gardens as *E. polychroma*, is one of the best herbaceous perennials, forming a hemispherical clump with beautiful yellow foliage of different shades when in bloom. *E. palustris* and related species are similar but erect and not compact.

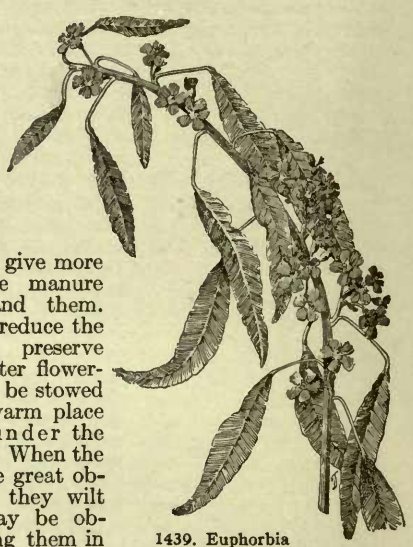
The succulent species can nearly all be propagated by cuttings. These are taken best in early summer, allowed to dry somewhat and then planted in sand, charcoal or a mixture of these. Coal-ashes are used effectively by some. When seeds can be procured, they may be used in propagation. Grafting, as is sometimes practised with cacti, is possible. Potting soil need not be rich. A coarse sandy loam, or, some say, any kind of soil will do.

E. pulcherrima and *E. fulgens* are good winter-flowering greenhouse plants, and require special treatment. *E. fulgens* succeeds well in the warmest parts of the house, in pots, or best planted out like roses and trained upon the wall or strings. It is propagated from cuttings taken in June, when the old plants have started to grow, kept in a warm frame until rooted, and then kept growing with heat, any transfers being made with as little root disturbance as possible. If stocky show plants are wanted, several cuttings may be planted in one pot and checked two or three times during summer by repotting, and kept pinched back freely to secure branches. They are best kept cooler when in flower, but are very sensitive to cold or sudden changes in temperature. After flowering they are kept dry for a few months. For the cut sprays they are best grown from cuttings each year. They last very well when cut.



1438. Euphorbia marginata (×⅓). No. 1

The culture of the poinsettia is very similar. To secure plants with large heads, the general plan is to grow from cuttings annually, but the old plants may be continued. Old plants that have been resting may be introduced to heat and moisture in late spring, and will soon give a liberal supply of cuttings, which are usually taken from the young wood. Successive sets of cuttings may be made at later periods if different-sized plants are wanted. When well started, the potted plants are plunged outdoors till September, with plenty of water, light and sunshine and good drainage. They do well in rich heavy loam in 5–7-inch pots. They are liable to drop their leaves if exposed to cold or other unfavorable conditions. In autumn they are transferred to the greenhouse, with moderate temperature. When the bracts begin to appear, give more heat and some manure water to expand them. When in flower, reduce the temperature to preserve them longer. After flowering the pots may be stowed away in a dry warm place till spring,—under the benches will do. When the buds are cut the great objection is that they wilt easily. This may be obviated by keeping them in water for a few days before using. See Grieve, G.C. III. 9:106, and Hatfield in Garden and Forest 9:496. See article *Poinsettia* for further treatment.



1439. Euphorbia fulgens (×⅓). No. 5.

Euphorbia splendens is another winter bloomer, and may be treated as the succulents, with more heat and water. It will do well in living-rooms, and bears some flowers all the year. It bears rough treatment well, and is propagated by cuttings from the young growth, which root with the greatest ease.

In tropical and subtropical regions many of the tree-like or succulent euphorbias make fine outdoor ornamentals. The poinsettia is a magnificent landscape ornament in California, West Indies and so on. In Southern California the poinsettia is propagated by sticking canes 3 feet long in the ground from April on, these growing and blooming, often profusely, the first season. In the West Indies and Florida, some of the thorny tree-like forms, especially *E. lactea*, are grown as hedges, their thick, erect thorny branches making an almost impenetrable barrier. This and other species are grown also as specimen plants. See *Succulents*.

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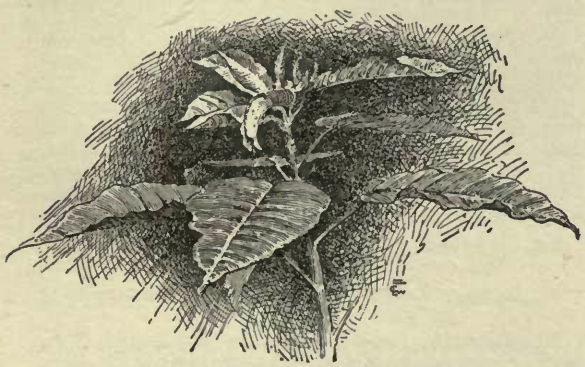
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A. *Glands of the involucre with petal-like appendages (almost none in 4): slender-branched herbs or rarely shrubs not spiny: lvs. entire.* Section ADENOPETALUM. The Section ANISOPHYLLUM, genus *Chamæsyce* of some, differs in having small opposite lvs., unequal at base, stipules present, fls. small, glands 4. It contains most of the low herbaceous wild euphorbias of U. S., such as *E. maculata*, Linn., *E. Preslii*, Guss., *E. serpens*, and *E. capitata;* names from this group occur in American catalogues, but the species to which they properly belong are inconspicuous weeds. *E. lorifolia*, Hillebr., of Hawaii, has recently been investigated as a possible source of rubber. (Descriptions of these species will be found in the floras.)

B. *Stipules present.*

1. **marginàta,** Pursh (*E. variegàta*, Sims). SNOW-ON-THE-MOUNTAIN. GHOST-WEED. Fig. 1438. Annual, about 2 ft. high, pubescent, dichotomously many-branched: lvs. numerous, light green, ovate-subcordate to oblong-lanceolate, 1–3 in. long, the upper white-margined, often entirely white: involucral glands with large white appendages. July–Oct. Plains from Dak. to Texas and extending eastward. B.M. 1747. Gt. 30:218. V. 2, p. 281; 5, p. 64. G.W. 13, p. 305.—Hardy annual, used for its white foliage in bedding and mixed borders in sunny situations.

2. **sanguínea,** Hort. (*E. hæmatòdes*, Boiss.?). A tall shrub: lvs, ovate, obtusely pointed, in whorls of 3, red when young to deep bronze or purplish red later.—This handsome plant of unknown nativity is cult. in S. U. S. While it is not possible to classify it exactly without fls. and fr., the foliage characters indicate its relationship to *E. cotinifolia*, Linn.



1440. Euphorbia pulcherrima (×⅛). No. 8.

BB. *Stipules absent or microscopic.*

C. *Plant a perennial herb.*

3. **corollàta,** Linn. (*Tithymalópsis corollàta*, Klotzsch & Garcke). FLOWERING SPURGE. Fig. 1437. Plant 1½–3 ft. high, usually glabrous, slender and diffusely branched above: lvs. ovate-oblong to lanceolate, 1–2 in. long, those of the infl. much smaller and opposite: involucral glands 5, with conspicuous white appendages. July–Oct. On rather dry soil E. U. S. B.M. 2992. L.B.C. 4:390. F.R. 1:969.—A hardy herbaceous perennial used like gypsophila for cutting, and as a bedder in light soil. There are many variations in size, shape, color and pubescence of plant, lvs. and infl.

4. **Ipecacuánhæ,** Linn. (*Tithymalópsis Ipecacuánhæ*, Small). IPECAC SPURGE. Only the forking infl. (3–6 in.) above ground, with its red or green glabrous, opposite lvs. varying from oval to linear on different plants, the alternate lvs. of the short st. usually subterranean and scale-like: cyathia long peduncled; appendages of glands rudimentary. April. Sandy soil E.U.S.L.B.C. 12: 1145. B.M. 1494. —*E. geniculàta*, Ort., is sometimes cult. under this name. It is a plant of Trop. Amer., related to *E. heterophylla*, but with broader lvs. the upper whitish at base.



1441. Euphorbia heterophylla (×⅛). No. 9.

CC. *Plant a shrub.*

5. **fúlgens,** Karw. (*E. jacquiniæflòra*, Hook.). SCARLET PLUME. Fig. 1439. Small shrub with slender drooping branches: lvs. long-petioled, lanceolate, bright green: cyathia in small axillary cymes, with the conspicuous appendages to the 5 involucral glands bright scarlet. Mex. B.M. 3673. R.B. 39:41. F.C. 2:55. R.H. 1905:440. Gn. 33:486; 39, p. 239; 67 p. 73. V. 2, p. 74. A.F. 16:1551. G.M. 53:89. G. 4:593. P.M. 4:31. Gng. 10:76.—A handsome winter-blooming plant, used for cut-fls. or for specimen plants.

6. **mísera,** Benth. Lvs. small, obovate, pubescent, clustered at the end of crooked branches: fls. inconspicuous. S. Calif. and Mex.—Recently catalogued in the Calif. trade.

7. **antisyphilítica,** Zucc. (*Tricherostigma antisyphilítica*, Klotzsch & Garcke). CANDELILLO. Slender, erect, rod-like branches 1–3 ft. high, almost leafless. Mex.—The plants yield a useful wax and are sometimes grown in collections of succulents.

AA. *Glands of involucre without petal-like appendages. (Nos. 8–65)*

B. *St. herbaceous or shrubby, not fleshy: lvs. well developed, the upper colored: stipules minute: infl. cymose.* Section POINSETTIA.

8. **pulchérrima,** Willd. (*E. Poinsettiàna*, Buist. *Poinséttia pulchérrima*, Graham). POINSETTIA. EASTER FLOWER. CHRISTMAS FLOWER. LOBSTER FLOWER. MEXICAN FLAME-LEAF. Fig. 1440. Shrub 2–10 ft. high, branched: lvs. ovate-elliptical to lanceolate, entire, sinuate toothed or lobed, or panduriform, 3–6 in. long, somewhat pubescent, the upper narrower, more entire to even linear-lanceolate and of the brightest vermilion-red: involucres 2–3 lines wide, greenish, with one large yellow gland. Nov.–March. Moist, shaded parts of Trop. Mex. and Cent. Amer. B.M. 3423. G.C. III. 21:125, 193. F.C. 1:33. Mn. 7, p. 67. Gn. M. 2:209.—Sometimes cut, usually used for specimen plants and in masses, often used in decorations. A gorgeous plant. Var. **plenissima,** Hort., has the fls., or most of them, transformed into red bracts, giving a fuller center. G.C. II. 5:17. Gt. 28:182. F.M.

1876:200. Var. **álba**, Hort., has the upper lvs. white. R.H. 1913: 228.—It is not so vigorous, blooms later and requires more heat.

9. **heterophýlla**, Linn. (*E. panduràta*, Hort.? *E. havanénsis*, Willd. *E. cyathophòra*, Murr.). Mexican Fire Plant. Hypocrite Plant. Painted Leaf. Fire-on-the-Mountain. Annual Poinsettia. Fig. 1441. Annual, nearly glabrous, 1–3 ft. high: lvs. ovate and sinuate-toothed, or panduriform, or some of them lanceolate or linear and entire, dark green, the upper bright red at least at the base: involucres small with 1 or 2 glands. July–Sept. E. and Cent. U. S. to Peru. Mn. 2, p. 53. Gt. 39, p. 105.—Easily grown from seeds in sunny gardens and also in pots indoors. White and yellow variegated forms are in cult.

BB. *Sts. more or less fleshy, often cactus-like and spiny: lvs. small, none or soon deciduous: infl. few-branched or cyathia single: stipules minute or none (except in E. Fournieri).* Section Euphorbium. Nos. 10–51.

C. *Branches cylindrical or angled, not thorny: lf.-bases not thickened and elevated as podaria: lvs. alternate or crowded on the angles.*

D. *Joints or branches cylindrical or flat.* Subsection Tirucalli.

10. **Tirucállii**, Linn. Milk-Bush. Indian Tree Spurge. A small tree, with a dense crown of slender, cylindrical whorled branches, curving outward then erect: joints about 4 in. long, twigs ¼–½in. thick: lvs. narrow, about 1 in. long, soon falling. S. Asia.—A striking plant for the succulent collection. Easy of cult., often grown outdoors in warm regions.

11. **rhipsaloìdes**, Lem., is a closely related African species probably not now in cult., but the name is in use in the trade.

12. **xylophylloìdes**, Brongn. Shrub or tree: trunk cylindrical, much branched; branches flat or 2-angled, ½in. wide, slightly toothed along the edges: lvs. minute, soon deciduous. Madagascar.

DD. *Joints or branches 4–5-angled from the decurrent lf.-bases or comb-like rows of stipules.* Subsection Goniostema (No. 13) and Subsection Pteroneuræ (No. 14).

13. **Fournièri**, André. St. 4–5-angled, the crowded persistent stipules forming comb-like rows on the angles: lvs. large at the apex of the short thick sts.; petioles and stipules red. Madagascar region. R.H. 1896, p. 226. L.B.C. 15:1477 (as *E. lophogona*).



1442. Euphorbia splendens. (×⅓)

14. **pteroneùra**, Berger. A low shrub with erect, jointed branches, ⅓in. thick, the 5–6 angles formed by sharp low ridges decurrent from the lf.-bases: lvs. reduced, soon deciduous. Mex.(?)—Erroneously grown under the name of *E. colletioìdes*, Benth.

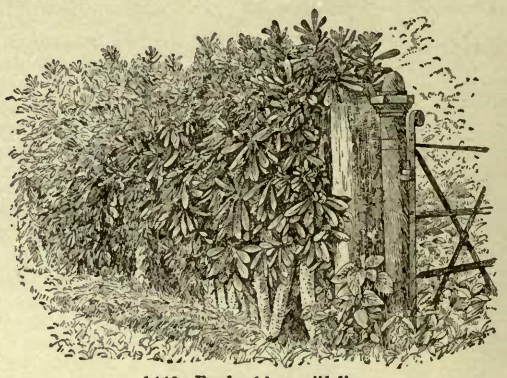
CC. *Branches succulent with thickened elevated lf.-bases (podaria).*

D. *Spines 1–2 on each side the lf.-base.* Subsection Diacanthium. Nos. 15–38.

E. *Podaria (lf.-bases) not united into ribs; branches nearly cylindrical: lvs. well developed.*

F. *Bracts bright red.* Class Splendentes.

15. **spléndens**, Bojer. Crown of Thorns. Fig. 1442. Sts. 3–4 ft. long, ½–1 in. thick, somewhat climbing, covered with stout spines about an inch long: lvs. few, on the young growth, obovate to oblong-spatulate, thin, bright green, 1–2 in. long: cyathia in long-peduncled dichotomous cymes, near the ends of the branches, each closely subtended by 2 broadly ovate bright red bracts. Madagascar. Flowering all the year but mostly in winter. B.M. 2902. L.B.C. 18:1713. V. 2, p. 74; 14, p. 16. G.C. II. 19:816 (as *E. jacquiniæflora*).—Coolhouse plant. The red bracts in the green lvs. on the sinuous spiny sts. are very striking. It can be trained into ornamental forms. The seedlings have larger sts. and lvs. and double spines, a smaller one below each of the ordinary ones.



1443. Euphorbia neriifolia.

FF. *Bracts not conspicuously colored.* Class Grandifoliæ.

16. **neriifòlia**, Linn. Fig. 1443. Arborescent or shrubby: st. obtusely 5-angled; the small mammiform podaria in rows, with short, dark-colored, divergent spines: branches somewhat whorled, bearing obovate-oblong, obtuse, thick lvs., 3–5 in. long, at the summit: small sessile cymes of greenish cyathia in the upper axils. June, July. E. Indies. Gn.M. 6:196.—The large lvs. persistent from autumn to spring. Cristate forms are in cult. Fig. 1443 shows a hedge in W. Indies.

17. **drupífera**, Schum. & Thonn. (*E. grandifòlia*, Haw.). Arborescent: st. terete: branches obsoletely 4–5-angled; spines small: lvs. terminal, obovate-cuneate, obtuse or retuse, 6–10 in. long: small cymes axillary, peduncled: caps. drupaceous. Guinea.

18. **mammillòsa**, Lem. Low, cespitose: branches less than an inch diam.: podaria elongated, conical, in 5 spiral rows: lvs. and spines small, soon deciduous. Nativity unknown.—Rare in cult. and not well known. Probably the plants grown under this name are something else.

EE. *Podaria united into ribs: branches 2–13-angled: lvs. usually very small or rudimentary.*

F. *Angles of the branches, 2 (rarely 3), the branches flattened.* Class Compressæ.

19. **alcicórnis**, Baker. St. obtusely 5-angled, 9 ft. high or less: branches flat, except the triangular base, ½in. broad: spines short, slender, dark-colored. Madagascar.

FF. *Angles of the branches 3 (sometimes 4), but the main st. often 5-angled.* Class Trigonæ.

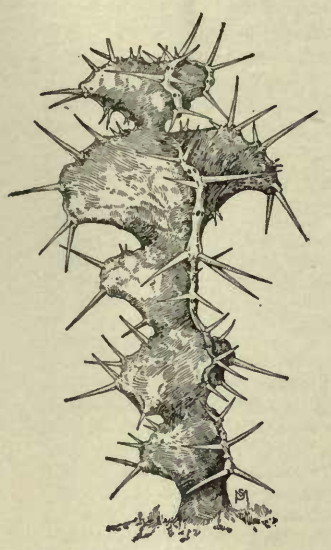
G. *Sides of branches solid green-colored.*

H. *Spine-shields separated by green tissue of ribs.*

20. **antiquòrum**, Linn. Shrub, 8–10 ft. high: branches erect, jointed, 1–2 in. thick, the angles repand-dentate; spine pairs about 1 in. apart; spines 1–3 lines long: lvs. very small, roundish. India. See *E. lactea*, No. 23.

21. **grândidens**, Haw. Tree, to 30 ft. high, with trunk as much as 2 ft. diam.: branches slender, ½–¾

in. wide, numerous, whorled, erect-spreading, making a dense rounded head in older plants; sides of branches almost plane; angles deeply sinuate dentate; spine pairs ½–¾in. apart, spines 3–5 lines long, slender, light brown to gray: lvs. very small, triangular. S. Afr.



1444. Euphorbia grandicornis. (×⅔)

HH. *Spine-shields united, forming a continuous horny edge to the ribs.*

22. **grandicórnis,** Goebel. Fig. 1444. Shrub or small tree: branches 3–5 in. wide, deeply jointed, the angles broadly winged, lobed and sinuate, the edge zigzag or wavy; spines large, 1–2 in. long, light colored: lvs. very small, triangular ovate. S. Afr.(?).—A fine plant, with the longest spines and widest wings of all. A rapid grower, the bright pale green contrasting beautifully with the rich light brown of the spines and horny margins on young plants.

GG. *Sides of branches marbled with white or yellow.*

23. **lâctea,** Haw. (*E. havanénsis,* Hort., at least in part). Fig. 1445. Similar to *E. antiquorum,* but with a white-marbled area running through the middle of each face of the branches. E. Indies.—One of the most common succulent euphorbias in cult., of fine candelabra form, and making rapid growth. The euphorbias grown for hedges in Fla., W. Indies, etc., are chiefly this species, though some may be *E. antiquorum.* It is often confused with *E. Hermentiana.* Cristate forms are in the trade as *E. lactea monstrosa* and *E. havanensis cristata,* though these should perhaps be referred to *E. antiquorum.*

24. **Hermentiàna,** Lem. Shrub, with closely erect, scarcely jointed branches, about 2 in. thick; sides strongly concave, striped or marbled with white, especially when young, angles closely dentate; spines slender, brown, 2–3 lines long: lvs. lanceolate, ½–2¼ in. long. W. Afr. G.Z. 19:101.—One of the best. The true *E. candelàbrum,* Trem., but probably not the one common in cult. under that name, is distinguished from *E. Hermentiana* by its rudimentary scale-like lvs.

FFF. *Angles of the branches 4–8 (rarely 3 on some branches).* Class POLYGONÆ.

G. *Spine-shields united, forming a continuous horny edge to the ribs.*

H. *Sides of mature branches plane or slightly convex, angles not winged, branches about 2 in. diam.*

25. **Pseudocáctus,** Berger. St. 4–5-angled: branches 3–5-angled, joints tapering upward from a broad base, 4–6 in. long, 2 in. or less thick, the surface with yellow U-shaped marks from center to angles; spines stout, ½in. long, brown to gray. Nativity (?). J.H. III. 60:99 (as *E. lactea*).—Frequent in cult., often under the name of *E. lactea;* also as *E. marmorata* and *E. tessellata.*

26. **cæruléscens,** Haw. (*E. viròsa,* and var. *cæruléscens* of Berger). Low, shrubby: st. 4–5-angled: branches 3-angled at base, 4–5-angled above, 2 in. thick; joints 2 in. or less long, the sides bluish glaucous; spines stout, ½in. long: lvs. triangular, scale-like. S. Afr. G.Z. 19:102.—A handsomely colored compactly branched succulent. According to N. E. Brown, *E. viròsa,* Willd., is quite a different plant. It is probably not in cult. in Amer.

27. **Echînus,** Hook. & Coss. Branching shrub, with 6-angled st., branches ascending, about 2 in. thick, 5- or more-angled: spine pairs less than ½in. apart; spines ½in. long, red to gray. Morocco. G.Z. 1904:122.

HH. *Sides of mature branches concave, angles more or less winged, branches often 3–4 in. thick.*

28. **triangulàris,** Desf. Tree-like: st. at first 6-angled, later cylindrical: branches whorled, divergent, then ascending, 3–5-angled, 2–4 in. thick; joints 2–12 in. long; spine pairs 3–9 lines apart; spines less than 5 lines long; spine-shields united only on stronger shoots: lvs. small, roundish. S. Afr.(?).

29. **Coòperi,** N. E. Br. Tree-like: whorled ascending branches, 3–5 in. thick, the joints broad at base and tapering upward, 6-angled, spines 5 lines long, black to gray. Natal.—A fine species.

GG. *Spine-shields separate.* See also No. 28.

H. *Sides of mature branches plane or slightly convex, angles not winged, branches less than 2 in. thick.*

30. **resinífera,** Berg (*E. San Sálvador,* Hort.). A much-branched shrub: branches 4-angled, spine-shields triangular-rounded, small, 3–5 lines apart. S.W. Morocco. G.Z. 19:102.—This species yields the euphorbium gum of the ancients.

31. **canariénsis,** Linn. Shrub or tree, 12–20 ft. high, with many 4–6-angled, suberect, not conspicuously jointed branches, as much as 3 in. thick; angles subentire; spines 2 lines long, black: lvs. almost none. Canary Isls. Gn. 53, p. 46.—This is one of the most common succulent euphorbias. It is easy to grow and prop. readily from cuttings, as well as from seeds which are frequently produced in cult. Several other species are in cult. under this name.



1445. Euphorbia lactea. No. 23.

HH. *Sides of branches concave to deeply grooved between the ribs, which are more or less winged; branches 2–6 in. thick.* (The species of this group and several others, e. g. *E. tenebrosa*, N. E. Br., *E. acrurensis*, N. E. Br., *E. grandis*, Lem. (*E. neutra*, Berger), *E. controversa*, N. E. Br., *E. Erythræa* N. E. Br., are in cult., probably some in Amer., as *E. abyssinica* or some as *E. candelabrum*. The true *E. abyssinica*, Gmel., is not in cult.)

32. **neglécta**, N. E. Br. (*E. abyssínica*, Berger, not Gmel.). Tree: branches 5–8-angled, joints 4–12 in. long, 4–5 in. thick, the conspicuous wings marked by swollen veins; spine pairs 1 in. apart, sunken; spines stout, brown, 1–2 lines long: lvs. narrow, 1 in. or more long: flowering eye above the spine-shield. N. Afr. G.C. III. 20:497. Gn. 52, p. 106.



1446. Euphorbia meloformis (×⅓). No. 44.

33. **símilis**, Berger (*E. natalénsis*, Hort., not Bernh.). Differs from *E. neglecta* in branches 5-angled: spine pairs on apex of a recurved tooth: lvs. shorter; spines darker; veins in wings not prominent. Natal(?).

34. **disclùsa**, N. E. Br. (*E. candelàbrum*, Berger, not Trem., see No. 24). Tree, with 4–5-angled st. and branches, slightly jointed: spine pairs 8–10 lines apart; spines 3–5 lines long, stout, dark brown to gray: flowering eye included in the spine-shield. Abyssinia.

FFFF. *Angles of branches 9–13.*

G. *Spine-shields almost always united into a horny margin; grooves between ribs rather shallow: branches about 2 in. thick.*

35. **Beaumieràna**, Hook. & Coss. A shrub to 9 ft. high: branches erect, 9–10-angled; spines short, spreading, red when young. Morocco. J.H. III. 59:627.

36. **officinàrum**, Linn. Shrub: branches 9–13-angled; spines but little spreading, yellowish to gray, 3–6 lines long: lvs. minute. N. Afr. R.H. 1875, pp. 336–7.

GG. *Spine-shields often isolated; grooves between ribs very deep.*

37. **fruticòsa**, Forsk. Low shrub: branches erect, scarcely jointed, 6–9 lines thick, 10–13-ribbed; spines 6–9 lines long, spreading, brown when young. Arabia.

38. **Pférsdorfii**, Hort. Trunk round, 1½–2½ in. thick, 9-angled, much branched when old: spines large, 4–9 lines long.—A species not very well known.

DD. *Spines, if any, not in stipular position.* Subsection TREISIA.

E. *Podaria in longitudinal rows or ribs.*

F. *Body cylindrical: sterile infl. transformed into thorns.* Class ANTHACANTHA.

G. *Ribs without prominent cross furrows between podaria.*

39. **heptagòna**, Linn. St. 3–4 ft. high, over 1 in. thick, candelabraform-branched, 5–8-ribbed: ribs broader than high; thorns not numerous, strong, yellow, ¾in. long: lvs. linear-lanceolate, acute. Cape of Good Hope.—According to N. E. Brown the plants of this section and their names are much confused in cult. and without careful study it would be difficult to say just what is being grown under the names of *E. heptagona*, *E. mammillaris*, *E. enopla*, etc.

40. **cereifórmis**, Linn. (*E. enneagóna*, Haw.). St. erect, 2–3 ft. high: branches with 9–13 straight ribs, the podaria forming declined teeth: lvs. small, triangular; thorns numerous, 4–7 lines long. Cape region.—Cuttings from the branches have a different form from seedlings.

41. **polygòna**, Haw. St. up to 5 ft. high, 5 in. thick, 10–13-ribbed, the ribs high and narrow, often somewhat spiral: thorns 4–5 lines long; lvs. minute. Cape region.

GG. *Ribs with the podaria separated by cross furrows.*

42. **mammillàris**, Linn. Low: branches 7–12-ribbed, about 1 in. thick; ribs flat; podaria not prominent; zones of spines up to 1 in. long, alternate with areas free from them. Cape region. Var. **spinòsior**, Berger, is more vigorous and spiny, with more prominent podaria.

43. **submammillàris**, Berger. St. irregularly branched, 1 in. thick: branches with about 5–8 straight ribs, 2 lines high; podaria forming pointed tubercles: lvs. linear; thorns numerous on strong branches, few on others. Cape region(?).—Grown as *E. mexicana*, *E. imbricata*, and *E. cereiformis*.

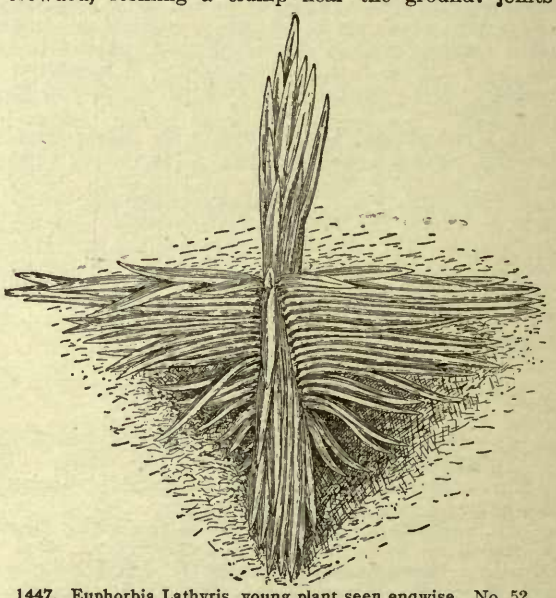
FF. *Body spherical, not thorny.*

44. **meloförmis**, Ait. MELON SPURGE. Fig. 1446. Globose or pyriform, 3–5 in. thick, deeply 8–10-ribbed; ribs obscurely tuberculate on the almost acute angles; sides transversely dark and light green-striped, or wrinkled when old: lvs. few and small: fls. at the depressed apex; the old forked branches of the infl. sub-persistent but not spinose. A few small branches similar to the main st. present. S. Afr. L.B.C. 5:436. A.G. 11:463.—A curious and rare plant, often mistaken for a cactus and showing extreme reduction in xerophytic euphorbias as Mammillaria does for the cacti.

EE. *Podaria in spirals checkering the axis.*

F. *Joints or branches globose to short-cylindrical: glands of the involucre with lobed or comb-like edges.* See also No. 51. Class DACTYLANTHES.

45. **globòsa**, Sims (*E. glomeràta*, Hort.). Low, the spherical or short cylindrical to club-shaped joints crowded, forming a clump near the ground: joints



1447. Euphorbia Lathyris, young plant seen endwise. No. 52.

½–2 in. long; podaria very flat, pentagonal: lvs. very small, triangular: peduncle 2–4 in. long; glands of involucre with 3–4 lobes which are green with white pits; flowering all summer. Cape region. B.M. 2624.

46. **ornithopus**, Jacq. Much-branched half-shrub: joints 1 in. or less thick, short-cylindrical; podaria

elongated into conical projections: lvs. small ovate: peduncles short; fls. much as in *E. globosa*, involucral glands erect, the 3–4 teeth pitted and white-marked. Cape region. B.M. 2520. L.B.C. 3:220 (as *E. anacantha*).

47. **anacántha,** Ait. Cespitose sub-shrub, with some joints 4–8 in. long, ¾in. thick: podaria oblong, somewhat projecting: lvs. small, ovate-oblong; cyathia almost sessile at apex of branches; glands divergent, the 3-lobes white with greenish pits. Cape region.

FF. *Joints of the branches obscure or none; branches cylindrical, many times as long as thick.*

G. *Sinuous or snake-like branches many, from a thick basal st.; thorns none: lvs. small; glands comb-like.* Class MEDUSEA.

48. **Càput-Medùsæ,** Linn. (*E. Commélinii*, DC.). MEDUSA'S HEAD. Branches 1–2 in. thick, numerous, declined about the short, obconical st., with ends erect, 6–12 in. long: lvs. linear-lanceolate, about 1 in. long: cyathia single, from short, thick peduncles; glands erect, white. Cape region.—A curious and interesting plant; often seen as single-stemmed plants grown from branch cuttings. *E. parvimámma*, Boiss., is also in cult. under this name. See Suppl. list.

49. **inérmis,** Mill. (*E. viperìna*, Berger, fide N. E. Br. *E. serpentària*, Hort.?). Smaller: branches about ½in. thick, 12 in. long; podaria narrow, in 6–8 somewhat spiral rows: ivs. very small, ovate; cyathia ½in. wide, whitish, glands divergent. Cape region. B.M. 7971.

GG. *Sinuous or snake-like branches none; glands simple, flat, without divided appendages: lvs. usually large; cyathia usually long peduncled, subtended by several broad bracts.* Class TREISIA.

50. **loricàta,** Lam. (*E. Hýstrix*, Jacq., fide N. E. Br.). A shrub, 2–3 ft. high: branches divergent from the base, ½in. thick: lvs. linear, 2–3 in. long: peduncles persistent as numerous brownish red thorns. Cape region.—Some species of the subsection Anthacantha are in cult. under the name of *E. Hystrix*. The names *E. clàva*, Jacq., and *E. coronàta*, Thunb., are used in the trade and belong to closely related if not identical species of S. Afr., probably not in cult. The sts. are smaller and the infl. less spinose than in *E. loricata*.

51. **bupleurifòlia,** Jacq. St. ovate-spherical, elongated in age, 3 in. thick, 4–5 in. high: podaria scale-like, imbricated, quadrangular: lvs. at st. apex, 4–8 in. long, lanceolate: fls. long-stalked; peduncle not persistent. Cape region. B.M. 3476.—Seldom cult., and, as it does not branch, cannot be prop. by cuttings. *E. clandéstina*, Jacq., differing in the club-shaped st., 1½–2 in. thick, with oblong podaria divergent above, small lvs. and nearly sessile cyathia is listed, probably erroneously, in the trade.



1448. Euphorbia epithymoides. No. 57.

BBB. *Sts. herbaceous or woody, rarely somewhat fleshy, not spiny: infl. umbellate: stipules none.* Section TITHYMALUS.

C. *Lvs. below the umbel decussate: tall annual herb.*

52. **Láthyris,** Linn. CAPER SPURGE. MOLE PLANT. Fig. 1447. Annual, 2–3 ft. tall: lvs. long, lance-linear, those of the infl. ovate-acuminate: glands short-horned: caps. somewhat fleshy, ¼–½in. diam. Eu., and naturalized in E. U. S. Rept. Mo. Bot. Gard. 11, pl. 11.—Cult. in old gardens. Caps. sometimes pickled, seeds used as a purgative. Said to drive away moles from its neighborhood (see Cornell Bull. 61:331); for a similar reason known as "gopher plant" in S. Calif.

CC. *Lvs. usually clustered at ends of branches: shrubs.* (*Euphorbiodendron*, Millsp.).

53. **atropurpùrea,** Brouss. Branching shrub, 3–6 ft. high: lvs. pale, glaucous green, spreading or drooping, 2–3 in. long: umbel 5–10-rayed; cyathia surrounded by large, dark purple, broadly ovate, obtuse, connate bracts; glands ovate. March. Teneriffe. B.M. 3321.—Some other red-leaved species used for bedding in Amer. have been cult. under this name, i.e., a purplish variety of *E. pulcherrima*, and possibly *E. hæmatodes*, Boiss.

54. **Règis-Jùbæ,** Webb. Like the last but lvs. narrowly linear and bracts almost yellow: involucral glands with 2 short horns. Teneriffe.—Some plants under this name are *E. piscatòria*, Ait. See Suppl. list.

55. **dendroìdes,** Linn. A large branching shrub, more foliaceous than the two preceding: lvs. linear-lanceolate, obtuse or acute: bracts yellowish, rhomboid-orbicular mucronate; glands truncate or semi-lunate. Medit. region. Gn. 36, p. 203. R.H. 1887:160.

56. **fúlva,** Stapf (*E. elástica*, Altam. & Rose). PALO AMARILLO. Small tree: lvs. lanceolate, acute, pubescent: cyathia few, bracts small, glands ovate: caps. conical, 1 in. long. Mex.—Used for rubber.



1449. Euphorbia Cyparissias (×¼). No. 60.

CCC. *Lvs. below the umbel alternate: leafy perennial herbs.*

D. *Glands of the involucre oval, entire.*

57. **epithymoìdes,** Jacq. (*E. polychròma*, Kern.). Fig. 1448. Many sts. 1 ft. or more long, forming a hemispherical clump: rays of umbel 5: lvs. oblong, dark green, those of the infl. various shades of yellow at flowering time. May. Eu. B.M. 2258. Gn. 69, p. 295.—A beautiful plant for the formal or informal border.

58. **pilòsa,** Linn. Sts. about 18 in. high from a thick rootstock, pilose: lvs. oblong, nearly entire: umbel 5–6-rayed, with similar branches below: caps. 2 lines broad, nearly smooth or hairy, with or without minute warts. Eu. and N. Asia. Var. **màjor** is a better form for gardens with beautiful golden yellow foliage.

59. **palústris,** Linn. Differs from *E. pilosa* chiefly in being glabrous or nearly so, more rays in the umbel, and caps. with small but distinct warts on the back. Eu. Gn. 76, p. 499.—The floral lvs. are a bright yellow.

DD. *Glands of involucre truncate, retuse, 2-horned or crescent-shaped.*

E. *Seeds smooth.*

60. **Cyparíssias,** Linn. CYPRESS SPURGE and many local names. Fig. 1449. Many short plume-like branches from the crowns and adventitious root-buds, covered with spreading, narrowly linear, dark green lvs. 1 in. long. Eu. L.B.C. 2:118. G.C. II. 22:469. Rept. Mo. Bot. Gard. 11, pl. 50.—Cult. in old gardens and cemeteries for its moss-like growth. Naturalized and a weed in E. U. S., but rarely producing seed here.

61. **Wúlfenii**, Hoppe. Sts. 3–4 ft. high, forming a clump, densely covered with lanceolate, linear, acute, bluish green pubescent lvs., those of the infl. yellow, or the base of the st. bare later, except for the conspicuous leaf-scars: umbel many-rayed; glands 2-horned. Eu. B. R. 24:6 (as *E. Veneta*). G. 31:103. G.C. III. 39:331. Gn. 57, pp. 440–1; 74, p. 40. G.W. 13, p. 305.

62. **biglandulòsa**, Desf. Differs from *E. myrsinites*, chiefly in the erect sts., lanceolate, acute lvs. and smooth seeds. Sicily to Syria. B.R. 274 (as *E. rigida*).

EE. *Seeds rugose or pitted.*

63. **pìnea**, Linn. St. glabrous: st.-lvs. linear; those of the infl. reniform-cordate: rays of umbel 5–7. Eu.

64. **robústa**, Small, and **Pálmeri**, Engelm., are many-stemmed desert plants from W. U. S., about 1 ft. high with small ovate lvs., irregularly crescent-shaped glands and roughened seeds. Rept. Mo. Bot. Garden. 11:pls. 40, 49.—They have been offered for sale, but have little cultural value.

65. **myrsinìtes**, Linn. The many declined sts. covered with large, fleshy, glaucous, obovate-oblong, concave, pointed lvs. in close spirals: umbel 7–12-rayed; glands and fls. yellow: seeds rugose. Eu.—A plant of old gardens; good for walls and rockeries.

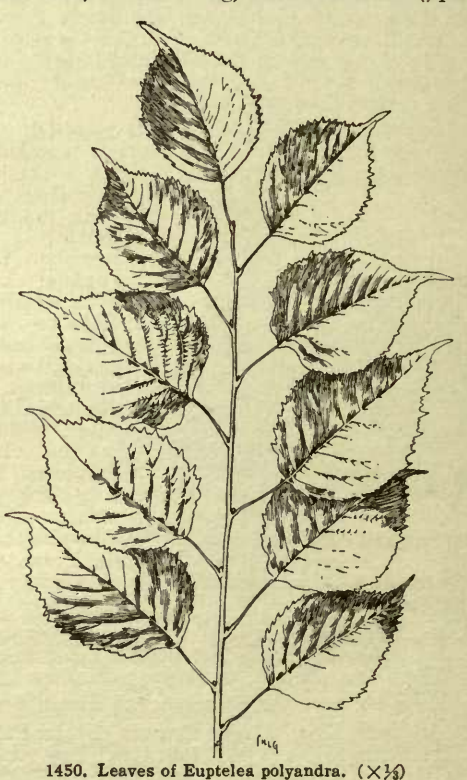
The following have been reported in cult. in Eu. but are not in the American trade.

E. aggregàta, Berger. A succulent grown like E. cereiformis.—*E. aléppica*, Linn. Annual of Tithymalus section.—*E. amygdalòides*, Linn. Perennial and almost woody. Common in England.—*E. angulàris*, Klotzsch (E. fimbriata, Hort.). A 3–5-angled succulent.—*E. aphýlla*, Brouss. Semi-succulent shrub, near E. Tirucalli. Gt. 37:277.—*E. arbúscula*, Balf. Semi-succulent shrub near E. xylophylloides.—*E. balsamífera*, Ait. Tropical shrub: lvs. at end of branches. Allied to E. dendroides.—*E. Berthelòtii*, C. Bolle. Subtropical shrub allied to E. Regis-Jubæ; name used incorrectly in the trade.—*E. Bòjeri*, Hook. (E. Breonii). Semi-succulent, slender, spiny shrub near E. splendens, Hook. B.M. 3527.—*E. bubalina*, Boiss. (Section Treisia). Low, slender, spineless succulent, leafy at apex. R.B. 209 (as E. oxystegia).—*E. Cáctus*, Erenh. Succulent, spiny 3-angled shrub, near E. Hermentiana.—*E. cattimándoo*, Ell. Small, succulent, spiny, 5-angled tree.—*E. cervicòrnis*, Boiss.=E. hamata.—*E. chamæsỳce*, Linn. Low, opposite-lvd. herb with corolla-like cyathia in clusters.—*E. charàcias*, Linn. Umbellate perennial herb near E. Wulfenii. Gn. 59, p. 447. G.C. II. 13:657.—*E. colletioìdes*, Benth. Low Mexican shrub: lvs. opposite. Plants grown under this name may be E. pteroneura.—*E. Dinteri*, Berger. Spiny, 6–8-angled succulent shrub often grown under names of E. virosa and E. tetragona.—*E. Dregeàna*, Mey. Spineless, almost leafless shrub, near E. Tirucalli.—*E. enópla*, Boiss. Spiny succulent near E. heptagona, and confused with it.—*E. eròsa*, Willd. Spiny succulent, near E. mammillaris.—*E. falcàta*, Linn. Annual herb, near E. Aleppica.—*E. fimbriàta*, Hort.=E. angularis.—*E. hamàta*, Sweet (E. cervicornis, Boiss.). Low succulent shrub, leafy at apex, near E. clandestina.—*E. helicóthele*, Lem. Spiny, succulent tree, leafy at apex, near E. neriifolia. I.H. 4, p. 100, desc.—*E. helioscòpia*, Linn. Umbellate annual, (Section Tithymalus). Rept. Mo. Bot. Gard. 11: pl. 26.—*E. Intisy*, Drake. Semi-succulent tropical shrub, near E. Tirucalli.—*E. Lagáscæ*, Spreng. Annual, near E. pilosa.—*E. Láro*, Drake. Semi-succulent shrub near E. Tirucalli.—*E. laurifòlia*, Juss. Tropical shrub, leafy at ends of branches, near E. atropurpurea.—*E. Ledièni*, Berger. Spiny succulent, near E. virosa, grown under the names of E. pentagona, E. cœrulea, and E. cœrulescens. B.M. 8275.—*E. Lemaireàna*, Boiss. Spiny succulent. Near E. grandicornis.—*E. lophogòna*, Lam. Succulent with fringed angles, near E. Fournieri. B.M. 8076.—*E. macroglypha*, Lem. Spiny, 3-angled succulent.—*E. Márlothii*, Pax= E. Montieri.—*E. mauritánica*, Linn. Semi-succulent shrub. Near E. Tirucalli.—*E. mellífera*, Ait. Tree, leafy at branch ends. Near E. dendroides. B.M. 1305.—*E. Montièri*, Hook. (E. Marlothii, Pax). Succulent shrub, leafy at the apex, of Section Pseudeuphorbium. B.M. 5534.—*E. Morìnii*, Berger. Spiny succulent, near E. cereiformis.—*E. múlticeps*, Berger. Succulent. Near E. Caput-Medusæ.—*E. nivùlia*, Ham. Spiny, succulent shrub, leafy at apex. Near E. neriifolia.—*E. Nyikæ*, Pax. Succulent tree with 2-angled joints.—*E. obèsa*, Hook. Succulent. Near E. meloformis. B.M. 7888.—*E. obtusifòlia*, Poir. Semi-succulent shrub. Near E. Tirucalli.—*E. officinàrum*, Linn. Succulent, spiny, 9–13-angled shrub. Near E. Beaumieriana.—*E. Paralias*, Linn. Perennial herb of Section Tithymalus.—*E. parvimámma*, Boiss. Low succulent, without spines. Near E. Caput-Medusæ.—*E. Phillipsiæ*, N. E. Br. Succulent, spiny, 9-angled shrub. Near E. Beaumierana.—*E. pilulífera*, Linn. Low annual with opposite lvs. and inconspicuous cyathia in clusters: glands appendaged.—*E. piscatòria*, Ait. Tropical shrub: narrow lvs. at end of branches. Near E. Regis-Jubæ.—*E. plumerioìdes*, Teysmann. Tropical shrub similar to the previous one.—*E. procúmbens*, Mill. (E. pugniformis, Boiss.). Succulent, uot spiny. Near E. Caput-Medusæ. B.M. 8082. R.B. 161.—*E. punícea*, Swartz. Tropical shrub. Near E. atropurpurea. B.R. 190. B.M. 1961. L.B.C. 20:1901. G.C. II. 15:529.—*E. pyrifòlia*, Lam. Semi-succulent shrub, leafy at the apex. Near E. lophogona.—*E. Sapínii*, De Wild. Slender, spiny succulent. Near E. cereiformis. G.C. III. 45:66.—*E. Schimperi*, Presl. Semi-succulent shrub. Near E. Tirucalli.—*E. Schimperiàna*, Hochst. An African annual of Section Tithymalus. This name perhaps used erroneously for E. Schimperi.—*E. Scolopéndria*, Don=E. stellata.—*E. scopifórmis*, Boiss.=E. serpiformis.—*E. serpifórmis*, Boiss. Section Arthrothamnus. Slender-branched semi-succulent shrub with opposite, rudimentary lvs.—*E. Sibthorpii*, Boiss. Perennial herb. Near E. Wulfenii.—*E. Sipolisii*, N. E. Br. Slender succulent shrub with decurrent lf.-bases. Near E. pteroneura.—*E. spinòsa*, Linn. Umbellate sub-shrub or herb of S. Eu. Section Tithymalus.—*E. stapelifórmis*, Hort. =E. stapelioides, Boiss.(?). A plant near E. bupleurifolia.—*E. Stápfii*, Berger. Spiny, succulent, 4-angled shrub.—*E. stellæspìna*, Haw. Spiny 10–13-ribbed succulent. Near E. cereiformis.—*E. stellàta*, Willd. (E. uncinata, DC., referred here according to N. E. Br.). Spiny succulent with branches V-shaped in cross-section, and clustered on a short thick st.—*E. tetragòna*, Haw. Spiny, succulent 4-angled tree. R.B. 39.—*E. trigòna*, Haw. Spiny, succulent, 3-angled shrub, near E. antiquorum.—*E. tuberculàta*, Jacq. Low succulent, near E. Caput-Medusæ.—*E. uncinàta* =E. stellata.

Other names used but not classified: *E. Amèlia*, Hort.—*E. articulàta*, Hort.—*E. aurèlia*, Hort. (E. Amelia?).—*E. Càput Commélinii*, Hort. (E. Caput-Medusæ?)—*E. Càput-odoràta*, Hort.—*E. Càput-Símiæ*, Hort.—*E. capénsis*, Hort. (succulent).—*E. colubrìna*, Hort.—*E. cylíndrica*, Hort.—*E. dentàta*, Hort.—*E. de Smetiàna*, Hort.—*E. erécta*, Hort.—*E. funàlis*, Hort.—*E. gardeniæfòlia*, Hort.—*E. grácilis*, Hort.—*E. Houlletiàna*, Hort.—*E. Houllètii*, Hort.—*E. longifòlia*, Hort.—*E. mángador*, Hort. (E. mogador, Hort.?).—*E. Milleri*.—*E. obtùsa*, Hort.—*E. pavoénsis*, Hort.—*E. púlchra*, Hort.—*E. Pulletiàna*, Hort.—*E. Rebùtii*, Hort.—*E. sahariènsis*, Hort.—*E. waltoniénsis*, Hort.

J. B. S. NORTON.

EUPHÒRIA (name refers to the fact that the plant *carries well* its edible frs.). *Sapindàceæ*. A half-dozen trees in Trop. and Subtrop. Asia, allied to Litchi but differing in having petals and a deeply 5-parted imbricate calyx; both genera are sometimes combined in Nephelium. Lvs. pinnate: fls. regular; petals spatulate or lanceolate, hairy inside; stamens usually 8: fr. globular or ellipsoid, more or less tuberculate or warty, the size of a cherry or plum. The following species is widely cult. in the eastern tropics. *E. Longàna*, Lam. (*Nephèlium Longàna*, Cambess.). Tree, 30–40 ft., with gray bark: lvs. scattered; lfts. opposite or alternate, elliptic to ovate to lanceolate, 2–5 pairs, rather obtuse at both ends, to 12 in. long, entire: fls. small (¼in. or



1450. Leaves of Euptelea polyandra. (×⅓)

less across), yellowish white, in puberulent terminal and axillary panicles; calyx deeply 5–6-lobed; petals about equaling calyx, spatulate: fr. globose, reddish or purple, ¾in. or less diam., tuberculate or becoming warty or nearly smooth, with an edible aril. India. B.M. 4096. B.R. 1729.—A much-prized fr. in China, under the name of longyen, or linkeng, resembling litchi but smaller and smoother and yellow-brown.

L. H. B.

EUPHRÀSIA (Greek for *hilarity* or *delight*). *Scrophulariàceæ*. Eyebright. More than 100 low herbs, of no special horticultural value although some of them are mentioned in connection with alpine-gardening. They are more or less parasitic on roots of other plants: lvs. opposite, dentate or incised: fls. small, largely whitish or purplish, in terminal leafy spikes; calyx mostly 4-cleft; corolla 2-lipped; stamens 4, didynamous, ascending under the upper lip: caps. oblong, many-seeded, dehiscent. The species range in temperate and cold parts of the globe, several of them being N. American.

EUPTÈLEA (Greek *eu*, well, handsome, and *ptelea*, elm). *Trochodendràceæ*. Ornamental woody subjects grown for their handsome foliage; also the red anthers of the precocious flowers are conspicuous in early spring.

Deciduous shrubs or small trees: winter-buds conspicuous, with imbricate dark brown scales: lvs. alternate, slender-petioled, dentate: fls. before the lvs., in axillary clusters along last year's branches, perfect, without perianth; stamens many, with large oblong-linear, red anthers: carpels many, stipitate, oblique, with a decurrent stigma, developing after the stamens have dropped, growing into a small, slender-stalked obliquely winged 1–4-seeded nutlet.—Three species in Japan, Cent. and W. China, and E. Himalayas.

They are graceful bushy trees resembling the linden in habit and foliage; the bright green leaves are very slender-stalked, and the tree is conspicuous in early spring from the bright red anthers of its flowers. *E. polyandra* has proved hardy at the Arnold Arboretum and possibly *E. Franchetii* is of the same hardiness. They seem to grow well in a loamy well-drained soil and prefer somewhat moist situations. Propagation is by seeds or by grafting on their own roots.

polyándra, Sieb. & Zucc. Figs. 1450, 1451. Shrub or small tree, to 20 ft.: lvs. long-petioled, usually roundish ovate, cuspidate, coarsely and irregularly dentate, below pale green and slightly pubescent on the veins, 2–4 in. long: carpels usually 1-seeded, ⅓in. long. April. Japan. S.Z. 72. S.I.F. 1:41. Gng. 16:162.

Franchètii, Van Tieghem (*E. Davidiàna*, Hemsl., not Baill.). Tree, to 40 ft.: lvs. long-petioled, usually roundish-ovate, cuspidate, fairly regularly sinuate-dentate, light green below, 2–4 in. long: carpels usually 2–3-seeded. April. Cent. and W. China. H.I. 28:2787. V.F. 9.

E. pleiospérma, Hook. f. & Thoms. (E. Davidiana, Baill.). Closely related to E. Franchetii. Lvs. glaucous below: carpels somewhat larger. W. China, E. Himalayas.

Alfred Rehder.

EÙRYA (Greek for *large*, but of no application). *Ternstrœmiàceæ* (or *Theàceæ*). Shrubs of S. Asia and Malaya (30 or more species), with small dicœcious fls., berry-like frs., and simple, glabrous evergreen lvs.: fls. in axillary clusters, or rarely solitary; petals and sepals 5; stamens 15 or less (rarely only 5), joined to the base of the corolla; ovary usually 3-loculed. Cleyera is by some included in this genus. The euryas are allied to camellias, and require much the same treatment. They are grown for foliage rather than for fls. They require an intermediate temperature and a peaty soil. Prop. by cuttings taken from the tips of growing shoots. **E japónica**, Thunb. (*E. Siebòldii*, Hort.), is the common species, and is very variable. The variegated form of it (known in the trade as *E. latifòlia variegàta*) is one of the best glasshouse decorative pot shrubs: lvs. variable in shape, usually ovate-acuminate and irregularly toothed or notched, short-petioled, variously blotched with white: fls. greenish white, in small, axillary clusters. Japan. V. 23:5.

L. H. B.

EÙRYALE (mythological name). *Nymphæàceæ*. One species, the Indo-Chinese representative of *Victoria regia*, from which it differs in having all the stamens fertile (in Victoria the inner ones are sterile) and in the very small fl. and in other technical characters. **E. fèrox**, Salisb., is the species. The lvs. are 1–4 ft. across, circular, purple and spiny-ribbed beneath, dark green and uneven above: fls. about 2 in. broad, open by day, prickly outside; calyx reddish inside and the 20–30 purple petals shorter than the calyx-lobes; stamens numerous: fr. a small many-seeded, globular berry, bearing the remains of the calyx on its top; seeds edible. B.M. 1447.—Long cult. in China. Treated as an annual. Has attracted little attention since the intro. of Victoria. Prop. by seeds only, which are best stored in fresh cold water. Plant in rich earth as for nympheas, at 70–75° F. As far north as Philadelphia and St. Louis it is hardy, sowing itself every season. It is ferociously spiny.



1451. Flowers of Euptelea polyandra. (Natural size.)

E. amazónica, Poepp., still advertised in catalogues, is Victoria regia.

H. S. Conard.
Wm. Tricker.

EURYÁNGIUM: *Ferula*.

EURÝCLES (Greek-made name, of no particular application). *Amaryllidàceæ*. Two south hemisphere tunicated-bulbous plants, allied to Hymenocallis and Pancratium. Fls. white or whitish, umbellate on peduncles 12–18 in. long; perianth-tube cylindrical, the segms. oblong-lanceolate, ascending and nearly equal; stamens inserted in the throat of the tube: lvs. broad and stalked, with prominent curving veins and interlocking veinlets. **E. sylvéstris**, Salisb. (*E. amboinénsis*, Loud.). Brisbane Lily. Scapes 1–2 ft., bearing an umbel of 10–40 handsome, creamy white fls. (2 in. across): lvs. round-cordate, with a very short, blunt point; blooms in May and June in Eu., the lvs. appearing later. B.M. 1419 (as *Pancratium amboinense*). B.R. 715 (as *Pancratium australasicum*). R.H. 1879, p. 456 and p. 457 (as *E. australasica*); 1913, p. 111. G.W. 11, p. 583. G.Z. 24, p. 25. Malaya, Philippines, N. Austral.—Cult. apparently as for pancratiums.

L. H. B.

EÙRYOPS (*large eyes*, because of the prominent fls.). *Compósitæ*. Small shrubs of 25–30 species of Afr. (mostly S. Afr.), Arabia and Socotra, very little known in horticulture. The fls. are yellow, the heads with female rays and tubular 5-toothed perfect disk-fls.; receptacle convex or conical; involucre of 1 series of scales: achene wingless and beakless, the pappus of several rows of caducous bristles. These little bushes or undershrubs grow from ½–3 ft., or sometimes 5 ft.,

high. They are bloomed in the greenhouse or grown in the open in mild climates. None seems to be regularly in the trade.

EÙSCAPHIS (Greek, *eu*, handsome, and *scaphis*, vessel; alluding to the shape and the handsome color of the dehiscent capsule). *Staphyleàceæ*. Ornamental woody plant grown for its handsome foliage and the attractive fruits.

Deciduous upright shrub or small tree, glabrous: lvs. opposite, odd-pinnate, stipulate: fls. in terminal upright panicles, perfect; sepals, petals and stamens 5, all of nearly equal length; ovary 2–3-celled, surrounded at the base by an annular disk; styles 2–3, often connate: fr. consisting of 1–3 spreading, leathery dehiscent pods, each with 1–3 black seeds.—One species in Japan and Cent. China. A handsome plant with large pinnate lvs., small whitish fls. in upright panicles followed by attractive brownish red frs. disclosing shining black seeds when opening. It grows in any good garden soil, but is only half-hardy N. Prop. by seeds and greenwood cuttings under glass.

japónica, Dipp. (*E. staphyleoìdes*, Sieb. & Zucc. *Sambùcus japónica*, Thunb.). Shrub, to 10 ft.: lfts. 7–11, ovate-lanceolate, glabrous, serrate, 1½–3 in. long, each with 2 small stipules: fls. in broad many-fld. panicles to 6 in. long: fr. consisting of 1–3 pods, ½in. long, apiculate, each with 1–3 steel-blue seeds. May, June; fr. Aug., Sept. Japan. S.Z. 67. S.I.F. 1:70.

ALFRED REHDER.

EÙSTOMA (*good mouth*, alluding to the corolla). *Gentianàceæ*. Two or 3 N. American large-fld. glaucous opposite-lvd. small herbs: fls. more or less paniculate, single on the peduncles, 5-merous or rarely 6-merous; calyx with narrow keeled lobes; corolla nearly campanulate, white, blue or purple, the lobes oblong or obovate, usually erose; stamens attached on the corolla-throat; ovary 1-celled; stigmas 2: caps. oval or oblong, many-seeded. **E. selenifòlium**, Salisb. (*E. exaltàtum*, Griseb.). Annual, but in S. Calif. said to be perennial, 9–15 in. erect: lvs. oblong, glaucous-green: fls. light blue or purple, the corolla-lobes about or nearly 1 in. long, twice exceeding the tube. Fla. to Calif. Offered in Calif.

EÙSTREPHUS (Greek, referring to the climbing habit). *Liliàceæ*. One or two Australian plants, botanically related to Lapageria, but much less showy; in habit suggestive of smilax (*Asparagus medeoloides*). Plants more or less woody at base, slender, branching, tall-climbing: lvs. alternate, sessile or short-petioled: fls. 2 to many, in axillary fascicles; perianth-segms. distinct and spreading; stamens 6. **E. latifòlius**, R. Br., is a tall and much-branched half-twining herb, more or less woody at the base, bearing alternate, stiff, linear-lanceolate, short-stalked lvs. and small, axillary, drooping light blue fls. with spreading, ciliate perianth-segms.: fr. a dry berry: lvs. 2–4 in. long, sharp-pointed: fls less than 1 in. across. B.M. 1245. Of easy cult., either in the glasshouse border or in pots. Very useful for table decoration and for design work.

L. H. B.

EUTÁCTA: *Araucaria*.

EUTÁXIA (from Greek words referring to the attractive appearance). *Leguminòsæ*. Shrubs of Austral., with golden or yellow papilionaceous fls., one of which is offered for greenhouse cult.: lvs. small, opposite, simple and entire: fls. solitary or a few together, or sometimes crowded at ends of branches; standard orbicular, entire or nearly so, exceeding the other petals; stamens free: pod ovate, 2-valved. Said to require general treatment of Chorizema. **E. myrtifòlia**, R. Br. Glabrous, 2–3 ft.: lvs. obovate-oblong to linear, mostly ¾in. or less long: fls. yellow with dark orange keel, solitary or 2–4 together. B.M. 1274 (as Dillwynia). R.B. 26:13. Var. *floribùnda* is listed.

EUTÉRPE (mythological name). *Palmàceæ*, tribe *Arèceæ*. Slender erect spineless palms, with solitary or fasciculate ringed caudices, and grown chiefly for their graceful habit and feathery pinnate foliage.

Leaves terminal, equally pinnatisect; segms. narrowly linear-lanceolate, long, and gradually acuminate or ensiform, membranaceous, plicate, the thickened margins recurved at the base; rachis and petiole 3-sided toward the base, convex on the back, concave above; petiole elongated; sheath very long, cylindrical, entire: spadix paniculately branched: rachis elongated: branches slender, gradually shortening above, usually scaly, thick at the base, erect-spreading in fl.: spathes 2, coriaceous or membranaceous, lanceolate, the lower one shorter, split at the apex, dorsally 2-keeled, the upper one symmetrical, split down the ventral side: bracts bordering the furrows; bractlets ovate-acute: fls. small, white, sessile in the furrows of the spadix: fr. like a pea, purple.—Species about 8. Trop. Amer. and W. Indies. G.C. II. 24:586.

Three species of Euterpe are commonly found in cultivation, namely: *E. edulis*, *E. montana* and *E. oleracea*. These are found under varying conditions in Central and South America and the West Indies, and all three species are valuable as food-producers to the natives of those countries. *E. edulis* grows in great quantities in the lowlands of Brazil, where it is known as the assai palm, owing to the fact that its seeds are macerated in water, and by this means is produced a beverage known as assai. *E. oleracea* is the well-known cabbage palm of the West Indies, growing in the lowlands near the coast, while *E. montana* is the mountain cabbage palm, and is frequently found at considerable altitudes in the same islands, and consequently does not attain the great dimensions of *E. oleracea*.—The euterpes do not present any special cultural difficulties, being free-rooting and rapid-growing palms; a night temperature of 65° F., and abundant moisture are among their chief requirements. A good turfy loam, with the addition of about one-fifth of stable manure while in the compost heap, provides a suitable soil. From their habit of forming a tall slender stem without suckering from the base, the euterpes are liable to become rather leggy specimens. When under cultivation, and for trade purposes, it is advisable to group three or four of the young plants together, thus producing a more bushy specimen. White scale is one of the worst pests to which these palms are subject, and soon ruins the foliage unless care is taken. Seeds germinate in a few weeks if sown in a warm greenhouse, and the young plants make better progress when moderately shaded. (W. H. Taplin.)

edùlis, Mart. PARA PALM. ASSAI PALM. St. 60–90 ft. high, 8 in. thick, flexuous: lvs. 10–15, spreading; the lfts. often pendulous; sheaths 3–4½ ft.; petiole 1½ ft.; blade 6–9 ft.; segms. linear, spreading, deflexed, 60–80 on each side, densely crowded, 28–36 in. long, ¾–1 in. wide: spadix about 2–3 ft. long, bearing numerous rather inconspicuous fls. Brazil.

oleràcea, Mart. CABBAGE PALM. St. 60–100 ft., scarcely 1 ft. diam. at base, attenuate above, flexuous: lvs. arcuate-spreading, 4–6 ft. long, the apex more or less deflexed; segms. pendent, linear-lanceolate, the upper 2 ft. long, 1 in. wide, many-nerved. Brazil. See *Oreodoxa*.

montàna, R. Graham. St. 10 ft. high, swollen at the base, ringed: lvs. 9 ft. long, elliptical-obovate; segms. lanceolate, entire, glabrous, alternate; petiole 2 ft. long, scaly beneath, unarmed; rachis plano-convex below, subtriangular toward the apex: spadices several on the trunk at one time, axillary, much branched; fls. numerous, white. Grenada. B.M. 3874.—Intro. into Botanic Garden at Edinburgh in 1815.

JARED G. SMITH.
N. TAYLOR.†

EŪTOCA: *Phacelia.*

EVAPORATING FRUIT. The domestic operation of drying fruit has been practised ever since men looked beyond their immediate wants and stored food for time of greater need. Dried fruit has long been an article of commerce, yet until a few years ago only the most primitive methods were used in drying, and the industry, commercially, was confined to a few favored regions in Europe. The modern industry is not yet a half-century old. Its almost inconceivable growth in America in this brief time is one of the industrial phenomena of the times. Spurred into activity by the encroachment of American products in their markets, the European producers, by the adoption of better methods, and by governmental encouragement, have increased greatly their output of dried fruit. Thus, from an adjunct to fruit-growing for home use, drying fruit has become, within recent years, one of the main branches of horticulture.

An idea of the dried-fruit industry in the United States and of its great growth in recent years may be obtained from the following figures from the census of 1910 for the crop of 1909:

Raisins	111,774,767 pounds, worth	$4,837,933
Prunes	138,498,490 pounds, worth	5,130,412
Peaches	46,843,391 pounds, worth	2,423,083
Apples	44,568,244 pounds, worth	3,098,095
Apricots	29,205,569 pounds, worth	2,277,177
All other fruits	29,438,306 pounds, worth	2,073,695

Adding the valuations given, results in a grand total of $19,840,395 for dried fruits in the year 1909. Comparing this sum with the census of 1900, one finds that the crop in 1899 was valued at $4,757,005 and that the industry, judged by the figures, has increased more than fourfold in ten years.

Fruit may be cured in the sun, or it may be cured in drying-machines, called evaporators. That cured in the sun is called by the producer "dried fruit;" that in evaporators, "evaporated fruit." By far the larger part of the world's product is cured in the sun. Thus, at least three-fourths of the fruit dried in America is sun-dried in California.

Sun-drying fruit.—In countries having a sufficiently warm and dry climate, as Greece and Turkey, and parts of France, Spain and western America, fruit is dried almost wholly in the sun. The fact that in these favored localities the drying capacity is limited only by the acreage of sunshine, makes it certain that the proportion of sun-dried fruit will always be vastly greater than that of evaporated fruit. Drying fruit in the sun is a simple process, but one hedged in by many little arts and methods that facilitate the work and improve the product. In general, the process is as follows: The fruit is graded, bleached by sulfur, if a light-colored product is desired, in the case of prunes dipped or pricked, and is then spread on trays to be exposed to the sun. When the drying process is completed, the fruit is again graded, in most cases put through a sweat, and then "finished" in various ways, as by dipping or glossing.

Evaporating fruit.—There are many styles of evaporators, but all possess in common a chamber for the reception of the fruit, through which a current of warm air is forced, or the fruit is forced through the air, or both, the object being to remove the aqueous matter from the fruit as quickly as possible, and the principle being that warm air will absorb more moisture than cool air. The saturated air must not remain in contact with the fruit. Since different fruits exact different conditions, it is necessary to change the temperature and velocity of the air-current in the drying-chamber at will. To make the product homogeneous, current and temperature must be equal in all parts of the evaporator. It is obvious that simplicity in the machine and economy in heat and in room are cardinal virtues in a good evaporator. It is the rule to start the evaporation of large fruits at a low temperature and finish at a high one, but with berries the reverse is true.

Recently two or three patented processes for curing fruit by "dehydration" have been introduced with much promise of betterment in the industry. While the machinery, the methods and the products are quite different in evaporating and dehydrating, the principle in the two operations is practically the same. In both processes the water is removed from the fruit by moving currents of warm air. In evaporation the air is warmed only. In dehydration the air is dried by cooling until the moisture is condensed out and is then warmed and passed over the fruit or vegetable to be cured. By the new process much time is saved and a greater variety of fruits and vegetables can be used.

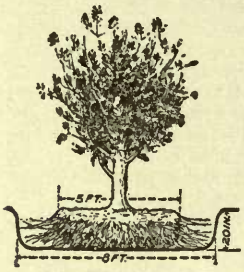
The following are definitions of the somewhat technical terms used in the industry: *Bleaching* is the process of changing the dark color of fruit to a lighter hue, or of preventing the discoloration; it is generally accomplished by sulfuring. *Bloaters* are prunes which in drying swell up to an abnormal size; they are usually produced by fermentation in over-ripe fruit. *Chops* are dried apples cured without paring or coring to be used in making cider or vinegar. *Dipping* is the process of cutting the skin of fresh prunes to facilitate curing. The operation is performed by submerging the fruit in boiling lye. Cured fruit is sometimes dipped in one of various solutions as a "finishing" process. *Drip* is the syrupy liquid which oozes from prunes in the process of evaporation; it generally characterizes a poor prune or a poor evaporator. *Frogs* are cured prunes having an abnormal shape, a condition caused by curing unripe fruit. *Pricking* is the process of puncturing the cuticle of fresh prunes. It is done by means of a machine, the essential part of which is a board covered with projecting needles, over which the prunes must pass. It accomplishes the same end as lye-dipping. *Sizes* is a term used to indicate the number of cured prunes it takes to make a pound. The "four sizes" known in the markets are 60's–70's, 70's–80's, 80's–90's, 90's–100's. *Sugaring* is the formation of globules of sugar on the cuticle of cured prunes or raisins. *Sulfuring* is a process to which fruit is subjected to give it a lighter color. The fruit is exposed to fumes of burning sulfur before being exposed to the sun or put in evaporators. *Sweating* is a process to which cured fruit is subjected before packing; it is put in a room at a high temperature and allowed to become moist. *Waste* is a dried product made from skins and cores of apples and pears and used for vinegar.

Apples and pears are peeled, cored, cut into rings and bleached by being exposed to the fumes of sulfur for about a half hour in preparation for drying or evaporating. Fruits so prepared are placed upon trays for sun-drying and must be cured in the sun for three to five days. In evaporating in the western states, the prepared fruits are placed on trays and passed in from six to twelve hours through the evaporator chamber, but in the East, where the product is chiefly made, the prepared fruit is piled from 4 to 6 inches deep on the floor of a kiln. Here it is left for fourteen to sixteen hours, being turned every two or three hours, until the fruit is no longer sticky, an indication that it has reached the proper stage of dryness. In New York, the law requires that evaporated apples contain not more than 27 per cent of moisture. One hundred pounds of apples will yield from twelve to fifteen pounds of evaporated apples.

Apricots, peaches and nectarines must be fully ripe before drying and without bruises. They are pitted, and may or may not be peeled. If peeled, the operation is done with a machine or with lye, though the use of the latter is considered bad practice. The fruit is placed on the trays cup side up. About three days are required for drying in the sun and about eight hours

for evaporating. The cured product should be of a translucent amber color.

Berries are seldom sun-dried for the markets. For evaporating they are placed on trays in quantities of sixteen to thirty quarts, given a temperature of about 175° at the start, and are finished in four to five hours, at a temperature of about 100°. After being taken from the evaporator, they are piled for sweating in a warm, ventilated room.



1452. Where to dig in removing an evergreen.

Figs for drying must be gathered when fully ripe. Some growers prefer drying in shade rather than in sun. Evaporators are seldom used. The fruit is not allowed to dry hard, and before packing must be well sweated. Usually, for "finishing," they are dipped in salt water or syrup. The drying process requires from five to eight days.

Prunes are allowed to ripen until they fall to the ground. Before being spread on the trays they are dipped or pricked in order to thin or crack the skin, that the moisture may easily escape, and dripping be prevented. Sun-drying requires from one to three weeks, while from twelve to thirty hours are required for evaporation. A thorough sweat prevents the sugaring so common to this fruit. Before packing they are graded in sizes. Dipping as a "finishing" process is practised by many producers. A good prune is soft, smooth and meaty, with loose pit, and of an amber, dark red or golden hue, depending upon the variety.

Grapes for raisins are sun-dried. They must be picked when fully ripe, the bunches, and the berries on the bunches, being sorted as the picking progresses. The operation of drying must be watched with care. The process requires from eight to fourteen days, during which time the bunches must be turned at least once. A sweat is given before packing. Raisins are graded into half a dozen or more brands for the market.

U. P. Hedrick.


1453 Digging up an evergreen.

EVERGREENS. In horticulture, evergreens are plants that retain green foliage the year around; they do not shed all their foliage at any one time; in some cases, the individual leaves may remain attached and green for some years, as in many of the Coniferæ, but in all evergreens the old leaves shed after a time when they become so overshadowed or crowded as to be no longer functional. The leaves of pines and spruces may persist three to fifteen years.

In the popular mind, "evergreen" and "conifer" are synonymous; but some conifers—as the taxodiums and larches—are deciduous. Moreover, in the tropics very many trees aside from conifers are evergreen, as notably the palms.


1454. The roots bound up, and tree being loaded.

Evergreens may be classified as coniferous and broad-leaved, the latter including such plants as rhododendron, kalmia, mahonia, box and many others. The number of plants that are evergreen in the latitude of New York City is very large. Few persons recognize the wealth of good winter greenery that may be secured by exercising careful choice of material and providing proper conditions and protection for its growth. There are many very low evergreen plants that may contribute much to the winter interest of a yard or garden, in the way of edgings, masses, rosettes, and ground cover. The following lists indicate the materials that are now at the command of the planter.


1455. The method of binding up the roots.

Beyond the latitude of Lake Erie, the dependable evergreens are mostly conifers. At the Central Experimental Farm at Ottawa, those deciduous plants that hold their foliage fairly late in the autumn are mostly too tender for use. A few good plants, however, are, Oregon grape (Mahonia), bearberry (*Arctostaphylos Uva-ursi*), *Pachysandra terminalis*, shrub yellow-root (*Xanthorrhiza apiifolia*), and *Quercus imbricaria*. The Oregon grape is perhaps the most useful evergreen there for ground-covering. The hardier species of Ligustrum are also fairly satisfactory, but most of the species of this genus leave so much dead wood after winter that in very large masses they are liable to be unsightly. Many attractive conifers are reliable at Ottawa, in the genera Abies, Chamæcyparis, Ginkgo, Juniperus, Picea, Pinus, Pseudotsuga, Taxus, Thuja, Tsuga.

The uses of evergreens are discussed in other places in the Cyclopedia, as under *Arboriculture, Herbary, Landscape-Gardening, Lawn-Planting, Perennials, Rock-Gardening, Screens, Shrubbery, Topiary Work, Wild-Garden, Windbreaks, Winter-Gardening*. For lists of evergreens for California, see pp. 379–381 (Vol. I).

L. H. B.

Moving large evergreens.
Figs. 1452–1457.

Large evergreens are moved with a ball of earth because they have no dormant period, but carry their foliage and need moisture at all times of the year. It is essential that the ball of earth contains a sufficient amount of small fibrous feeding roots to support the tree and that the tree be kept well watered for two or more seasons until the tree has spread its roots over sufficient area to gather enough rainfall to sustain the normal growth. The extent of fibers in the ball is increased by transplanting and root-pruning. Root-pruning is less essential with trees having an abundance of fibrous roots than with trees having only a few large coarse roots in the central portion. Some trees, as white pine, will survive with a comparatively small number of roots, their drought-resistant qualities enabling them to persist with a small supply of moisture. Other evergreens, as Nordmann's fir, have a long carrot-like taproot, and the tree is likely to die if this is cut and the tree given an inadequate quantity of water. Frequent nursery transplanting is, therefore, necessary with this species.

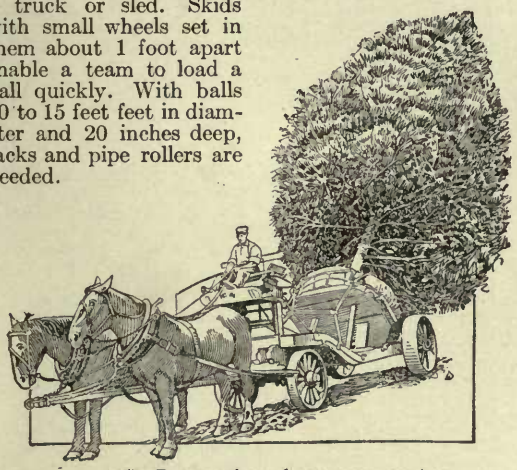
Trees are dug by starting a trench at a radius from the tree about 3 feet wider than the ball of earth to be taken. The roots are cut off on the outside of the trench and the soil dissected out from between the roots back to the size of the ball. These roots are bent around against the ball of earth if they are


1456. Digging the hole in frozen ground to receive the tree.

flexible enough to bend. If not sufficiently flexible and tractable, they are cut off.

A canvas is made 15 to 24 inches deep, and is made smaller at the bottom by folding over a V and sewing it. This makes it fit a conical ball and, when it is pulled up 3 inches by the cross-lashing at the top, makes it tighter. The canvas has cross-ropes sewed on it with rings at the top and bottom, and on the deeper balls two rows of rings in the middle. The bottom rope is tightened by a wooden lever 20 inches long with four holes, the rope being looped through the holes and the lever thrown over to pull the rope tight. The top rope is then tied and tightened by cross-lashing.

To get the ball free from the subsoil, dig under all around and tip the tree slightly. Level off the bottom with a fork. If there are tap-roots, tunnel under and cut them with a saw. Put a platform as far under as possible and tip the tree back. To get the ball in the center of the platform, put a hammock around the ball and pull. Hold the platform in position by crowbars driven in front of it. Lash the ball to the platform, make an incline, drag the platform out of the hole onto a truck or sled. Skids with small wheels set in them about 1 foot apart enable a team to load a ball quickly. With balls 10 to 15 feet feet in diameter and 20 inches deep, jacks and pipe rollers are needed.



1457. Transporting a large evergreen tree.

Trees over 10 feet need to be tipped over to go under wires. If the canvas is put on tight and at the proper taper, and if the ball is cut flat to fit close to the platform and lashed tight to the platform, the tipping can be done without the ball shaking loose. Sometimes a canvas or burlap bottom can be put between the platform and the ball. In unloading, the tree is stood up, team hooked to the platform and the tree dragged off to the ground. The tree may drop 2 feet without injury. The platforms are dragged to the hole and balls less than 4 feet rolled into the hole. Larger balls have the platform dragged into the hole and the platform pulled out holding the tree in position by a hammock. To straighten the tree, tramp the earth solid under it until it stands erect. Take off the canvas, spread out the side roots, pack the earth and anchor as with deciduous trees. Keep the ball moist; examine it once a month or more often by digging or boring into the ball during the first two years. Evergreens moved with a too small ball or with not enough fibers in the ball or with the watering neglected, may grow 3 inches a year for the first two or three years. If properly moved, they will grow 6 inches or more a year—half their normal growth.

Deciduous trees may be moved with balls of earth by the above method, and it has proved an aid with difficult species, as beech, oak, liquidambar, tulip. Especially when previously transplanted or root-pruned, the above trees 3½ inches in diameter moved with a ball of earth 4 feet in diameter are very successful, while without a ball many are lost or the growth is much slower. Investigation should be made to see whether this is because of less disturbance of the roots or because there is carried with the roots and soil a mycelium of a fungus which aids the roots to take up plant-food and moisture.



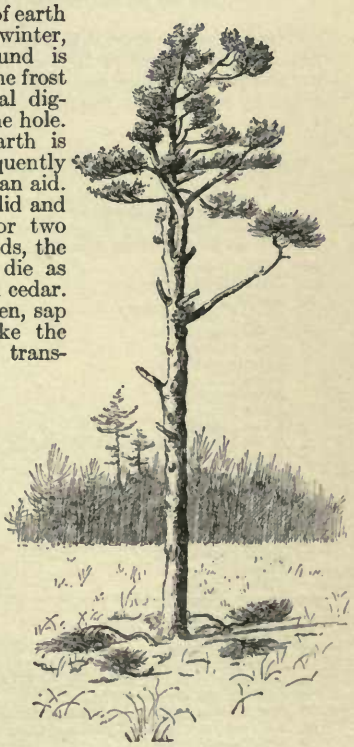
1458. Picea excelsa, the Norway spruce. One of the most popular coniferous evergreens.

The time of year for moving trees is of minor importance. It is overemphasized by purchaser, landscape architects and nurserymen, and results in heavy financial loss to nurserymen in congesting sales and their own planting in the short spring season. It greatly lessens the total amount of planting needed for forest, shelter-belt, landscape, fruit, and other economic purposes. A nurseryman may plant all the year. Evergreens can be taken up with a ball of earth even in May and June. The new growth may curve down. After June 20, the spruces, and after July 10, the pines, are firm enough not to wilt. August-September sales with a ball of earth are just as successful as April. The ground is warm and the roots grow rapidly; the ground can be made moist. Weather in September is less dry than in May and June.

Small evergreens up to 2 feet high may be planted in August and September from one part of the nursery to another without balls of earth, if the roots are very carefully dissected out without breaking. There will be more failures if the week following planting is hot and dry.

Planting with balls of earth may continue all winter, especially if the ground is mulched to keep out the frost and permit economical digging of the tree and the hole. The frozen ball of earth is an old method, frequently referred to, but is not an aid. If the ball is frozen solid and remains so for one or two months with dry winds, the top may dry out and die as has occurred with red cedar. If the ball is not frozen, sap can come up to take the place of that lost by transpiration.

A ball of earth 3 feet in diameter is needed for an evergreen 8 to 10 feet high; 4½ feet in diameter for an evergreen 15 feet high, except red cedar which can have a ball 3 feet; a ball of earth 12 feet in diameter is needed for a pine 35 feet high. Root-pruning pines, spruce and hemlock, permits moving the following year with a smaller ball than otherwise. In root-pruning, the trench



1459. Picturesque field pine, remnant of a forest.

can go three-quarters of the way around or three or four of the larger roots can be left across the trench to keep the tree from blowing over. Root-pruning of red cedars is of less advantage and is rarely practised. In New England and northern New York, the pine, spruce and hemlock, have only a few coarse roots just under the surface and no roots extending 2 feet deep. When moved to better-drained soils on the coastal plain, they develop deeper roots and have ten times as many fibers in a ball 4 feet in diameter. The above evergreens with their shallow root-systems can be taken up with a disc of roots, peat and grass 8 inches deep and 3 to 4 feet wide. This can be set on a wagon and trees 10 to 15 feet high easily moved. Less roots



1460. The beauty of young evergreens lies in their symmetry and the preservation of the lower limbs.

will be broken or bare if the ball is tied in burlap. The usual cause of failure in this operation is neglect of watering. Hemlocks and probably other trees will be aided by shading for the first two months.

HENRY HICKS.

Woody evergreens for New England and New York.

B=Broad-leaved evergreens.
S=Semi-evergreen.
P=Protected at Arnold Arboretum, Boston.
T=Tender above New York City.

SBT Abelia chinensis.
SBP Abelia grandiflora.
BT Abelia uniflora.
T Abies amabilis.
Abies appollinis.
Abies balsamea.
Abies cephalonica.
Abies cilicica.
Abies concolor.
Abies Fraseri.
T Abies grandis.
Abies homolepis=A. brachyphylla.
Abies magnifica.
Abies nobilis.
Abies Nordmanniana.
Abies pectinata=A. Picea.
Abies Picea.
T Abies Pinsapo.
T Abies shastensis.
Abies sibirica.
Abies Veitchii.
BT Acæna microphylla.
BT Acæna ovalifolia.
BS Akebia lobata.
BS Akebia quinata.
B Alyssum saxatile.
B Andromeda floribunda=Pieris floribunda.
B Andromeda glaucophylla.
BP Andromeda japonica=Pieris japonica.
BT Andromeda nitida=Lyonia nitida.
B Andromeda polifolia.
BS Andromeda speciosa=Zenobia speciosa.
BT Arbutus Menziesi.
BT Arbutus Unedo.
B Arctostaphylos Uva-ursi.
B Arundinaria chrysantha.
B Arundinaria Fortunei var. variegata.
B Arundinaria Hindsii.
B Arundinaria japonica.
BT Aubrietia deltoidea.
BT Aucuba japonica.
BS Azalea amœna=Rhododendron amœnum.
BT Azara microphylla.
BS Baccharis halimifolia.
BT Baccharis patagonica.
BS Baccharis salicina.
B Bambusa nana.
BS Berberis aristata. See *Mahonia* for evergreen barberries with compound leaves.
BP Berberis buxifolia.
B Berberis Gagnepainii.
B Berberis ilicifolia, Hort.=Neubertii.
BS Berberis Neubertii=B. vulgaris×M. aquifolium. Foliage intermediate drying and turning brown in winter and both single and trifoliate leaves on same plant.
Berberis Sargentiana (one of the best).
B Berberis stenophylla.
B Berberis verruculosa.
B Berberis Wallichiana, Hort.=B. Sargentiana.
BS Berberis Wilsonæ (leaves brown).
BT Bignonia capreolata.
Biota orientalis=Thuja orientalis.
Bruckenthalia spiculiflora (light leaf-mulch).
Bryanthus empetriformis.
Bryanthus erectus.
Bryanthus taxifolius=Phyllodoce cærulea.
SBP Buddleia japonica.
SBP Buddleia Davidii (variabilis) var. magnifica.
SBP Buddleia Davidii var. superba.
SBP Buddleia Davidii var. Wilsonii.
BSP Bumelia lanuginosa.
B Buxus japonica.
BP Buxus sempervirens.
P Calluna vulgaris, vars. alba, elata, rubra, tomentosa (light leaf-mulch).
SBT Carrieria calycina.
Caryotaxus=Torreya.
Cassiope hypnoides.
Cassiope tetragona.
BT Castanopsis chrysophylla.
BS Ceanothus Fendleri.
T Cedrus atlantica.
T Cedrus Deodara.
P Cedrus Libani.
Cephalotaxus drupacea.
P Cephalotaxus Fortunei.
B Cercocarpus parvifolius.
BS Chamæbatiara millefolium.
Chamæcistus=Loiseleuria.
T Chamæcyparis Lawsoniana.
Chamæcyparis nutkaensis (C. nootkatensis).
Chamæcyparis obtusa, especially var. nana.
Chamæcyparis pisifera.
Chamæcyparis sphæroidea.
BS Chamædaphne calyculata (leaves brown).
B Chimaphila maculata.
B Chimaphila umbellata.
B Chiogenes hispidula.
T Cistus laurifolius.
BS Clematis paniculata.
T Clematis Armandii.
BS Cocculus Thunbergii.
Corema Conradii.
SBP Cotoneaster adpressa
BP Cotoneaster buxifolia
BP Cotoneaster Dammeri
SBP Cotoneaster horizontalis
BP Cotoneaster microphylla
ST Cotoneaster salicifolia
} (light leaf-mulch).
Cryptomeria japonica.
T Cupressus Macnabiana.
BS Cytisus capitatus.
BS Cytisus nigricans.
BP Cytisus purgans.
P Dabœcia polifolia (light leaf-mulch).
B Daphne Blagayana.
B Daphne Cneorum.
SBP Daphne Houtteana.
BT Daphne Laureola.
BP Daphne pontica.
Diapensia lapponica.
BT Distylium racemosum.
B Dryas octopetala (better with winter shade).
BS Elæagnus umbellata.
Empetrum nigrum.
Ephedra distachya.
Ephedra gerardiana.
B Epigæa repens.
P Erica carnea
T Erica stricta
P Erica Tetralix
P Erica vagans
} (light leaf-mulch).
ST Evonymus americana.
BS Evonymus Bungeana var. semipersistens.

BT Evonymus japonica.
B Evonymus nana (leaves bronze).
Evonymus nana var. Koopmannii (leaves bronze).
BT Evonymus patens.
B Evonymus radicans, in variety, especially vegeta and Carrierei.
BT Garrya elliptica.
BT Garrya Fremontii.
BT Garrya Veitchii var. flavescens.
B Gaultheria procumbens.
B Gaylussacia brachycera.
BS Genista elata.
BS Genista germanica.
BPS Genista pilosa.
BPS Genista procumbens.
BS Genista tinctoria.
B Hedera helix (tender in exposed places; safer with winter shade).
BS Helianthemum vulgare.
BS Hippophaë rhamnoides.
B Hyssopus officinalis.
BS Hypericum.
B Iberis sempervirens.
B Iberis tenoreana.
PB Ilex crenata.
B Ilex crenata microphylla.
B Ilex glabra.
B Ilex opaca.
B Ilex rugosa.
BT Ilex vomitoria.
BT Jasminum humile=J. revolutum, Hort.
Juniperus chinensis in variety, especially procumbens.
Juniperus communis in variety, especially fastigiata, hibernica and nana.
Juniperus sabina in variety, especially humilis, prostrata and tamariscifolia.
Juniperus virginiana in variety, especially globosa, procumbens and tripartita.
B Kalmia angustifolia.
B Kalmia glauca.
B Kalmia latifolia.
B Ledum grœnlandicum.
B Ledum palustre.
B Leiophyllum buxifolium.
B Leucothoë axillaris.
B Leucothoë Catesbæi.
BS Leucothoë racemosa.
T Libocedrus decurrens.
BS Ligustrum Ibota var. myrtifolium.
BS Ligustrum strongylophyllum.
BST Ligustrum ovalifolium.
B Ligustrum Prattii.
BS Ligustrum vulgare.
B Linnæa borealis.
Loiseleuria procumbens.
BS Lonicera fragrantissima.
BS Lonicera Henryi.
BS Lonicera japonica (= L. Halleana) in variety.
BS Lonicera similis var. Delavayi.
BS Lonicera Standishii.
BS Lonicera Standishii var. lancifolia.
BS Lonicera xylosteum.
BS Lycium chinense.
BS Lycium halimifolium=L. vulgare.
Lycopodium annotinum.
Lycopodium clavatum.
Lycopodium complanatum.
Lycopodium lucidulum.
Lycopodium obscurum.
BT Lyonia nitida=Andromeda nitida.
BS Magnolia glauca.
B Mahonia Aquifolium
B Mahonia Fortunei
BP Mahonia japonica
B Mahonia nepalensis
B Mahonia nervosa
B Mahonia repens (most hardy)
} Formerly included in Berberis.
B Mitchella repens.
BT Osmanthus Aquifolium.
B Pachysandra terminalis.
B Pachystima Canbyi.
BP Pachystima Myrsinites.
BT Pernettya angustifolia.
BT Pernettya mucronata.
BT Phillyrea decora.
Phyllodoce cærulea=Bryanthus taxifolius.
B Phyllostachys flexuosa.
B Phyllostachys Marliacea.
B Phyllostachys violascens.
Picea Abies=P. excelsa.
Picea ajanensis.
Picea Alcockiana.
Picea alba=P. canadensis.
Picea Engelmannii.
Picea excelsa=P. Abies.
Picea excelsa var. Barryi.
Picea excelsa var. clanbrasiliana.
Picea excelsa var. Ellwangeriana.
Picea excelsa var. Gregoriana.
Picea excelsa var. Maxwellii.
Picea excelsa var. pendula.
Picea excelsa var. pumila.
Picea excelsa var. pygmæa.
Picea excelsa var. pyramidalis.
Picea Mariana=P. nigra.
Picea Menziesii=P. pungens.
Picea nigra and var. Doumettii.
Picea omorika.
Picea orientalis.
Picea polita=P. Torano.
Picea pungens.
Picea rubra.
T Picea sitchensis.
Pieris=Andromeda.
Pinus austriaca.
Pinus Banksiana=P. divaricata.
Pinus cembra.
Pinus densiflora and var. pumila.
Pinus divaricata.
Pinus echinata.
Pinus edulis.
T Pinus excelsa.
Pinus flexilis.
T Pinus Jeffreyi.
Pinus montana.
Pinus monticola.
Pinus palustris.
Pinus parviflora.
Pinus ponderosa.
Pinus resinosa.
Pinus rigida.
Pinus Strobus.
Pinus sylvestris.
Pinus Tæda.
Pinus Thunbergii.
Pinus virginiana.
B Polygala chamæbuxus.
B Potentilla tridentata (leaves brown-purple).
BP Prunus Laurocerasus var. schipkaensis.
Pseudotsuga taxifolia=P. mucronata or P. Douglasii.
BT Pyracantha coccinea var. Lalandii.
BT Pyracantha coccinea var. pauciflora.
Pyxidanthera barbulata.
BS Quercus imbricaria.
BT Quercus macedonica.
BTS Quercus Libani.
BS Quercus Turneri.
Retinospora decussata=Thuja orientalis var. decussata.
Retinospora dubia=R. ericoides, Hort.
Retinospora Ellwangeriana.
Retinospora ericoides, Zucc.=Chamæcyparis sphæroidea var. ericoides.
Retinospora ericoides, Hort.=Thuja occidentalis ericoides.
Retinospora filicoides.
Retinospora filifera.
Retinospora juniperoides=R. decussata.
Retinospora leptoclada, Hort.=Chamæcyparis sphæroidea var. andelyensis.
Retinospora lycopodioides.
Retinospora meldensis.
Retinospora obtusa.
Retinospora pisifera.
Retinospora rigida=R. decussata.
Retinospora Sieboldii=R. decussata.
Retinospora squarrosa, Sieb. & Zucc.=Chamæcyparis pisifera var. squarrosa.
Retinospora squarrosa, Hort.=R. decussata.
BT Rhamnus Alaternus.
BTS Rhamnus hybrida.
B Rhododendron arbutifolium.
B Rhododendron brachycarpum.
B Rhododendron californicum.
B Rhododendron carolinianum=R. punctatum, in part.
B Rhododendron catawbiense.
B Rhododendron caucasicum.
B Rhododendron ferrugineum.
B Rhododendron hirsutum.
B Rhododendron maximum.
B Rhododendron Metternichi.
B Rhododendron minus=R. punctatum, in part.
B Rhododendron myrtifolium.
BT Rhododendron ponticum.
B Rhododendron præcox var. "Early Gem" (flowers often caught by early frost).
B Rhododendron Wilsonii, Hort.=R. arbutifolium (true Rhododendron Wilsonii is tender and not cultivated in the United States).
B Rhodothamnus chamæcistus=Rhododendron chamæcistus.
BS Rosa wichuraiana.
BS Rubus laciniatus (leaves bronze).
BS Rubus spectabilis var. plena=R. fruticosus.
BS Ruta graveolens.
B Salvia officinalis.
Sciadopitys verticillata.
T Sequoia sempervirens.
T Sequoia Washingtoniana.
BT Smilax laurifolia.
SD Spiræa cantoniensis.
Taxus baccata in variety, especially repandens, which is the most hardy English yew.
Taxus canadensis.
Taxus cuspidata (best and hardiest of all yews).

Taxus cuspidata var. brevifolia or nana.
Teucrium chamædrys.
T Thuja gigantea=T. plicata.
Thuja japonica.
Thuja occidentalis in variety, especially plicata.
Thuja orientalis in variety, especially decussata.
T Thujopsis dolobrata.
BS Thymus Serphyllum.
BS Thymus vulgaris.
Torreya nucifera.
T Torreya taxifolia.
Tsuga canadensis.
Tsuga caroliniana.
Tsuga diversifolia.
Tsuga heterophylla.
T Tsuga mertensiana.
Tumion=Torreya.
T Ulex europæus.
B Vaccinium macrocarpon.
B Vaccinium oxycoccus.
B Vaccinium Vitis-Idæa.
B Viburnum rhytidophyllum.
B Vinca minor.
B Yucca filamentosa.
B Yucca flaccida.
B Yucca glauca=Y. angustifolia.
BS Zenobia speciosa nitida.
BS Zenobia speciosa var. pulverulenta.

RALPH W. CURTIS.

Broad-leaved evergreens for Washington and the South.

Broad-leaved evergreens hardy at Washington, D.C. The evergreens and half evergreens of foregoing list are also good.

Abelia floribunda.
Aucuba himalaica.
Aucuba japonica.
Aucuba japonica var. concolor.
Buxus balearica.
Buxus sempervirens var. arborescens.
Buxus sempervirens var. Handsworthii.
Buxus sempervirens var. suffruticosa.
Cotoneaster Simonsii (nearly deciduous at Washington).
Cotoneaster thymifolia (nearly deciduous at Washington).
Daphne Laureola.
Elæagnus pungens var. reflexa.
Eriobotrya japonica.
Evonymus japonica var. macrophylla.
Garrya elliptica.
Ilex aquifolium.
Ligustrum japonicum.
Ligustrum lucidum.
Ligustrum lucidum var. aureo-marginatum.
Ligustrum Quihoui (half evergreen).
Ligustrum sinense (half ever-
Magnolia grandiflora. [green).
Nandina domestica.
Osmanthus Aquifolium.
Phillyrea angustifolia.
Photinia serrulata.
Prunus Laurocerasus var. Bertini.
Prunus Laurocerasus var. colchica.
Prunus Laurocerasus var. schipkaensis.
Prunus Laurocerasus var. rotundifolia.
Pyracantha coccinea.
Rhododendron amœnum.
Rhododendron arbutifolium.
Rhododendron carolinianum.
Rhododendron Hinodegiri.
Rhododendron minus.



1461. Picea pungens. The two small tufts at the right are P. excelsa var. Maxwelli.

Broad-leaved evergreens hardy at Norfolk and South

Berberis congestiflora.
Berberis Darwinii.
Elæagnus pungens var. maculata.
Elæagnus pungens var. Simonii.
Gardenia jasminoides.
Gardenia jasminoides var. Fortunei.
Ilex cornuta.
Laurus nobilis.
Laurus regalis.
Leucothoë acuminata.
Magnolia fuscata.
Magnolia Thompsoniana.
Mahonia Fortunei.
Mahonia nepalensis.
Mahonia trifoliata.
Photinia serrulata.
Prunus caroliniana.
Prunus lusitanica.
Quercus acuta.
Quercus Darlingtonii.
Quercus sempervirens.
Yucca aloifolia.
Yucca Treculeana.

The following list of broad-leaved evergreens hardy at Arnold Arboretum may also be expected to thrive at Washington.

Abelia grandiflora.
Arctostaphylos Uva-ursi.
Azara microphylla.
Buddleia japonica.
Bumelia lanuginosa.
Bumelia lycioides.
Buxus japonica.
Buxus sempervirens.
Cistus laurifolius.
Cotoneaster buxifolia.
Cotoneaster microphylla.
Daphne Blagayana.
Daphne Cneorum.
Daphne pontica.
Ilex crenata.
Ilex glabra.
Ilex opaca.
Ilex vomitoria.
Kalmia angustifolia.
Kalmia latifolia.
Leucothoë axillaris.
Leucothoë Catesbæi.
Mahonia japonica.
Pachistima Canbyi.
Pachistima Myrsinites.
Pernettya angustifolia.
Pernettya mucronata.
Phillyrea decora.
Pieris floribunda.
Pieris japonica.
Prunus Laurocerasus.
Pyracantha coccinea var. Lalandii.
Pyracantha coccinea var. pauciflora.
Rhododendron amœnum.
Rhododendron indicum.
Yucca filamentosa and varieties.
Yucca floccida and varieties.
Yucca glauca.
Zenobia speciosa and varieties.



1462. Young trees of Pinus ponderosa, useful in the Rocky Mountain region.

A list of broad-leaved evergreens in addition to those recommended for Norfolk, Virginia, for the South Atlantic and Gulf Coast regions and as far inland as Augusta and Montgomery. Those marked "S" thrive only in the warmest sections.

Arbutus Unedo.
Ardisia crenulata.
Berberis fascicularis.
Bumelia angustifolia.
Bumelia tenax.
Camellia japonica (S).
Cinnamomum Camphora (S).
Cleyera japonica.
Cytisus canariensis.
Cytisus filipes.
Cytisus monspessulanus.
Gardenia florida.
Gardenia Fortunei.
Gardenia radicans.
Helianthemum ocymoides.
Illicium anisatum (S).
Leucothoë acuminata.
Prunus lusitanica.
Prunus versaillensis.
Ligustrum nepalense.
Metrosideros floribunda (S).
Myrtus communis.
Nerium odorum.
Nerium Oleander.
Nerium splendens.
Olea fragrans.
Othera japonica=Ilex integra.
Pittosporum Tobira.
Quercus suber.
Ruscus aculeatus.
Thea Bohea.
Trachycarpus Fortunei (S).
Viburnum odoratissimum.
Viburnum suspensum.
Viburnum Tinus.
Viburnum sandankwa.

F. L. MULFORD.

Plants that are evergreen on the middle Great Plains.

It must be remembered that on the Great Plains the conditions vary enormously, and that few plants naturally range over the whole area, or are capable of being successfully grown in artificial plantations throughout the whole area Two special localities are frequently mentioned in the list. Arbor Lodge is the arboretum established by the late J. Sterling Morton at Nebraska City, within a few miles of the Missouri

River. The University Arboretum is at Lincoln, Nebraska, on the high prairies 60 miles west of the Missouri River.

Trees.

Abies balsamea (not common).
Abies cephalonica (Arbor Lodge; University Arboretum).
Abies cilicica (Arbor Lodge).
Abies concolor (common).
Abies nobilis (Arbor Lodge).
Abies Nordmanniana (Arbor Lodge).
Abies Picea (Arbor Lodge)=A. pectinata.
Abies Pinsapo (Arbor Lodge).
Abies Veitchii (Arbor Lodge; University Arboretum).
Chamæcyparis pisifera (Arbor Lodge).
Juniperus scopulorum (native in western portion).
Juniperus virginiana (native in eastern portion.)
Juniperus virginiana var. aurea variegata (University Arboretum).
Juniperus virginiana var. elegantissima (University Arboretum).
Juniperus virginiana var. glauca (University Arboretum).
Picea Alcockiana (Arbor Lodge; University Arboretum).
Picea canadensis (common)=P. alba.
Picea Engelmanni (rare).
Picea excelsa (common)=P. Abies.
Picea excelsa var. inverta (University Arboretum).
Picea excelsa var. pumila (University Arboretum).
Picea excelsa var. pumila compacta (University Arboretum).
Picea mariana (Arbor Lodge)=P. nigra.
Picea orientalis (Arbor Lodge).
Picea nigra (University Arboretum)=P. mariana.
Picea nigra var. Doumetti (University Arboretum).
Picea Parryana (common)=P. pungens.
Picea polita (Arbor Lodge; University Arboretum)=P. Torano.
Pinus austriaca (very common; University Arboretum).
Pinus austriaca var. cebennensis (monspeliensis) (University Arboretum).
Pinus cembra (Arbor Lodge).
Pinus divaricata (common)=P. Banksiana.
Pinus laricio (Arbor Lodge).
Pinus massoniana (Arbor Lodge).
Pinus montana (Arbor Lodge; University Arboretum).
Pinus resinosa (not common).
Pinus rigida (Arbor Lodge).
Pinus scopulorum (native in western portion).
Pinus Strobus (common).
Pinus sylvestris (very common).
Pseudotsuga taxifolia (common)=P. Douglasii.
Taxodium distichum (not common).
Taxus canadensis (Arbor Lodge).
Thuya occidentalis (common).
Thuya orientalis (Arbor Lodge; University Arboretum).
Tsuga canadensis (Arbor Lodge).

Shrubs.

Arctostaphylos Uva-ursi (native in western portion).
Berberis ilicifolia (University Arboretum).
Buxus (not common; tender at University Arboretum).
Evonymus japonica (University Arboretum).
Evonymus nana? (University Arboretum).
Evonymus radicans (University Arboretum).
Hedera helix (rarely hardy; tender).
Ilex opaca (rarely planted; tender).
Juniperus chinensis (University Arboretum).
Juniperus communis var. aurea (University Arboretum; tender).
Juniperus communis (native in western portion; University Arboretum).
Juniperus communis var. hibernica (University Arboretum; tender).
Juniperus sabina var. prostrata (University Arboretum).
Juniperus stricta (University Arboretum).
Ligustrum Ibota (half evergreen; University Arboretum).
Ligustrum ovalifolium (evergreen; half hardy; University Arboretum).
Ligustrum ovalifolium var. aurea (half evergreen; hardy; University Arboretum).
Ligustrum vulgare (half evergreen; University Arboretum).
Ligustrum vulgare var. buxifolium (evergreen, hardy; University Arboretum).
Ligustrum vulgare var. fructealba (half evergreen; University Arboretum).
Lonicera japonica var. Halliana.
Mahonia Aquifolium (native in western portion).
Rhododendron maximum (rarely planted; tender).
Smilax hispida (half evergreen; native).
Yucca filamentosa (common).
Yucca glauca (native in western portion).

Herbs.

Equisetum hiemale (native throughout).
Equisetum lævigatum (native throughout).
Equisetum scirpoides (native throughout).
Equisetum variegatum (native throughout).
Iris germanica.
Iris pumila.
Mamillaria missouriensis (native in western portion).
Mamillaria viviparus (native in western portion).
Opuntia arborescens (native in southwestern portion).
Opuntia camanchiana (native in southwestern portion).
Opuntia fragilis (native throughout).
Opuntia humifusa (native throughout).
Opuntia polyacantha (native throughout).
Opuntia tortispina (native in southern portion).
Pellæa atropurpurea (native throughout).
Salvia officinalis (common).
Selaginella rupestris (native throughout).
Vinca minor (common).

Rosettes.

Many herbaceous plants have rosettes of green leaves throughout the winter, the following being the more conspicuous on the Great Plains.

Capsella Bursa-pastoris (throughout the region; common cruciferous weed, introduced long ago and known as "shepherd's purse").
Dianthus, Plantago, Rumex (several species).
Fragaria virginiana (throughout the region).
Geum canadense (throughout the region).
Hieracium longipilum (in eastern portion).
Œnothera biennis (throughout the region).
Pentstemon grandiflorus (throughout the region).
Pyrola chlorantha (in the western portion).
Pyrola elliptica (in the western portion).
Pyrola secunda (in the western portion).
Taraxacum officinale (throughout the region); not green in University Arboretum, Lincoln, except where covered by snow.
Taraxacum erythrospermum.

CHARLES E. BESSEY.

EVERLASTINGS. A term applied to flowers or plants that retain their shape and other characteristics after being dried; equivalent to the French word "immortelle." With everlastings are also included various artificial or manufactured articles that imitate flowers or plants.

The most important commercially of the flowers that retain their form and color in a dried state have been the French immortelles, *Helichrysum arenarium*. These flowers are used very extensively in France in their natural yellow color, for the manufacture of memorial wreaths and crosses, which, being constructed very compactly, are exceedingly durable, even in the severest weather, and are exported in large numbers to all parts of the world. The flowers bleached white, or bleached and then dyed in various colors, are also shipped in enormous quantities, either direct to this country or by some of the large exporting houses of Germany. In the United States, however, the use of these immortelles has fallen off on account of the high duty.



1463. A mature field tree of Pinus ponderosa.

Approaching the French immortelles in aggregate value have been the so-called "cape flowers," *Helichrysum grandiflorum*, which formerly reached an enormous sale in this country, and they largely supplanted the immortelles on account of their silvery texture and greater beauty every way. They are naturally white, but require bleaching in the sun to give them the desired luster. They came from the Cape of Good Hope, and reached this country mainly from Hamburg. Of recent years, these products have been less important in the American trade because of the uncertainty of the crop, poor quality, and the competition of artificial materials. There is now being made in Germany an artificial "cape flower;" this flower is made from paper and waxed, and is an excellent imitation African cape. Large quantities of these goods are being imported into this country, and they have given great satisfaction to all florists that have used them. Probably in time the German product will

entirely supersede the natural African cape, more particularly as each flower has a wire stem which the florists attach to the toothpicks or sticks, and this saves considerable labor.

The common everlasting of American and English country gardens, *Helichrysum bracteatum*, is the only one of these flowers grown to any extent in North America, and more or less extensive cultivation of it, commercially, has been practised in this country but a large percentage is still imported. These plants come in white, straw and brown colors naturally, and take readily to a variety of artificial tints; together with *Ammobium alatum* and the well-known globe amaranth, *Gomphrena globosa*, they are grown and used to a considerable extent by the country folk in the construction of the many forms of wreaths, stars, and other Christmas forms, which they sell in the city markets in large quantities, but their sale by wholesalers and jobbers for general consumption is very limited. *Statice incana*, cultivated or wild from the swamps of southern Europe, and Gypsophila in several species are used to a considerable extent; and the sale of statice especially, which is popular in combination with cape flowers in memorial designs, is quite an item with the dealers in florists' supplies.

Of the dried grasses, the pampas plumes of California, *Cortaderia argentea*, native of South America, are the only American production attaining any great commercial importance. Their beautiful silky plumes, unapproached by any other horticultural product, are used in enormous quantities for decorative purposes, and are an important item of American export. They are used mainly in a sun-bleached state, but more or less dyeing, often parti-colored, is also done. *Bromus brizæformis* is the most extensively used of the smaller grasses. It is mostly imported from Europe. It can be imported, however, including duty, for about 25 per cent less than it is possible to grow it in this country. It is handled in the natural state. *Briza maxima*, another popular grass, is grown in Italy. *Briza media*, a medium-sized grass, and *Briza minima*, the flowers of which are as fine as sawdust, are also handled in the same way as *Briza maxima*, very little of the *B. minima* being used dyed, however. *Phleum pratense*, *Stipa pennata*, and various kinds of oats have more or less commercial value, being used considerably in the manufacture of imitation flowers and straw goods, but from a florist's standpoint they are not important. The most important commercially of the imported grasses is the Italian wheat, the quantities used in this country for the manufacture of sheaves for funeral purposes being enormous, and increasing yearly. It comes in many grades of fineness and length of stem. In this country all attempts to cultivate it in competition with the European product have failed. Of late years, a decorative natural grass called "Minerva" and treated artificially is being imported in large quantities, and is used by florists in combinations, making a very effective setting-off to flowers in basket decoration.

Much use is now made in this country of the dried twigs and foliage of ruscus. This is grown in Italy, and is shipped to Germany where it is prepared and dyed in many attractive colors. It holds its form well. It is made up into wreaths and other articles, and provides a good foliage effect.

Enormous use is now made of magnolia leaves prepared and colored in brown, red and green. In former years these goods were secured from Germany and Italy, but they are no longer imported for the reason that they are prepared in this country as good, if not better than they are on the other side, and much cheaper. They are gathered and prepared in Florida, and shipped to all parts of the United States, put in cartons containing about 1,000 leaves. They are used very extensively by all classes of florists on account of their lasting qualities and fine appearance. They have almost entirely superseded the galax leaf, which has been in use for so many years in the making up of mortuary emblems.

A number of our native composites—of the genera Gnaphalium, Antennaria and Anaphalis—are called everlastings, and are often used in home decorations, particularly in the country; but they have no commercial rating.

There is an increasing demand for artificial decorative articles, to be used alone and in conjunction with fresh cut-flowers; they are now being used by the best florists and plantsmen. The demand for decorative artificial flowers, plants and like materials, has grown to such an extent that there are now a large number of businesses devoted exclusively to the manufacture of them. This is well illustrated in the product called "Japanese wood frieze," in appearance resembling very much the well-known worsted and silk chenille. It is made from wood-fiber colored in shades to represent the colors of immortelles. This frieze or wood chenille, when worked up in various designs, so closely resembles immortelles that the difference between them can hardly be detected.

One of the interesting artificial greens is the "sea moss." It is an alga-like hydroid (one of the animal kingdom), known as *Sertularia argentea*, which is commonly distributed along our Atlantic coast northward from New Jersey to the Arctic. The long moss-like strands are dyed bright green, and the "plant" is used in making table decorations and jardinière pieces. It is sometimes called "air plant." The apparent lateral minute buds clothing all the branches are, of course, the shelter for the zoöids of the colony during life. There is another one (*Aglaophenia struthionides*) found on the Pacific coast, which is even more beautiful, and which is put to the same decorative uses, and is known there as the ostrich plume, the branches having a beautiful pinnate arrangement along the two sides of a single axis. These sea-mosses are dried, the dirt picked out, and then dyed and fixed in a preparation to make them permanent. They are likely to have an unpleasant odor.

H. Bayersdorfer.
Wm. N. Reed.†

Everlastings for home use.

After much experience with the growing of everlastings for home winter decorations, the three following species have been found the best for plantings: *Helichrysum monstrosum*, the double form of *H. bracteatum*, known as "golden ball," *Acroclinium (Helipterum) roseum flore-pleno*, and the Chinese lantern plant, *Physalis Franchetii*. These are easily grown, are free bloomers and give better and brighter color in their dried state than other forms. They have a certain warmth in color that is appreciated in zero weather.

The helichrysum and acroclinium are started in the greenhouse or hotbed during the latter part of March, planting them out in full sun as soon as all danger of frost is past. Any good garden soil suits them.

It is most important that the flowers of the acroclinium be picked just as soon as the buds show color, even if they look almost too small, because if too far advanced the ray petals open up flat, exposing the center, which will soon turn brown when dried and spoil the effect. Those cut early will open up part way, presenting only their full color. In full blooming season they should be picked daily. With the helichrysum one can wait until the bud is of fairly good size but all the smaller ones will open up also when dried. Those fully open or showing the center at all will turn brown. With both plants pluck off all foliage, place in bundles and hang them, heads down, in some dry closet. They should be examined at times, as in the drying the stems shrink and the flower may fall down. They should remain in this dry shelter until the house is heated in the

fall, reducing the moisture in the air, otherwise the dry flower-stems would absorb the moisture and become limp.

A certain number of "droopers" is wanted when arranging a bouquet, in order to avoid stiffness. These are easily secured. Take a long sheet of a pliable cardboard about 8 inches wide, tack one edge lengthwise on the top of a shelf, at the front bringing it out and downward so as to form a half circle, and fasten it there. Then lay the freshly picked flower-stems on the shelf, heads hanging down. It is sometimes necessary to place a book or some weight on the stems to keep them in place. They will dry in this curved form. Brown split bamboo baskets make good vases, as they harmonize well with the deep orange of the golden ball and the pink of the acroclinium. A wire mesh in these baskets enables the flowers to be arranged more easily. As there is no green foliage used, it is well to use some short-stemmed flower in the center, midway between the basket and the tallest flowers. These "flecks" of color relieve the bareness of the stems.

The Chinese lantern plant (*Physalis Franchetii*) is an easily grown perennial, spreading at the roots. The seed-pods are very ornamental, retaining their brilliancy of color when dried, the colors ranging from a pale green to orange and red. They hang like inverted balloons, on slender peduncles and lose their graceful appearance unless the main stem that carries them can be curved outward when dry. They have to be treated differently from the others. Boards on a partition in a wood-shed may be used, driving tacks, one each side, close up to the side of the bottom of the main stem, the heads of the tacks overlapping the stick. Run the stem up straight for about 6 inches, then curve to right or left and fasten in same manner. Then, when dried, the lanterns will hang clear of the stem. The seed-pods of the balloon vine, *Cardiospermum Halicacabum*, work in well among the lanterns. Cut away part of the side of the lantern, and see the brilliant wick inside.

W. C. Egan.

EVÒDIA (Greek, *pleasant odor*). *Rutàceæ*. Ornamental woody plants grown chiefly for their handsome foliage.

Deciduous or evergreen trees or shrubs: trunk with smooth bark: winter-buds naked: lvs. opposite, petioled, simple or pinnate with entire punctate lfts.: fls. in terminal or axillary panicles or corymbs, unisexual, usually 4-merous, less often 5-merous; sepals imbricate; petals valvate or slightly imbricate; stamens 4–5, at the base of a cupular disk: carpels 4–5, each with 2 ovules, nearly free or connate, with a cylindric style, at maturity dehiscent, 2-valved, 1–2-seeded.—About 50 species in E. Asia, from Korea and N. China to S. Asia., Austral. and Polynesia. Allied to Zanthoxylum which is easily distinguished by its alternate lvs.; very similar in habit and foliage to Phellodendron which besides in the berry-like frs. differs in the winter buds being inclosed in the base of the petiole, while in Evodia they are borne free in the axils.

The cultivated hardy species are strong-growing deciduous trees with rather large pinnate leaves of aromatic odor when bruised, and with whitish flowers in terminal broad panicles followed by small capsules exposing glossy black seeds when opening. *Evodia Daniellii* has proved hardy at the Arnold Arboretum. *E. glauca* and *E. Henryi*, are somewhat tenderer. There are also a few tropical species from New Guinea, rarely cultivated as warmhouse evergreens; they are little known and their correct names have not yet been determined. Propagation is by seeds and of the warmhouse species by cuttings of half-ripened wood; probably also by root-cuttings.

A. *Frs. obtuse or only mucronulate at the apex.*

glaûca, Miq. (*E. Fárgesii*, Dode). Tree, to 50 ft.: lfts. 5–11, usually 7, on slender slightly hairy stalks, ¼–⅓in. long, elliptic-ovate to oblong-lanceolate, long-acuminate, broadly cuneate or rounded at the base, minutely crenulate, glaucous below and glabrous except hairs along the midrib near the base, 2½–4 in. long: infl. corymbose, 6–8 in. broad, nearly glabrous; pistil of the staminate fls. glabrous: fr. about ¼in. long, finely pubescent. June; fr. Sept. Cent. China.

AA. *Frs. strongly beaked.*

Hénryi, Dode. Tree, to 35 ft.: lfts. 5–9, short-stalked, ovate-oblong to ovate-lanceolate, long-acuminate, rounded or narrowed at the base, finely crenulate, glaucescent or pale green below and glabrous, 2½–4 in. long: infl. paniculate, 2–2½ in. across: fr. reddish brown, sparingly hairy, ¼in. long, with slender beaks about half as long. June; fr. Sept. Cent. China. See page 3568.

Daniéllii, Hemsl. (*Zanthóxylum Daniéllii*, Bennett). Small tree: lfts. 7–11, ovate to oblong-ovate, acuminate with an obtusish point, rounded at the base, sometimes subcordate or broadly cuneate, pale green below and glabrous except hairs along the midrib and sometimes on the veins, 2–3½ in. long: infl. corymbose, 4–6 in. across: fr. nearly ⅓in. long, slightly hairy or nearly glabrous, with a rather short, usually hooked beak. June; fr. Sept. N. China, Korea.

E. élegans, Hort. Evergreen: lvs. 3-foliolate; lfts. linear-lanceolate, undulate and crenate; resembling Aralia elegantissima. New Guinea. F.E. 1899:291. Gng. 12:404. G. 21:273.—*E. formòsa*, Hort. A similar species, intro. in 1900 by Sander & Co. This and the preceding are warmhouse evergreens and belong probably to species already described.—*E. officinàlis*, Dode. Allied to E. glauca. Small tree: lfts. 5–11, ovate to elliptic-oblong, acuminate, pubescent and light green beneath: infl. pubescent: fr. glabrous, Cent. China.—*E. rutæcárpa*, Hook. f. & Thoms. Allied to E. glauca. Small deciduous tree: lft. short-petioled, broader, pubescent on both sides: infl. smaller and denser, with stout pedicels, pubescent, Japan, Himalayas. S.Z. 1:21 (as Boymia rutæcarpa).—*E. velùtina*, Rehd. & Wilson. Allied to E. Henryi, but lvs. and young branchlets densely short-pubescent: fruiting corymb 4–8 in. across. Cent. China.

Alfred Rehder.

EVÓLVULUS (*to unroll*, because not twining as in Convolvulus). *Convolvulàceæ*. Prostrate or erect annual or perennial herbs or sub-shrubs, rarely planted or grown in greenhouses. The genus differs from Convolvulus in having 2 styles 2-cleft, stigmas always narrow, corolla often open or rotate, and not twining: lvs. entire, small: fls. small, in summer and autumn; sepals 5, the calyx not bracted at base; corolla blue, rose or white, 5-angled or shortly 5-lobed. The species are about 80; in warm regions, several in the U. S. *E. purpùro-cœrùleus*, Hook., of Jamaica, appears to be the only species prominently mentioned horticulturally, and this is seldom planted: 1–2 ft., woody at base: lvs. small, lanceolate-acute: fls. purplish, terminal, the corolla rotate, white-centered and purple-rayed. B.M. 4202.

EVÓNYMUS (ancient Greek name). Often spelled *Euonymus*. *Celastràceæ*. Spindle-Tree. Woody plants, erect or climbing, grown chiefly for their handsome foliage and the attractive fruits.

Deciduous or evergreen shrubs or small trees with usually more or less 4-angled branches, mostly erect, rarely creeping or climbing by rootlets: winter-buds usually conspicuous with imbricate scales: lvs. opposite, petioled, usually serrate, and mostly glabrous: fls. small, in axillary cymes, 4–5-merous, generally perfect; style and stamens short, the latter inserted on a disk: fr. a 3–5-lobed, somewhat fleshy caps., each dehiscent valve containing 1 or 2 seeds inclosed in a generally orange-colored aril; the seed itself is white, red or black.—About 120 species in the northern hemisphere, most of them in Cent. and E. Asia, extending to S. Asia and Austral.

The spindle-trees are of upright or sometimes procumbent or creeping habit, with rather inconspicuous greenish, whitish or purplish flowers in axillary cymes; very attractive in fall, with their handsome scarlet,

pink or whitish, capsular fruits, showing the bright orange seeds when opening, and with the splendid fall coloring that most of the species assume, especially *E. alata, E. Maackii, E. sanguinea, E. verrucosa, E. europæa* and *E. atropurpurea*. The wood is tough, close-grained and light-colored, often almost white, and used, especially in Europe, for the manufacture of small articles. The bark of *E. atropurpurea* has medical



1464. Evonymus obovata. (×⅓)

properties.—Most of the cultivated deciduous species, except those from Himalayas, are hardy North, while of the evergreen ones only *E. radicans* is fairly hardy, and, on account of its greater hardiness, is often used North as a substitute of the ivy for covering walls, rocks and trunks of trees, climbing if planted in good soil, to a height of 15 and sometimes 20 feet. *E. europæa*, and South, the evergreen *E. japonica* are sometimes used for hedges.

The spindle-trees are not particular as to the soil and are well adapted for shrubberies. Propagation is by seeds which are usually stratified and sown in spring, or by cuttings of ripened wood in fall. The evergreen species grow readily from cuttings of half-ripened wood under glass in fall or during the winter in the greenhouse. Varieties are sometimes grafted or budded on stock of their typical species.

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A. *Foliage deciduous.* Nos. 1–13.

B. *Caps. tuberculate, depressed-globose: fls. 5-merous.*

1. americàna, Linn. STRAWBERRY BUSH. Upright shrub, to 8 ft.: lvs. ovate-lanceolate or oblong-lanceolate, usually acute at the base, acuminate, crenately serrate, 1½–3 in. long: peduncle slender, few-fld.; fls. yellowish or reddish green: fr. pink. June; fr. Sept.–Oct. From S. N. Y. south, west to Texas. L.B.C. 14: 1322. B.B. (ed. 2) 2:491. Var. **angustifòlia,** Wood (*E. angustifòlia*, Pursh). Lvs. lanceolate or linear-lanceolate, half-evergreen S.

2. obovàta, Nutt. (*E. americàna* var. *obovàta*, Torr. & Gray). Fig. 1464. Procumbent shrub, with rooting st. and erect branches, to 1 ft.: lvs. obovate or elliptic-obovate, crenately serrate, light green, 1–2 in. long: fls. purplish: caps. usually 3-celled. May; fr. Aug., Sept. From Canada to Ind. and Ky. G.F. 9:385 (adapted in Fig. 1464).—It may be used for covering the ground under large trees, or for borders of shrubberies. Var. **variegàta,** Hort., has the lvs. marked pale yellow.

BB. *Caps. smooth: fls. generally 4-merous.*

C. *Fr. divided to the base into 4 or less nearly separate pods.*

3. alàta, Maxim. (*E. Thunbergiàna*, Blume. *E. striàta*, Loes.). Spreading shrub, to 8 ft.: branches stiff, with 2–4 broad, corky wings: lvs. elliptic or obovate, acute at both ends, sharply serrate, 1–2 in. long: fls. 1–3, short-peduncled, yellowish: caps. purplish, small; seeds brown with orange aril. May, June; fr. Sept., Oct. China, Japan. S.I.F. 1:63. F.E. 32:54. Var. **subtriflòra,** Franch. & Sav. Branches not winged: fls. 1–5. Var. **apérta,** Loes. Aril open at the apex, disclosing the black seed. Cent. China.—This species is one of the handsomest; the lvs. turn bright crimson in autumn, the small, but numerous frs. are brightly colored and in winter the shrub is conspicuous by its broadly winged branches.

CC. *Fr. more or less 3–5-lobed.*

D. *Branches densely warty.*

4. verrucòsa, Scop. Erect shrub, to 6 ft.: lvs. ovate-lanceolate, crenately serrulate, acuminate, 1–2½ in. long: fls. slender-peduncled, 1–3, brownish: caps.



1465. Evonymus europæa. (×⅓)

deeply 4-lobed, yellowish red; seed black, not wholly covered by the orange aril. May, June; fr. Aug. S. E. Eu., W. Asia. H.W. 3, p. 55.

DD. *Branches smooth.*

E. *Anthers yellow.*

F. *The caps. with obtuse lobes.*

5. nàna, Bieb. Low shrub, to 2 ft., with slender, often arching or sometimes procumbent and rooting

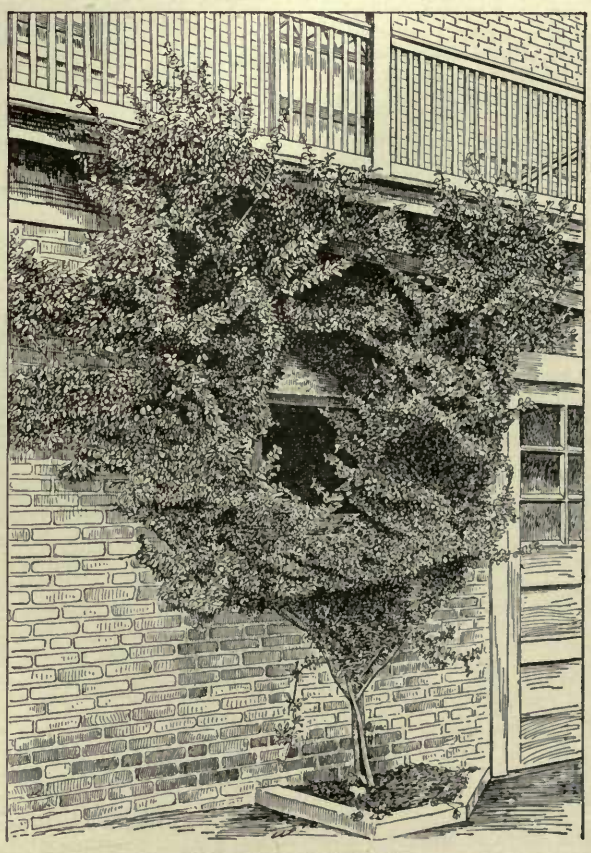
branches: lvs. linear or linear-oblong, mucronulate, entire or remotely denticulate and revolute at the margins, ½–1½ in. long: fls. slender-peduncled, purplish: caps. deeply 4-lobed, pink; seed brown, not wholly covered by the orange aril. May, June; fr. Aug. W. Asia to W. China.—Handsome shrub for rockeries and rocky slopes; forming a graceful, pendulous, standard tree if grafted high on *E. europæa*. Fr. ripens in Aug., earliest of all species. Var. **Koõpmannii**, Beissn. (*E. Koõpmannii*, Lauche). Lvs. larger and broader.

6. **europæa,** Linn. (*E. vulgàris*, Mill.). Fig. 1465. Erect shrub or sometimes small tree, to 20 ft.: lvs. ovate or oblong-lanceolate, acuminate, crenately serrate, 1½–2½ in. long: fls. yellowish, in few-fld. cymes: caps. 4-lobed, usually pink. May. Eu. to E. Asia. B.B. (ed. 2) 2:492. H.W. 3, p. 53.—Varying with narrower and broader lvs. There are also several varieties with variegated lvs. and some with frs. of different colors, as var. **atrórubens,** Rehd. (*E. vulgàris* var. *atrórubens*, Schneid. *E. europæa fr. atropurpùreo*, Hort.), with deep purple frs.; var. **leucocárpa,** DC. (*E. europæa fr. álbo*, Hort.), with whitish frs., and var. **atropurpùrea,** Arb. Kew, with rather narrow purplish lvs. Var. **nàna,** Lodd., is a dwarf, dense, and strictly upright form with elliptic to elliptic-lanceolate lvs. 1–1½ in., or on vigorous shoots, to 2½ in. long: it hardly ever flowers and is tenderer than the type.

FF. *The caps. with winged lobes: lvs. broad.*

7. **latifòlia,** Scop. Shrub or small tree, to 20 ft.: winter-buds elongated, acute, about ½in. long: lvs. obovate-oblong, acuminate, crenately serrate, 2–4 in. long: fls. yellowish, often 5-merous, in slender-peduncled, rather many-fld. cymes: caps. pink, large, with winged lobes. May, June; fr. Sept. S. Eu., W. Asia. B.M. 2384. Gn. 39, p. 213. Gt. 53, p. 30. G. 4:235. H.W. 3, p. 54. F.S.R. 3, p. 29.—A very decorative species, with handsome foliage and large pendulous frs.

8. **sanguínea,** Loes. Shrub or small tree, to 20 ft.: winter-buds elongated, acute: branchlets nearly terete: lvs. broadly oval or ovate to elliptic-ovate, acute, broadly cuneate or rounded at the base, densely fimbriate-serrulate, dull green above, paler below and slightly reticulate, 1¾–4 in. long: cymes lax, long-peduncled; fls. usually 4-merous: fr. purple, slightly lobed, 4-winged, the wings ¼–⅓in. long; aril orange, entirely covering the black seed. June; fr. Sept. Cent. and W. China. Var. **brevipedunculàta,** Loes. Peduncles about 1 in. long. W. China. Var. **camptoneùra,** Loes. Lvs. oval or ovate to elliptic-ovate, veins curved (broader in the type and veins nearly straight). Cent. and W. China.



1466. Evonymus radicans.

EE. *Anthers purple.*

F. *Fls. purple.*

9. **atropurpùrea,** Jacq. (*E. americàna*, Hort.). BURNING BUSH. Shrub or small tree, to 20 ft.: lvs. elliptic, acuminate, obtusely serrate, pubescent beneath, 1½–5 in. long: fls. purple, in slender-peduncled, many-fld. cymes: caps. deeply 3–4-lobed, scarlet. June; fr. Oct. E. N. Amer., west to Mont. B.B. (ed. 2) 2:491.

FF. *Fls. yellowish or whitish.*

G. *Petioles one-fifth to one-sixth as long as the lf.; lvs. acute or gradually acuminate: fr. pink.*

H. *Lvs. oblong to ovate-oblong, broadest about or below the middle.*

10. **Maàckii,** Rupr. (*E. Hamiltoniàna,* Dipp., not Wall.). Large shrub or small tree, glabrous: lvs. elliptic-oblong to oblong-lanceolate, acuminate, gradually narrowed toward the base, serrulate, 2–3 in. long and ¾–1¼ in. broad: cymes small, about ¾in. across: fr. pink, 4-lobed, about ⅓in. across; aril orange-red, usually closed, rarely slightly opened at the apex. June: fr. Sept. N. E. Asia.

11. **hians,** Koehne. Large shrub: lvs. ovate-oblong, short-acuminate, rounded or broadly cuneate at the base, serrulate, 2½–4½ in. long and 1–1¾ in. broad: cymes rather long-stalked, small; stamens with very short filaments: fr. pink, turbinate, deeply 4-lobed, ⅓in. across; aril blood-red, open at the apex and disclosing the blood-red seed. June; fr. Sept. Japan. S.I.F. 2:39 (as *E. europæa*).

HH. *Lvs. generally obovate or obovate-oblong, to 2½ in. broad.*

12. **yedoênsis,** Koehne (*E. Sieboldiàna*, Rehd., not Blume). Large shrub: lvs. usually obovate, sometimes elliptic, broadly cuneate at the base, abruptly acuminate, serrulate, 2–5 in. long and 1½–2½ in. broad: cymes long-stalked, rather dense and many-fld.: fr. pink, deeply 4-lobed, ½in. across; aril orange, usually closed. June; fr. Sept. Japan. Gt. 53, p. 31. S.T.S. 1:62. F.E. 31:125. Var. **calocárpa,** Koehne. Fr. bright carmine. Var. **Koehneàna,** Loes. Lvs. hairy on the veins below. Cent. China.

GG. *Petioles usually a third to a fourth as long as the lf.; lvs. abruptly long-acuminate: fr. pale yellowish or pinkish white.*

13. **Bungeàna,** Maxim. Shrub, to 15 ft., with slender branches: lvs. slender-petioled, ovate-elliptic or elliptic-lanceolate, long-acuminate, finely serrate, 2–4 in. long: fls. in rather few-fld. but numerous cymes: fr. deeply 4-lobed and 4-angled; seeds white or pinkish, with orange aril. June; fr. Sept., Oct. China, Man-

churia, M.D.G. 1899:569.—Very attractive with its rather large, profusely produced frs., remaining a long time on the branches. Var. **semipersístens,** Schneid. (*E. Hamiltoniàna* var. *semipersístens*, Rehd. *E. Sieboldiàna*, Hort., not Blume). Lvs. elliptic, long-acuminate, half-evergreen, keeping its bright green foliage S. until mid-winter: fr. bright pink, usually sparingly produced and ripening very late.

AA. *Foliage evergreen or half-evergreen (see also the preceding var.).*

B. *Lvs. rather thin, half-evergreen.*

14. **pàtens,** Rehd. (*E. kiautschòvica* var. *pàtens*, Loes. *E. Sieboldiàna*, Hort., not Blume). Spreading shrub, to 10 ft., the lower branches sometimes procumbent and rooting: branchlets obscurely 4-angled, minutely warty: lvs. elliptic to elliptic-oblong, rarely obovate-oblong, acute, cuneate at the base, crenately serrulate, bright green above: cymes 2–3 in. across, loose, slender-peduncled: fr. subglobose, pink; seed pinkish brown, covered entirely by the orange aril. Aug., Sept.; fr. Oct., Nov. Cent. China. S.T.S. 1:64.—Hardy as far north as N. Y., in sheltered positions to Mass. One of the best shrubs for winter-effect on account of its abundant late-ripening frs. and the handsome foliage remaining on the branches until spring except when destroyed by severe frost.



1467. Evonymus radicans.

BB. *Lvs. thickish, evergreen.*

15. **japónica,** Linn. Upright shrub, to 8 ft., with smooth and slightly quadrangular or striped branches: lvs. obovate to narrow-elliptic, cuneate at the base, acute or obtuse, obtusely serrate, shining above, 1½–2½ in. long: fls. greenish white, 4-merous, in slender-peduncled, 5- to many-fld. cymes: caps. depressed, globose, smooth, pink. June, July.; fr. Oct. S. Japan. S.I.F. 2:39. B.R. 30:6.—A very variable species. Var. **macrophýlla,** Sieb. (var. *robústa*, Hort.). Lvs. oval, large, 2½–3 in. long. Var. **microphýlla,** Sieb. (*E. pulchélla*, Hort. *Eùrya microphýlla*, Hort.). Lvs. small, narrow-oblong or oblong-lanceolate. Var. **columnàris,** Carr. (var. *pyramidàlis*, Hort.). Of upright, columnar habit: lvs. broadly oval. There are many varieties with variegated lvs.; some of the best are the following: Var. **argénteo-variegàta,** Regel. Lvs. edged and marked white. Var. **aùreo-variegàta,** Regel. Lvs. blotched yellow. Lowe, 49. Var. **álbo-marginàta,** Hort. Lvs. with white, rather narrow margins. Var. **mèdiopícta,** Hort. Lvs. with a yellow blotch in the middle. Var. **pállens,** Carr. (var. *flavéscens*, Hort.). Lvs. pale yellow when young; similar is var. **aùrea,** Hort., but the yellow is brighter and changes more quickly to green. Var. **víridi-variegàta,** Hort. (var. *Duc d'Anjou*, Hort.). Lvs. large, bright green, variegated with yellow and green in the middle. Var. **aùreo-marginàta,** Hort. Lvs. edged yellow. F.E. 16:436; 29:815.

16. **radìcans,** Sieb. (*E. japónica* var. *radìcans*, Regel. *E. rèpens*, Hort.). Figs. 1466, 1467. Low, procumbent shrub, with often trailing and rooting or climbing branches, climbing sometimes to 20 ft. high: branches terete, densely and minutely warty: lvs. roundish to elliptic-oval, rounded or narrowed at the base, crenately serrate, usually dull green above, with whitish veins, ½–2 in. long: fls. and fr. similar to the former, but fr. generally of paler color. June, July; fr. Oct. N. and Cent. Japan. R.H. 1885, p. 295. G.C. II. 20:793. M.D. 1906, p. 219.—Closely allied to the former, and considered by most botanists as a variety; also very variable. Var. **Carrièrei,** Nichols. (*E. Carrièrei*, Vauv.). Low shrub, with ascending and spreading branches: lvs. oblong-elliptic, about 1½ in. long, somewhat shining. G.W. 8, p. 16. Var. **argénteo-marginàta,** Rehd. Lvs. bordered white. Var. **ròseo-marginàta,** Rehd. Lvs. bordered pinkish. Var. **reticulàta,** Rehd. (var. *pícta*, Hort., var. *argénteo-variegàta*, Hort. *E. grácilis*, Sieb.). Lvs. marked white along the veins. R.H. 1876, p. 354; 1878, p. 135. G.W. 1, p. 475. A.G. 19:37. Var. **mínima,** Simon-Louis (*E. kewénsis*, Hort.). Lvs. marked like those of the preceding variety but smaller, ¼–½in. long.

Var. **végeta,** Rehd. Low spreading shrub, to 5 ft., usually with a few prostrate rooting branches at the base, and climbing high, if planted against a wall: lvs. broadly oval or almost suborbicular, acutish or obtusish, crenately serrulate, 1–1¾ in. long, those of the rooting branchlets smaller and thinner and generally ovate. Japan. S.T.S. 1:65. M.D.G. 1908:13.—Handsome and hardy shrub; the frs. appear in great profusion and remain on the branches a long time. Var. **acùta,** Rehd. (*E. japónica* var. *acùta*, Rehd.). Rooting and climbing: lvs. elliptic or ovate-elliptic, acute or short-acuminate, serrulate, with the veins below slightly elevated. Cent. China.

E. Aquifòlium, Loes. & Rehd. Evergreen shrub, to 10 ft.: lvs. coriaceous, nearly sessile, ovate to ovate-oblong, spiny sinuate-dentate: fr. 4-lobed, usually solitary. W. China. One of the most striking species on account of its holly-like lvs.—*E. echinàta*, Wall. Usually creeping or climbing, with rooting branches: lvs. ovate-lanceolate: fr. spiny. Himalayas. B.M. 2767.—*E. fimbriàta*, Hort., not Wall.=E. pendula.—*E. grandiflòra*, Wall. Shrub, to 12 ft.: lvs. obovate or obovate-oblong, finely and acutely serrate: fls. white ½ in. across: fr. globose, yellow; aril scarlet. Himalayas, W. China.—*E. Hamiltoniàna*, Wall. Allied to E. Maackii. Small tree: lvs. oblong-lanceolate, acuminate, finely and irregularly serrulate, 2½–4 in. long: anthers yellow: fr. pink, turbinate, 4-lobed. Himalayas. Probably not in cult.; the plant cult. under this name is E. Maackii.—*E. lanceifòlia*, Loes. Allied to E. hians. Shrub or tree, to 30 ft.: lvs. firm at maturity, lanceolate to elliptic-oblong, crenately serrulate, 3–6 in. long: anthers purple: fr. 4-lobed, pale; aril orange, open at the apex; seed crimson. Cent. and W. China.—*E. macróptera*, Rupr. Allied to E. latifolia. Lvs. obovate or obovate-oblong, cuneate at the base: cymes many-fld.: fr. with 4 narrow wings ½–¾in. long. Japan. N. E. Asia. I.T. 6:121. Hardy.—*E. occidentàlis*, Nutt. Shrub, to 15 ft.: winter-buds rather large: lvs. ovate or elliptic-lanceolate, irregularly serrulate: fls. 5-merous, purple: fr. slightly lobed. Ore., Calif.—*E. oxyphýlla*, Miq. Shrub or small tree: lvs. ovate or obovate, acuminate, rather large, serrulate: fls. 5-merous, purple or whitish: fr. globose. Japan.—*E. péndula*, Wall. (E. fimbriata, Hort.). Evergreen, small tree, with pendulous branchlets: lvs. oblong-lanceolate, sharply serrate, shining, 3–6 in. long: fr. with 4 tapering wings. P.F.G. 2:55. F.S. 7, p. 71.—*E. plànipes*, Koehne. Allied to E. latifolia. Lvs. cuneate at the base; petioles flat, not grooved: fr. acutely 5-angled, scarcely winged. Japan. M.D. 1906, p. 62. Gt. 53, p. 29.—*E. sacchalinénsis*, Maxim. Allied to E. latifolia. Lvs. ovate-oblong, crenate-serrulate: cymes very long-peduncled; fls. purple: fr. distinctly winged, convex at the apex. N. E. Asia.—*E. Sargentiàna*, Loes. & Rehd. Evergreen shrub: lvs. obovate to oblong-obovate, abruptly acuminate, remotely crenate-serrate, 2–3½ in. long: fr. oblong-obovoid, 4-angled. W. China.—*E. Semenòvii*, Regel & Herd. Allied to E. europæa. Small shrub: lvs. lanceolate, serrulate: cymes usually 3-fld.: fr. 4-lobed with obtuse lobes. Turkestan.—*E. semiexsérta*, Koehne. Allied to E. Maackii. Lvs. oblong or oblong-lanceolate, crenate-serrate, 2–5 in. long: fr. light pink; aril orange, open, with the blood-red seed almost half exposed. Japan.—*E. Sieboldiàna*, Blume. Allied to E. Maackii. Lvs. slender-petioled, elliptic to oblong, acuminate, serrulate: fr. not lobed, strongly 4-ribbed. Japan. M.D. 1906, p. 62. Not in cult.; the plants cult. under this name belong to E. yedoensis, E. patens or E. Bungeana var. semipersistens.

ALFRED REHDER.

ÉXACUM (classical name, of no significance to these plants). *Gentianàceæ*. Herbs treated either as annuals or biennials or perennials, with flowers of white, lilac, blue or dark purplish blue, cultivated in a very few greenhouses.

Very rarely suffruticose: dwarf or tall and paniculate-branching: lvs. sessile, clasping or short-stalked, ovate or lanceolate, mostly 3–5-nerved: fls. small or attaining 2 in. across, rotate, pedicelled or not, in forking cymes;

calyx 4–5-parted, the segms. keeled, winged or flat and 3-nerved; corolla-lobes 4 or 5, ovate or oblong, twisted; stamens 4 or 5, attached to the throat, with very short filaments, the anthers opening by apical pores that finally enlarge nearly to the base: fr. a globose 2-valved caps.—Species about 30, in Trop. and Subtrop. Asia, Malaysia, Trop. Afr., Socotra.

Plants of *E. affine* flower in summer. If specimens in 5-inch pots are desired, sow in March of the same year; for larger specimens, sow in August of the preceding year. The plants must be kept in a cool but not draughty greenhouse or frame in summer, and shaded from fierce sunlight. They usually are given warmhouse conditions.

A. *Lvs. with stalks often ½in. long.*

affíne, Balf. St. cylindrical, 1–2 ft. high, much branched from the base: lvs. 1–1½ in. long, elliptic-ovate, faintly 3–5-nerved: sepals with a broad wing on the back; corolla 6–9 lines wide; lobes almost rounded. Socotra. B.M. 6824. A.F. 13:1104. Gng. 6:229. R.H. 1883, p. 512. Gt. 32:1108. G.C. II. 21:605.

AA. *Lvs. nearly or quite stalkless.*

B. *Corolla-lobes rounded.*

zeylánicum, Roxbg. Annual: st. 4-sided, branched only above: lvs. becoming 3 in. long, strongly 3-nerved, elliptic-oblong, acuminate, narrower than in *E. affine*, and tapering: fls. blue, 1½ in. across, in terminal, leafy corymbs; sepals broadly winged; corolla-lobes obovate, obtuse. Ceylon. B.M. 4423 (sky-blue, with a dash of purple). R.H. 1859, p. 238. J.F. 1:43. H.F. II. 2:60.

BB. *Corolla-lobes usually tapering to a point.*

macránthum, Arn. (*E. zeylánicum* var. *macránthum*). Fig. 1468. St. cylindrical, slightly branched: lvs. as in *E. zeylanicum*, though perhaps more variable from base to summit: fls. purplish blue, 2 in. across. In both species there is a narrow ring of yellow at the mouth, to which the conspicuous clusters of stamens are attached. Ceylon. B.M. 4771 (deep purplish blue). G.C. III. 15:331. R.H. 1911, p. 31. J.H. III. 42:182; 51:259.—The best of the genus. The rich, dark blue is worth striving for.

Fórbesii, Balf. Bushy and shrubby: lvs. triangular or ovate-lanceolate, 1¼ in. across at base: fls. upwards of ½in. across, purple or violet-purple, in terminal racemes, the anthers yellow and prominent. Socotra. G.C. III. 31:93. G. 23:679. G.W. 6, p. 290. G.M. 45:81.—A good plant for intermediate temperature, blooming well in a 6-in. pot. WILHELM MILLER. L. H. B.†

EXCŒCÀRIA (from Latin *excœcares*, referring to its effect on the eyes). *Euphorbiàceæ*. Tropical trees or shrubs with poisonous milky juice rarely cultivated for ornament.

Glabrous: lvs. alternate or opposite, usually entire (or crenate to serrate): infl. usually in axillary spikes; fls. dicœcious or monœcious; calyx imbricate; sepals 2–3, free or connate at base; petals none; stamens 2–3, erect in bud; filaments free; ovary 3-celled, 3-ovuled: seed not canaliculate.—About 25 species in the Old World tropics. Related to Stillingia and Sapium.

bícolor, Hassk. (*Cròton bícolor*, Hort.), with the opposite lvs. red beneath is sometimes cult. for ornament in European greenhouses or outdoors in the tropics. *E. Agallócha*, Linn., AGALLOCHA, BLINDING TREE, RIVER POISON, etc., with alternate lvs., is a well-known poisonous tree of the coasts of S. Asia. J. B. S. NORTON.

EXHIBITIONS of horticultural products have been both a concomitant and a stimulant of progress in American horticulture. The great international expositions ushered in by the Centennial Celebration of 1876 at Philadelphia, through the opportunities afforded for the comparison of products, have been the means of unusual education in the indentification of varieties. No amount of descriptive literature can compare with this method of acquiring accuracy in naming and describing fruits, flowers, and vegetables.

The interest in these great exhibitions by the growers of soil products indicates a peculiarity of this class of producers. They are the ones to reap the smallest direct result, and yet they have always been willing to give freely of their productions to swell the volume of these great fairs and emphasize the possibilties of the localities in which they lived. They would even pay their own expenses to attend these fairs and explain to the world how they succeeded in growing such attractive things. No producers of the useful things of life will compare with the horticulturist in willingness to impart to his fellow the secrets of his



1468. Exacum macranthum (×⅓).

success. National, state, district and township exhibitions have thus become great methods of disseminating information of value to the horticulturist—educators of the people.

For many years the most prominent feature of fruit shows was the nomenclature of the exhibit. In vegetables it was the size of the specimen, in flowers the number of sorts and their tasteful arrangement. People flocked together to identify varieties, to see the big things and to satisfy esthetic longing. Later the art in exhibiting products was given more attention, and wonderful creations have resulted from combinations and artistic arrangement.

Exhibitions have been the favorite opportunities of bringing out new and valuable sorts and often the usefulness of a variety dates from some particular fair at which it was prominently displayed. Notable instances of this were the grapefruit, which was shown in quantity for the first time at the great New Orleans exhibition; the Kieffer pear, which was a distinguishing

feature of a meeting of the American Pomological Society in Philadelphia; the Niagara grape, which was featured at a winter meeting of New York fruit-growers. Striking examples of this are found in the annals of floral exhibits. The dissemination of the most delightful strains of carnations and chrysanthemums dates from some particular fair or "show."

In recent years, the experiment stations of the country have added greatly to their usefulness in preparing technical exhibits for winter exhibitions of horticultural societies, helping their progressive work, through graphic illustrations of the results which they have obtained in growing products under varying conditions, and having in mind the demonstration of problems of value to growers.

One of the most recent developments has been the opportunity given students of agricultural colleges of putting into practice the knowledge of varieties which they have acquired in the naming of various collections as a competitive drill.

The products of glass farming have been brought into prominence through national, state, and local horticultural societies in their annual exhibitions, and the great seedhouses of the country have used these exhibitions as avenues for the dissemination of new and valuable varieties. Nurserymen have successfully utilized exhibitions in publishing to the world not only their new creations but their methods of propagation.

During recent years the initiative of the American Pomological Society has been followed by many other organizations in perfecting a scale of points for judging exhibits of horticultural products. By this means, more accurate methods have come into use at our great fairs, and, in the hands of experts, the judgments rendered have been far more satisfactory and useful.

A most important result of exhibitions has been the acquirement of the knowledge that varieties vary a great deal as the result of climatic conditions and differences in soil, and it is found as an outcome of these comparisons that certain localities are especially adapted to certain varieties in which they reach their highest perfection. This is illustrated in the Rocky Ford cantaloupe, the Albemarle Pippin, certain strains of carnations, and head lettuce. The facts brought out through these comparative exhibits are leading to scientific investigations concerning the conditions which produce these variations which will be of great use to the producers, as well as deep interest to the scientist.

Commercial problems are finding their solution through exhibitions which illustrate styles of packing and kinds of packages and general attractiveness in presenting the products to the consumer. Already these exhibitions have brought to the attention of law-makers the importance of uniform legal requisitions concerning methods of marketing throughout the land.

The most recent development of values resulting from horticultural exhibits of great utility has been the carrying of the methods of comparison instituted there to the growing of products on the farm and in the garden, orchard and vineyard, thus awakening a deeper interest in the factors which affect the production of horticultural creations and a recognition of the uses of these creations in landscape art. Thus an abiding interest has been awakened in the development of the science as well as the art of horticulture through the adoption of new and improved methods of production and widening the usefulness of the products.

CHARLES W. GARFIELD.

Exhibitions of plants and flowers.

Floral exhibitions undoubtedly had their origin, in part, in the desire to display publicly the products of one's skill and to attain renown and a position of preëminence among one's fellows by successful rivalry and the demonstration of superior cultural abilities. But, in addition to this factor of self-interest and excusable pride, the laudable spirit that seeks to promote a taste for ornamental gardening and floriculture in general, and to acquire knowledge and diffuse information concerning it, has from the first been a powerful incentive; and it cannot be questioned that public floral exhibitions have contributed most substantially to the advancement of refinement and good taste and exercised a potent and salutary influence on the domestic life, health, morals and happiness of the respective communities in which they have been held.

Exhibitions of plants and flowers, as usually conducted, may be broadly divided into two classes: (1) Those whose particular purpose is to demonstrate advancement in cultural methods and exploit new and improved varieties and which are calculated to interest primarily the trade and professional gardeners. The unavoidably monotonous system of staging exhibits in such an affair is well known. To the general public, its salient points are scarcely apparent, and the elements which often appeal most strongly to the professional are all but lost on the average visitor. It has been demonstrated over and over again, that as an attraction for the people who look for entertainment in a show and are willing to pay for the privilege of seeing it, this sort of an array is fundamentally deficient. (2) If public support is sought, the first requisite is that the public fancy be considered and catered to and the character and scope of the exhibition be such as the people care to take an interest in. A practical demonstration of the uses of flowers and plants and their appropriate arrangement for the various events of social or home life will invariably excite curiosity and interest when prim rows of dozens and fifties of competitive blooms will often fail to awaken appreciative response. It is to be regretted that the so-called retail florist trade has so long been neglectful of its duty and its opportunity as a supporter of and participator in the flower shows. Without the assistance and coöperation of the experienced decorator and artistic worker in flowers, these affairs must invariably fall short of their mission and their educational possibilities. How to overcome the indifference of this branch of commercial floriculture toward these enterprises which should bring immeasurable benefit to their industry is one of the serious problems for which those who believe in flower shows must find a solution before the ideal of what a horticultural exhibition should be can be realized.

The direct cost of installing a public flower show is no small matter and many a commendable enterprise has failed through lack of sufficient income properly to finance it. Rent of hall, music, advertising, premiums, tables, vases, management, labor and a host of incidentals must be taken carefully into consideration, and to launch any such project, under conditions now existing, without some form of endowment, subscription, guaranty or other definite and reliable resource, apart from the uncertain sale of admission tickets, is merely tempting fate and taking chances on misfortune.

The grouping of pot-plants for effect calls for talents of a high order. Arrangements of this kind, which are so indispensable in giving character to a flower show that will appeal to the artistic eye as effective studies in form and color, are indeed rarely seen. Two almost universal faults are excessive formality in contour of the group and overcrowding of material, and it not infrequently happens that when a studied effort has been made for irregularity of outline, the result is still unnatural and often almost grotesque. The promiscuous mixing together of incongruous subjects, as, for example, hardy conifers, tropical palms, geraniums and orchids in one group, is all too common. A taste-

ful grouping of plants of congenial character will always inspire enthusiastic admiration among cultured and discriminating visitors, and if the flower pots are hidden from sight by moss or other natural material, the pleasing effect will usually be further enhanced, particularly in the case of plants which might naturally grow together.

It is well known among flower-growers that the time of day, the condition of development, and other factors have a considerable influence on the keeping qualities of their product. A sojourn in a cool, dark room over night with stems deeply immersed in fresh water is really an essential with many flowers if they are to remain for any time in good condition in the atmosphere of an exhibition hall. Nothing is more disfiguring in a flower show than a lot of wilted blooms. Much depends upon the style of vases used. Vases spreading at the top and narrowing to a point at the bottom, while perhaps the most graceful in form, are very destructive to flowers, the small quantity of water available at the base of the stems soon becoming heated and impure. Constant changing of water, and keeping down the temperature of the hall will help to preserve the exhibits. Table baskets and dinner-table exhibits generally, as often arranged, scarcely last until the first visitors are admitted. Only those in which the flower-receptacles are such as contain water can give any satisfaction in a flower show.

The background against which flowers are shown, as the color and material of the walls, covering of tables, and so on, has much to do with the general impression, favorable or otherwise, on the visitor. Green—the natural foliage green—is unquestionably the "middle of the road" background hue for flowers. Back of and beyond green, the neutral grays and browns, and sometimes pure white, are pleasing and satisfactory. It is worth noting that, while terra-cotta or flower-pot tones are usually beyond reproach as a background for living green, yet a brick wall is a disheartening condition for this purpose, showing that it is not alone color which decides the appropriateness of exhibition hall walls or drapery.

The number of specimens usually shown in cut-flower classes depends upon the kind of flowers, the ingenuity of the schedule-makers, and the demands of the occasion. The more extensive and pretentious the exhibition, the larger should be the classes. Roses and carnations in half-dozens, for example, have little value in a large exhibition. Fifties and hundreds alone will impress the visitors. When individual blooms, or groups composed of individual varieties are displayed, much depends upon the taste shown in color-arrangement. This is especially important with such subjects as chrysanthemums, dahlias, gladioli and sweet peas, all of which afford wide scope for demonstration of taste in exquisite blending, contrasting and gradation of color-tones, qualities which should count for much in the final decisions of the judges. The question of the height of tables or platforms on which flowers are shown is one which should be carefully considered in planning an exhibition. There are flowers which should be looked down upon if their full beauty is to be seen. Others must arch overhead to display their graces, and there are many intermediate steps. As a rule, exhibition tables are set too high.

One main reason for the flower show being its educational value, the proper and legible labeling of species and varieties is essential. In no other respect are our exhibitions so deficient. A neat label, attached so it can be read without handling, and legible at a fair distance, is something rarely seen at a flower show, while obtrusive advertising cards or award cards frequently spoil the beauty of an otherwise creditable staging.

Competitive exhibitions properly conducted and entered into with the right spirit are, as before said, calculated to accomplish much good for the art of horticulture. Emulation in a friendly contest for honors is a strong factor in the success of a show, but the kind of rivalry which stimulates jealousies, envenoms disappointment and incites to angry protests over judges' decisions, is one of the most mischievous elements that can intrude upon the scene. In order to discourage the protesting habit and minimize the demoralizing influence of questionable decisions, great care should be exercised always in the selection of competent, disinterested and impartial judges. Their names should be announced a sufficient time in advance so that every intending exhibitor may know who is to pass upon his exhibits.

It is now a generally established custom to inclose the name of an exhibitor in an envelope bearing only the class number, the identity of the exhibitor not to be disclosed until after the judging has been completed. Some very excellent systems of cards, record books, envelopes, and so on for this purpose have been devised and are in general use.

WM. J. STEWART.

Exhibition of fruits. Fig. 1469.

The educational value of carefully planned exhibitions of fruits can scarcely be overestimated. That this fact is appreciated in increasing measure each year is demonstrated by the growing number of such exhibitions that are being held throughout the country. Commercial fruit regions do much of their advertising by means of these annual affairs, and there are few towns or hamlets, however unpretentious, without their yearly fruit show promoted by the grange, the school, the church, or some other organization whose aim is progress in country affairs.

Foresight, with careful attention to details, is essential if the possibilities of an exhibition are to be developed to the utmost. The larger number of such events are held in the fall, since fall is Nature's harvest season for fruits. This means that preparation must begin in midsummer to insure the greatest measure of success. There are many things that the grower can do at this time to secure high-class fruit for exhibition purposes, and no other should be considered.

The best fruit is often found near the top of the tree, if thorough spraying has been done. It is the best because conditions there are most nearly ideal for its development. As the fruit increases in size and the weight upon the branches becomes greater, the side branches settle more closely together, while the topmost branches and those most nearly upright in habit of growth, always advantageously situated, have an increased opportunity to receive the abundance of air and sunlight so essential to normal and perfect fruit. Fruit on such branches invariably possesses the highest color of any on the tree, and color is of vital importance for the matter in hand. The color may be heightened and the size increased if the fruit is thinned until the specimens hang 6 inches or more apart. A branch may be headed back, and occasionally one may be removed entirely to the benefit of those remaining, if good judgment is used. This matter of thinning is of considerable importance in the securing of high-class exhibition fruit, whether the fruit be apple, orange, or grape.

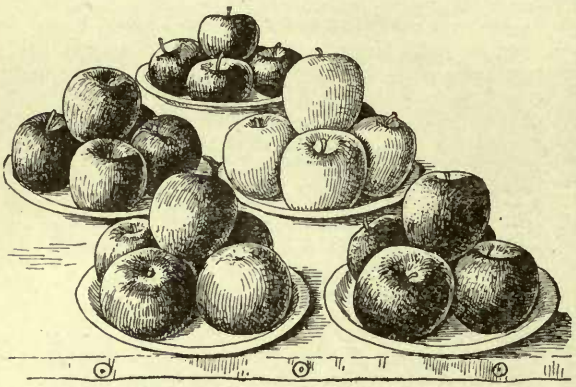
The production of exhibition specimens by abnormal processes—as by ringing or girdling—is not allowable, unless for the express purpose of showing what can be accomplished by such practices: fruits produced by such means should not be shown in comparison or competition with specimens produced under recognized and standard methods.

The specimens should be allowed to remain attached to the parent plant as long as possible. The longer they remain thus, the more intense will be their color and the greater will be their size. Pears especially

increase very rapidly in size just before maturity. The picking should be done by hand and with the greatest care. Many an excellent specimen has been ruined by careless handling. The stems should remain intact. The picker should remove, not a sufficient number of specimens to meet the requirements under which the exhibit is held, but many times that number. A bushel, or even a barrel, of seemingly high-class fruit will often yield after the most rigid inspection but a single plate of perfect specimens.

The actual selection of the specimens to be exhibited is the most difficult and perplexing problem connected with this work. Fundamental to a successful solution of this problem is a thorough knowledge of the variety, an intimate acquaintance with the characters of a normal specimen, and a fine discrimination in the balancing of these characters and in the attaching of the proper values to each.

The external factors that must be considered are size, form, color, uniformity, and freedom from blemishes. The criteria to be used in the inspection of the



1469. Good exhibition plates of apples.

first three factors are the attributes of a typical normal specimen of the variety when grown under conditions favorable to its development. The largest apple is not necessarily the best; in fact, great size is usually obtained at the expense of some equally desirable factor. The extra-large specimen is always an abnormal specimen and, as such, is not to be sought. It is in regard to this factor, however, that many exhibitors make their first mistake. A safe rule to follow is to choose the specimen combining large size with the highest color. This rule will almost invariably eliminate the abnormally large specimen.

The form of the specimen should be true to the prevailing type of the section in which it grows. Occasionally different sections produce different types, as, for example, the New York and the Oregon-grown Esopus. One is as true to type as the other, but the two types should never be mixed on the same plate or in the same package.

Of all external factors, none exceeds in importance the quality of color. High color always sets up in the mind the presumption of excellence; the higher the color, the more pronounced seems to be the presumption, though it is not always justified. Color is also an indication of fitness, of approaching maturity, but a specimen maturing far in advance of its companions should be regarded with suspicion lest it harbor a worm that may emerge at a most inopportune moment if it escapes detection. Polishing a specimen to enhance its color should not be practised. The operation removes the bloom, which is more beautiful than the high polish because it is natural.

The factor of uniformity implies that one specimen should resemble every other specimen as nearly as it is possible for the human eye and hand to make it. It is a literal application of the expression "as nearly alike as two peas." A single specimen of highest order should not be retained for a moment if its companions are on a more nearly equal though somewhat lower plane of excellence.

Freedom from blemishes implies that the specimen is perfectly sound. A blemish may be anything from a bruise, a broken stem, or a stem puncture to a scale-mark or scab-spot. In an age when knowledge of preventive measures is so widespread and so accessible, evidence of injury from insect or disease should completely exclude a specimen from consideration. Needless to say, the condition of the specimen should be as sound as the season permits, showing neither flabbiness nor physiological disintegration of the tissues.

The factor of quality is also worthy of consideration, though it is of more importance in case of collections in which one variety is exhibited against another than in case of different specimens of the same variety. Granted that size, form, and color are normal, the factor of quality will usually take care of itself.

There is need of a standardization of requirements under which fruit exhibits are held. These requirements should be based on trueness to type and all that the term implies, and the values attached to the different characters concerned should be fixed in proportion to their relative importance for the purpose in hand. Such a statement appears in the following score-card for apples, which is in somewhat common use in the eastern United States:

Size	10
Form	10
Color	20
Uniformity	15
Quality	20
Freedom from blemishes	25
Total	100

This score-card may be no more nearly correct than many others, but it represents a concerted effort to fix a satisfactory standard. There should be more of this work for every fruit.

Score-cards for other fruits have been adopted by particular exhibitions and institutions as the following for grapes:

Form of bunch	10
Size of bunch	15
Size of berry	10
Color	10
Bloom	5
Freedom from blemish	20
Flavor	25
Firmness	5
Total	100

There is need also of a general agreement as to the number of specimens to be exhibited on a single plate. The rules now governing all large exhibitions in the East require that plates of apples, peaches, pears, and quinces shall contain five specimens; of the smaller fruits a sufficient number to fill a 6-inch plate; and of grapes three clusters.

Fruit to be sent away for exhibition should be carefully packed. A bushel box is a satisfactory package for this purpose, being better than a larger package in which the pressure on the fruit is greater. Each specimen should be wrapped, and the box should be well lined with excelsior or other material. Extra specimens should be included to replace those that are injured in any way.

In selecting the room in which the exhibition is to be held and in setting up the fruit, one prime factor should always be kept in mind—there should be nothing in the room to detract in any way attention from the fruit. To this end, the walls should be plain or

even bare. The decorations should be few, simple, and in harmony with the colors of the fruit, that is, substantial and perfectly plain. Red and white make a very effective combination for ceiling decorations, if decorations seem desirable. Plain white is best for draping the tables. If electric lights are present, the shades may be covered with red crepe paper. This will give a quiet and subdued effect to the room when the lights are on and will be in keeping with the other decorations. The tables should be covered with a material that will throw the fruit into sharp relief without attracting attention to the covering itself. Oatmeal paper, gray-green in color, answers these specifications very well. Six- or eight-inch papyrus plates are better than smooth-pressed paper plates or the wooden plates and need no covering.

The fruit should be set up in such a way that a mass effect is produced, which impresses the observer with the fruit and with nothing else. This means that all the fruit must be on the same level. Shelves or tiers one above the other are not desirable. In other words, every detail should be subordinated to bringing out as sharply as possible the fruit that is on exhibition. It is therefore highly undersirable to place labels on the top of a specimen, as is so often done. The observer notes first of all a vast and meaningless sea of tags and after that perhaps the fruit. The label may be pinned into the plate in such a way that it is unnoticeable except on close inspection, when it can be plainly seen. A satisfactory label is a plain white card with three lines on it, the first for the variety name, the second for the name of the exhibitor when permissible, and the third for the section from which the fruit comes. If the exhibit is to attain its highest educational value, the varieties must be correctly named and the names correctly spelled.

In general, it will be better to group varieties together in order that comparisons may be made between the different plates. By so doing an opportunity is afforded for a study of variations of fruits grown under different methods of management and in different sections in which climatic conditions are unlike. Occasionally grouping by sections may be desirable, especially if there are general and marked contrasts between the same varieties as grown in different sections.

The plates should not be crowded on the tables lest the eye become confused and the fruit appear to be a jumble of specimens lacking orderly arrangement. The background of paper covering the table should be visible between every plate, not in order that it may be seen, but because it will serve to set off each plate as a separate unit meriting for the moment undivided attention.

Finally, the specimens should be arranged in the same order on every plate and the plates should be in perfect alignment in every direction. Not only this, but when the angles formed by the specimens on a plate are right angles, as in case of apples with four specimens on the bottom and one on top at the center, the angles should assume the same direction as those of the table top.

The same rules hold for the selection of fruit for barrels, boxes, or other packages as for single plates. The arrangement should be such as to bring out the fruit and subordinate the package, exemplified in the bank of boxed fruit.

C. S. Wilson.

Exhibition of vegetables.

The exhibition of vegetables is usually an important feature at county, district and state fairs, and often at farmers' institutes, horticultural society meetings and conventions of vegetable-growers. Vegetables are also likely to occupy a prominent place in county or state exhibits at state, national or international shows or expositions. The exhibits may be competitive or non-competitive. In the former case they are usually made by the individual producers; in the latter case, they are more often made by a company, development bureau, or an institution, primarily for advertising or educational purposes. In either case, they have some educational value, even the individual exhibitor learning by comparison of his exhibit with others.

Competitive exhibits are of two kinds: (1) those in which the exhibit consists of a specified quantity of a given kind of vegetable, e.g., one dozen table carrots, and (2) those which consist of a collection or display of vegetables alone, or combined with other products of the soil. Vegetables in exhibits that are designed primarily for advertising or educational purposes usually form only a part of some general exhibit.

In making exhibits in competition with the products of other exhibitors, the successful competitors are usually those who give most careful attention to the selection, preparation and installation of their exhibits.

In making single exhibits, care should be taken to show the exact quantity or number of specimens mentioned in the entry list. At county fairs, especially, exhibitors are prone to make their "pecks" or "half-pecks" exceedingly small if exhibition material is scarce or time limited. The present tendency is to specify in premium lists the number of specimens, whenever this is feasible, rather than a given bulk, and to disqualify exhibits which do not conform to the requirement in this respect.

In selecting specimens which are to form a single exhibit, very few inexperienced persons appreciate the importance of uniformity in size and type. Sometimes an exhibit will be very creditable with the exception of one or two specimens. These odd specimens may be very good as individuals, but differ much in size or type from the other specimens and detract seriously from the value of the exhibit.

Vegetables on exhibition should be clean. Root crops should usually be washed. Onions are best prepared by careful brushing. Cauliflower and cabbage should be carefully trimmed; tomatoes, eggplant and melons wiped with a moist cloth. Celery, lettuce and endive should be gathered with the roots on, carefully washed, and displayed with the roots immersed in water so that the plants will not wilt.

The arrangement of the specimens in a single exhibit is also important. When the judging is by comparison, only those exhibits which attract the immediate attention of the judge will be likely to receive careful consideration if the number of entries is at all large. Under such conditions it often happens that the arrangement of the specimens is fully as effective in securing careful examination of the exhibit as is the perfection of the specimens themselves. In the case of many kinds of vegetables, if the number of specimens is not over one dozen, the exhibit can often be displayed very advantageously on plates or trays. If one peck or one-half bushel is prescribed, splint baskets are desirable receptacles. In any case, the appearance of the exhibition room will be greatly enhanced if the receptacles used for all the single exhibits are as uniform as the nature of the products will permit. With this end in view, it is desirable that the management furnish the receptacles.

In the exhibitions held by thoroughly established organizations which give special attention to vegetables, there is likely to be a recognized appropriate method of disposing the specimens of each kind of vegetable in or upon a given type of receptacle. At county fairs, each exhibitor usually exercises his own ingenuity both as to type of receptacle and method of arrangement; and the result is at least lacking in monotony. To show at its best, every exhibit should be characterized by neatness and simplicity in arrangement.

The principles involved in making a general display

including a number of different kinds of vegetables are much the same as for making individual exhibits: the specimens must be selected with care, thoroughly cleaned, and attractively arranged. In addition, the character and arrangement of the exhibit as a whole must be given careful attention. Very often, general displays fail in effectiveness because the number of specimens of each kind is too limited or the different specimens of the same kind are too much scattered through the exhibit, instead of being massed so that they would make an impression upon the spectator. Exhibitors are likewise inclined to weaken the character of an exhibit by introducing a few specimens each of numerous species or varieties that are little known or of small commercial importance. These are often scattered promiscuously through the exhibit and detract the attention from the main features. The general effect of the exhibit as a whole is of prime importance.

Non-competitive exhibits of vegetables for advertising or educational purposes are usually confined to a comparatively few species or varieties in a given exhibit. In exhibits made for advertising some particular section or locality, the vegetables are likely to be merely a minor part of a general exhibit, and to consist of specimens likely to attract attention by reason of their unusual size rather than any other noteworthy feature.

Certain kinds of vegetables lend themselves readily to the making of purely educational exhibits to illustrate the influence of differences in soil treatment or cultural methods or the results of treatment for plant diseases. In such exhibits, it is unwise to attempt to illustrate the results of many different treatments in one exhibit. It is much better to concentrate the attention of the spectator upon one or two striking results than to try to demonstrate a number of minor variations. If the latter method is attempted, the effectiveness of the display will be destroyed; for the passing observer recognizes only striking contrasts. For example, if a number of different fertilizer treatments have been employed, and all give marked results as compared with the check (the unfertilized plat), it would be unwise in an educational exhibit to attempt to illustrate the proportionate yields from all the treatments. Only the yields of the check plat and one or two others should be given. The casual observer can see three things at a glance, but not a dozen.

In making an educational exhibit to represent differences in yields, the quantities shown should represent yields from definite areas of ground, such as one-hundredth or one-thousandth of an acre; and the specimens should be arranged in such a way that the differences will be most apparent.

In arranging an exhibit to illustrate the results of treatment for plant diseases, e.g., treatment of seed potatoes for the control of scab, it is better to sort the specimens from each plat into "diseased" and "sound," and to display them in two contiguous piles, than to mix the diseased and sound promiscuously in the same pile.

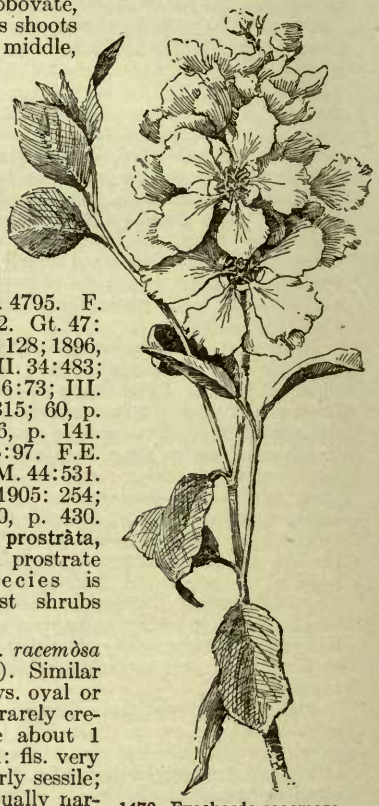
The educational value of all exhibits, whether competitive or non-competitive, is greatly enhanced if careful attention is given to the proper labeling of the various parts or features of each exhibit. Conspicuous legends of a concise nature are of some benefit to even the casual observer, and are greatly appreciated by the few who are specially interested in the particular exhibit or the matter it is designed to illustrate. JOHN W. LLOYD.

EXÓCHORDA (from *exo*, external, and *chorde*, a cord, referring to the chord belonging to the external part of the placenta on the ventral side of the carpels). *Rosàceæ*. PEARL-BUSH. Ornamental shrubs grown chiefly for the showy racemes of pure white flowers.

Deciduous: winter-buds conspicuous, with imbricate scales: lvs. alternate, petioled, entire or serrate: fls. in terminal racemes, polygamo-diœcious; calyx-tube broadly turbinate; calyx-lobes and petals 5; stamens 15–25, at the margin of a large disk, short; carpels 5, connate; styles distinct: fr. a 5-angled, deeply furrowed caps., separating into 5 bony, 1–2-seeded carpels; seeds winged.—Three species in China and Turkestan.

The pearl-bushes are slender-branched shrubs with rather thin bright green foliage and very showy white flowers. *E. Korolkowii* is hardy North. *E. racemosa* and *E. Giraldii* are at least hardy as far north as Massachusetts. They grow best in a well-drained loamy soil and in a sunny position. Propagation is by seeds, or by softwood cuttings taken from forced plants; taken in summer from the open they root slowly and with difficulty; also by layering.

racemòsa, Rehd. (*E. grandiflòra*, Lindl. *Amelánchier racemòsa*, Lindl.). Fig. 1470. Slender spreading shrub, to 10, rarely to 15 ft., glabrous: lvs. elliptic to elliptic-oblong or oblong-obovate, entire or on vigorous shoots serrate above the middle, 1½–2½ in. long, whitish below; petioles about ½in. long: racemes 6–10-fld.; fls. 2 in. across, pure white, short-stalked; petals roundish, clawed; stamens 15: fr. turbinate, about ½in. long. April, May. China. B.M. 4795. F. S. 9:954. L.I. 11–12. Gt. 47: 1455. R.H. 1889, p. 128; 1896, pp. 324, 325. J.H. III. 34:483; 53:285. G.C. II. 16:73; III. 7:613. Gn. 58, p. 315; 60, p. 232; 62, p. 161; 66, p. 141. A.F. 6:643. Gng. 5:97. F.E. 30:117; 31:971. G.M. 44:531. M.D.G. 1901:321; 1905: 254; 1906:561. G.W. 10, p. 430. H.F. 1867:250. Var. **prostràta**, Hort. A form with prostrate branches.—The species is among the showiest shrubs blooming in May.



1470. Exochorda racemosa. (×⅛)

Giràldii, Hesse (*E. racemòsa* var. *Giràldii*, Rehd.). Similar to the preceding: lvs. oval or elliptic, entire, very rarely crenate-serrate; petiole about 1 in. long, usually red: fls. very short-stalked or nearly sessile; petals obovate, gradually narrowed into the claw, sometimes toothed; stamens 25–30. N. W. China. M.D.G. 1909:295. G.W. 16, p. 450. Var. **Wilsonii**, Rehd. (*E. racemòsa* var. *Wilsonii*, Rehd.). Lvs. elliptic to oblong, occasionally serrate; petioles ½–¾ in. long, usually green: stamens 20–25. Cent. China.

Korolkôwii, Lav. (*E. Âlbertii*, Regel. *E. grandiflòra* var. *Âlbertii*, Aschers. & Graebn.). Upright, slender-branched shrub, to 12 ft., glabrous: lvs. oblong, to oblong-oblanceolate, obtuse or acute, gradually narrowed toward the base, entire, but the lvs. of the stronger shoots often serrate above the middle and at the base with 1 or few small narrow lobes, 1½–2½ in. long: racemes 5–8-fld.; fls. 1½ in. across; petals narrowly obovate; stamens 25: caps. ¾in. long, ovoid, pointed. April, May. Turkestan. G.W. 16, p. 451. G. 31:505.—This is one of the earliest shrubs to burst into leaf in spring; it is of more upright habit and with

darker and denser foliage than the preceding, but not so floriferous.

macrántha, Lemoine (*E. racemòsa* × *E. Korolkówii*). Similar to *E. racemosa,* but of more upright habit and more vigorous: lvs. generally obovate or oblong-obovate, bright green, entire on vigorous shoots crenate, 2–3 in. long: racemes 8–10-fld.; fls. 1¾–2 in. broad; petals obovate, narrowed into the claw; stamens about 20. April, May. Of garden origin. R.H. 1903, pp. 18, 64. M.D.G. 1902:484. G.W. 16:449.

ALFRED REHDER.

EXOGÒNIUM: *Ipomœa.*

EXORRHÌZA (*exo,* out, outside, *rhiza,* root; alluding to the large aërial roots above the ground). *Palmàceæ,* tribe *Cocoíneæ.* High-growing pinnate-leaved palm.

Stem or trunk straight, smooth, supported at the base by large aërial, spiny roots: lvs. large, pinnate. Allied to Kentia, but distinguished by the imbricate sepals of the staminate fls., the elongated subulate filaments of the stamens, by the roundish ovate sepals of the pistillate fls. and by the parietal ovule. In Kentia the ovule is basal and erect. Cult. as in Kentia. The following species flowered at Kew in 1901.

Wendlandiàna, Becc. (*Kéntia Exorrhìza,* Wendl.). Often more than 60 ft. high but in cult. reaching only 24 ft.: lvs. 10–12 ft. long; pinnæ alternately arranged, 1–2 in. from each other, becoming 4 ft. long and 2 in. broad, 8–10-nerved: spadix appearing below the lvs., enveloped in thick, coriaceous boat-shaped spathes; spadices 2, much longer than the spathes. Fiji Isls. B.M. 7797.

N. TAYLOR.†

EXOSTÉMMA (name alludes to the exserted stamens). *Rubiàceæ.* Evergreen trees and shrubs of W. Indies and other parts of Trop. Amer., by some united with Rustia. There are upwards of 20 species. They are little known as warmhouse subjects, and the name does not appear in the trade. It is probable that the general treatment given Cinchona and similar things will apply to them. Lvs. opposite: fls. white, various in size and arrangement; corolla salver-form, the lobes 5 and spreading and narrow; stamens 5, inserted in the bottom of the corolla-tube, long-exserted; disk annular: fr. an oblong, cylindrical or club-shaped 2-valved caps. The fls. are commonly axillary or in terminal corymbs.

EXPERIMENT STATIONS. Every state of the Union, every island dependency of the United States, and every province of the Dominion of Canada has one experiment station for agriculture supported by public funds. A very few of the states have two stations, one being the regular federal agency in the state and the other being usually an institution established and maintained directly by the state and representing the movement that began before the passage of the federal experiment station act.

By the middle of the last century, the discussion for institutions or agencies to make experiments in agriculture was well under way. It was not till 1875, however, that any legislative body made an appropriation for the establishing of such an institution. This was in Connecticut. Other stations followed in several states, some of them under direct legislative enactment and others being organizations within colleges or college departments of agriculture. These movements were marked in North Carolina, New York, New Jersey, Ohio, Massachusetts, and other states. The movement in the United States for a national system of experiment stations took form in a bill for the purpose introduced into Congress in 1882 by Hon. C. C. Carpenter of Iowa. The bill finally to become a law was introduced in the House of Representatives by Hon. William H. Hatch of Missouri; this became law March 2, 1887, by the signature of President Cleveland. It appropriates $15,000 to each state for the purpose of establishing an agricultural experiment station, to be located at the land-grant college unless the state shall determine otherwise.

A second act, supplementing the Hatch Act, was approved March 16, 1906, by President Roosevelt, it having been introduced and carried to passage by Hon. Henry C. Adams, of Wisconsin. This appropriates $15,000 to each state "for the more complete endowment and maintenance" of the stations, with the understanding and requirement that it shall support fundamental researches. About $1,500,000 is therefore expended annually by the federal government for the maintenance of experiment stations in the forty-eight states, aside from similar grants for stations in Porto Rico and Hawaii, expenditures in the Philippines through the War Department, and in Alaska and Guam directly through the United States Department of Agriculture; and there is also a large and important expenditure in the Department of Agriculture itself, both for supervision and for investigation. The states also contribute heavily to the experiment station work. The total revenue in the United States for the year ended June 30, 1912 was $4,068,240.09.

By law, reports are to be issued at least quarterly by the different experiment stations. These institutions are now issuing numerous bulletins, circulars and reports on an astonishing range of subjects and of the greatest importance to the people. The publications of the United States Department of Agriculture are very extensive and of the highest technical and general value.

In Canada, the experiment station movement was practically parallel with that in the United States. The Act for a dominion system was passed in 1886. One central station, or "central experimental farm," was established at Ottawa, and the stations in the provinces are branches of it and under the administration of its director. The grant of Parliament for the year 1913–1914 for the maintenance of the system of experimental farms was $900,000.

In both the United States and Canada, horticulture is one of the important subjects of experiment and research. Usually this work is in charge of a separate officer, commonly known as a "horticulturist;" and the number of associates and helpers may be several or many. The extent of horticultural research is now large and it is rapidly increasing. Persons desiring to be in touch with this work should apply to the experiment station in the state or province or to the national department; and a list of these institutions is given below. For further history and discussion of Experiment Stations in the two countries, see pp. 422–430, Vol. IV, Cyclo. Amer. Agric.

In the United States the address of the experiment station and of the college of agriculture is usually the same post-office. In New York, there is a state station at Geneva as well as the federal station and college at Ithaca; in Ohio, the experiment station is at Wooster, and the college is part of the State University at Columbus; in Georgia, the station is at Experiment and the college at Athens, in the University; in Connecticut, the federal station is at New Haven, and the college at Storrs; in other states the post-offices of the two are the same.

Canada.

The Dominion or headquarters institution is the Central Experimental Farm, Ottawa, Ontario.

Alberta.
Experimental Station, Lacombe.
Experimental Station, Lethbridge.

British Columbia.
Experimental Farm, Agassiz.
Experiment Stations, at Invermere, and at Sidney on Vancouver Island.

Manitoba.
Experimental Farm, Brandon.

New Brunswick.
Experimental Station, Fredericton.

Nova Scotia.
Experimental Farms, Nappan, Kentville.

Ontario.
Central Experimental Farm, Ottawa.

Prince Edward Island.
Experimental Station, Charlottetown.

Quebec.
Experimental Stations, Cap Rouge, Ste. Anne de la Pocatiere, Lennoxville.

Saskatchewan.
Experimental Farm, Indian Head.
Experimental Stations, Rosthern and Scott.

United States.

United States Department of Agriculture, Washington, D. C.

Alabama.
Agricultural Experiment Station of the Alabama Polytechnic Institute, Auburn.
Canebrake Agricultural Experiment Station, Uniontown.
Tuskegee Agricultural Experiment Station, Tuskegee Institute.

Alaska.
Alaska Agricultural Experiment Stations, Sitka, Kodiak, Rampart, and Fairbanks.

Arizona.
Agricultural Experiment Station of the University of Arizona, Tucson.

Arkansas.
Arkansas Agricultural Experiment Station, Fayetteville.

California.
Agricultural Experiment Station of the University of California, Berkeley.

Colorado.
Agricultural Experiment Station, Fort Collins.

Connecticut.
The Connecticut Agricultural Experiment Station, New Haven.
Storrs Agricultural Experiment Station, Storrs.

Delaware.
The Delaware College Agricultural Experiment Station, Newark.

Florida.
Agricultural Experiment Station of Florida, Gainesville.

Georgia.
Georgia Experiment Station, Experiment.

Guam.
Guam Agricultural Experiment Station, Island of Guam (address Island of Guam, via San Francisco).

Hawaii.
Hawaii Agricultural Experiment Station, Honolulu.
Hawaii Sugar Planters' Experiment Station, Honolulu.

Idaho.
Agricultural Experiment Station of the University of Idaho, Moscow.

Illinois.
Agricultural Experiment Station of the University of Illinois, Urbana.

Indiana.
Agricultural Experiment Station of Indiana, La Fayette.

Iowa.
Iowa Agricultural Experiment Station, Ames.

Kansas.
Kansas Agricultural Experiment Station, Manhattan.

Kentucky.
Kentucky Agricultural Experiment Station, Lexington.

Louisiana.
State Experiment Station, Baton Rouge.
North Louisiana Experiment Station, Calhoun.
Rice Experiment Station, Crowley.
Sugar Experiment Station, Audubon Park, New Orleans.

Maine.
Maine Agricultural Experiment Station, Orono.

Maryland.
Maryland Agricultural Experiment Station, College Park.

Massachusetts.
Massachusetts Agricultural Experiment Station, Amherst.

Michigan.
Experiment Station of Michigan Agricultural College, East Lansing.

Minnesota.
Agricultural Experiment Station of the University of Minnesota, University Farm, St. Paul.

Mississippi.
Mississippi Agricultural Experiment Station, Agricultural College.
McNeill Branch Experiment Station, McNeill.
Delta Branch Experiment Station, Stoneville.
Holly Springs Branch Experiment Station, Holly Springs.

Missouri.
Missouri Agricultural College Experiment Station, Columbia.
Missouri State Fruit Experiment Station, Mountain Grove.

Montana.
Montana Agricultural Experiment Station, Bozeman.

Nebraska.
Agricultural Experiment Station of Nebraska, Lincoln.

Nevada.
Nevada Agricultural Experiment Station, Reno.

New Hampshire.
New Hampshire College Agricultural Experiment Station, Durham.

New Jersey.
New Jersey Agricultural College Experiment Station, New Brunswick.
New Jersey State Agricultural Experiment Station, New Brunswick.

New Mexico.
Agricultural Experiment Station of New Mexico, State College.

New York.
New York Agricultural Experiment Station, Geneva.
Cornell University Agricultural Experiment Station, Ithaca.

North Carolina.
North Carolina Agricultural Experiment Station, West Raleigh.
Agricultural Experiment Station of the North Carolina State Department of Agriculture, Raleigh.

North Dakota.
North Dakota Agricultural Experiment Station, Agricultural College.

Ohio.
Ohio Agricultural Experiment Station, Wooster.
Oklahoma.
Oklahoma Agricultural Experiment Station, Stillwater.
Oregon.
Oregon Experiment Station, Corvallis.
Pennsylvania.
The Pennsylvania State College Agricultural Experiment Station, State College.
Philippine Islands.
Lamao Experiment Station, Lamao, Bataan.
Porto Rico.
Porto Rico Agricultural Experiment Station, Mayaguez.
Porto Rico Sugar Producers' Experiment Station, Rio Piedras.
Rhode Island.
Agricultural Experiment Station of the Rhode Island State College, Kingston.
South Carolina.
South Carolina Agricultural Experiment Station, Clemson College.
South Dakota.
South Dakota Agricultural Experiment Station, Brookings.
Tennessee.
Tennessee Agricultural Experiment Station, Knoxville.
Texas.
Texas Agricultural Experiment Station, College Station.
Utah.
Agricultural Experiment Station, Logan.
Vermont.
Vermont Agricultural Experiment Station, Burlington.
Virginia.
Virginia Agricultural Experiment Station, Blacksburg.
Virginia Truck Experiment Station, Norfolk.
Washington.
Washington Agricultural Experiment Station, Pullman.
West Virginia.
West Virginia Agricultural Experiment Station, Morgantown.
Wisconsin.
Agricultural Experiment Station of the University of Wisconsin, Madison.
Wyoming.
Wyoming Agricultural Experiment Station, Laramie.

Research in horticulture. (U. P. Hedrick.)

For the purposes of this discussion we need not concern ourselves with formal definitions of horticulture nor discuss its several divisions. (For definitions, see *Horticulture.*) It is more to the point to indicate the nature of the research problems to be solved in the several loosely correlated industries of which horticulture is composed. Experimenters in horticulture may investigate the phenomena of science, the mechanical methods of an art, and latterly they have come to have much to do with business affairs. What should be the relative status of science, art and business in research work in this branch of agriculture?

Horticulture is a "no man's land" in science. Botanists, chemists, entomologists, bacteriologists and geneticists, join in solving its problems. First one science and then another lets in its light and illuminates an obscure nook. Thus, systematic botany, in the classification of orchard and garden plants, began the construction of rational horticulture; then came chemistry to furnish knowledge of soils and fertilizers; botany and entomology brought aid in combating innumerable pests. When, however, a discovery is made in any science men are drawn to it as moths to a light, and botany and entomology, which have recently been most prominent, are now giving way in horticulture to genetics and the sciences having to do with the soil, discovery and activity being greatest in these fields. Thus, there is no science of horticulture, but there is science in horticulture. The science field, also, is as open to horticulturists as to experimenters in the sciences that form the foundation of horticulture.

The application of science is art. The botanist and entomologist discover the life-history of insects and fungi; the control of the pests, by means of spraying or otherwise, is an art. The discovery of the laws that govern soil-moisture and soil-heat is a field for the scientist; the art of tillage is or should be founded on the science of soil physics. A widely different phase of physics comes into action when the mechanical engineer is asked to help solve the problems of cooling, storing and transporting horticultural products. The manipulation of plants in propagating, grafting and training is an art based on plant physiology. Thus, research work in horticulture partakes of the "practical;" indeed, applicability usually must be a paramount consideration in investigations in this field. Much that is called "pure science" is helpful in horticulture, but the horticulturist is chiefly concerned with applied science.

So, also, there are inter-relations between business, science and art in horticulture. A prevalent phase of experimentation is the determination of the cost of the unit—the barrel of apples, for example—of agricultural products; other business experiments seek to determine the outgo and the income of the orchard and garden; still others consider the relative profits of two crops in certain soils or other environmental conditions. These problems are largely studies of business methods and are not true research subjects, but one can conceive of scientific investigations in the business affairs of horticulture and certainly science and business come into close touch in this industry.

The distinctions that have been made are not clearly defined in the activities of horticulturists. Too often men supposed to be engaged in research work in horticultural science are busy with the art—very often not in discovery or invention in art but simply with the details of well-established art. Much that is put out as the result of research work is a description or a discussion of the technic of horticulture. A study of business methods, pure and simple, is frequently offered as the results of research. These isolated observations on the art and business of horticulture, having no relation to either pure or applied science, ephemeral and of but limited application, bear but poorly the brand of investigation. Data in the art and business of horticulture, to be worth the while of the true research worker, must be a part of the coördinated and classified knowledge of horticulture, must be of more or less universal application, and must deal more or less directly with scientific principles. Investigating is not teaching, nor demonstrating, nor observing, nor describing, nor proving, unless primarily behind any of these is the design to discover laws.

On the other hand, much that passes as scientific investigation turns out to be theory made attractive by the rouge of speculation; or it is controversy for controversy's sake; not infrequently the offering of science is an old garment made over in a new style; or it is a small truth much adorned; sometimes the scientific offering but heralds a discovery which never appears. Pseudo-research is by no means confined to the practical phases of horticulture.

The writer does not overlook the body of good work being turned out by the American experimenters in horticultural lines, but this is not the subject of the present discussion.

The training of research workers.

The diverse character of experimentation in horticulture as set forth indicates somewhat the training that investigators in this field should have. It follows from the importance attached to science in horticulture, that thorough training in the sciences is imperative, but the distinctions here made indicate just as clearly that a person trained in the sciences and not in the art and business of horticulture is sadly handicapped. We may put down as the first essential in the mental equipment of the research worker, a broad and severe scientific training. The second essential is, perfect familiarity with garden, orchard and greenhouse plants and methods of handling their products. It is not sufficient that the horticultural experimenter know but the industry in which he may specialize. Knowledge of what is done in the greenhouse, for example, is indispensable to the experimenter with fruits, offering him suggestions at every turn. Whatever knowledge a man may possess of the needs and care of plants in any field of agriculture will be helpful in a specialized field. Perhaps the ability to correlate science and art should be put down as a third essential.

But at present chief emphasis must be laid on the scientific training. The art of horticulture is sufficiently well taught in agricultural colleges, and the money-earning value of an education is in most institutions over-emphasized. The atmosphere of practicums and money-making which prevails in most of our colleges is not one in which investigators are born and bred. Instead, for the proper training of a horticulturist there should be an atmosphere of investigation for investigation's sake, of sound learning, of appreciation of science not only in its applications but as pure science and for its disciplinary value. It is desirable, almost imperative, that one training to become a horticulturist should take a post-graduate course in which special attention may be devoted to the sciences and the problems of horticulture.

Equipment for research.

Less need be said about the material equipment for horticultural research than the mental make-up of the worker. The nation and the states have been free in the expenditure of money for experimental work. Not a few horticultural departments in the experiment stations of the country are over-equipped with land, buildings and laboratories—the things that money can buy. Certain it is that the output from the institutions conducting research is not in proportion to the money spent or to the number of men on the staff. The fact that equipment and materials do not create, needs emphasis everywhere in horticultural experimentation. The custom of obtaining money to build up a department without specific work to be done is a vicious one from which there must in time be a reaction. Opportunity, equipment and problem should go together, and all these are valueless without a man with initiative, ideas, and training to use them. There are probably more over-equipped departments in horticulture than under-equipped ones. Large experimenting is sometimes small experimenting and small experimenting large experimenting.

In one particular, however, the horticultural departments of the country are sadly under-equipped. There are no comprehensive plantations of economic plants in the experiment stations of the United States. The amelioration of plants is the chief work in horticulture and it would seem that the establishment of economic gardens is imperative, since material to be used advantageously must be near at hand. At least one station in every distinct agricultural region in the country should have an economic garden where may be found the food plants of the world suitable for the region. This should be an agricultural garden, not a plant museum to show the curious and the ornamental; in it agriculture must be dominant, not recessive.

Organization for research.

Horticulture is composed of so many industries and involves so many sciences that its problems are too diverse and too complex to permit of many definite statements in regard to organization for research. But several generalities may be set down as essentials to a good organization: (1) There must be a man in command—a broadly trained man. (2) The position of the experimenter should be permanent, subject only to efficiency. (3) The time and thought of the investigator must not be taken up with other activities, as administration, teaching, extension work and the like. (4) The organization must be permanent, to give continuity, coherence and exhaustiveness to the work. (5) The organization should usually correspond with the subdivisions of horticulture rather than the sciences upon which it is founded. That is, there should be pomologists, gardeners and florists, rather than botanists, chemists and entomologists. (6) Money and effort should be concentrated upon a few comprehensive problems that can be exhaustively carried to sound conclusions. Too many experiments are but fragments of a larger problem; discovered to be such, they are often discarded after waste of time and money.

The third of the essentials just given needs amplification. The greatest deterrent to good work in experimentation is the association of research with teaching either in the classroom or from the institute platform. So much of the time and energy of men having these dual-purpose positions is taken by the more present, and therefore more pressing, work of teaching that they are often investigators only in name. In every institution where teaching and investigating are combined, the demand is naturally strongest from students, and investigation suffers. There are, it is true, advantages in the combined position of teacher and investigator, but few indeed are the cases in which the disadvantages do not outweigh them and always the research work suffers.

There should be coöperation between the horticultural experimenters in the several states and the United States Department of Agriculture. A most pathetic spectacle in our agricultural institutions is that of isolated men attacking one and the same problem, duplicating results, often duplicating errors and in either case wasting public funds. So far as possible there should not be overlapping of experimental work, unless duplication is desirable to make more certain the results. In the latter case the work should be jointly planned and from time to time compared and adjusted to secure efficiency and economy. The Society for Horticultural Science is an excellent clearing-house in which the official horticultural experimenters in North America may interchange ideas and adjust their work.

Theories in horticulture are so general, facts so numerous, evidence of one kind or another so easily adduced, that the temptation is strong to state a theory, supply facts from the many already known, adorn the work with a dash of personally collected evidence and call the result an experiment. Such work lacks coherence and is incomplete. Few, indeed, are the horticultural investigators who make their work invincible by exhaustiveness. Again, the urgent call for results has led to the study of problems admitting of hurried conclusions rather than those that are fundamental, and for this reason much work is unfinished and inconclusive. The superb exhaustiveness of Darwin's work, much of it horticultural experimentation, should furnish inspiration and method to investigators in this

field of agriculture in particular. All call to mind that the "Origin of Species" is but a short statement of the theory of evolution which is then shown to be an impregnable fact by a vast amount of evidence over which Darwin labored for twenty years, biding time until his views reached full maturity. There is every temptation to publish prematurely, but permanent work is that which is completely worked out. Besides, given time, investigation is easier, material coming of itself which, under speed, would have required travail of mind to bring forth.

The immediate field.

In conclusion it may be well to state, as a record of the times, and for possible suggestive value, some of the present problems of horticulture.

Experimentation is needed in the oldest of horticultural operations—pruning. It must be approached through physiological botany. We know next to nothing about the feeding of plants and the influences of the food elements on plant-products—current methods of fertilizing are largely arbitrary. Many questions having to do with sex are before us. There is need of more precise knowledge about bud-formation and the setting and dropping of fruits. There is yet much to be done in the classification and description of horticultural plants. More than elsewhere in agriculture, horticultural plants are inter-planted as in catch-crops, cover-crops and in crop-rotation; the inter-relationships of plants and the effects of crop residues, therefore, must be studied. Greater knowledge of the associations of plants would throw new light on the relations of climates and soils to plant-growing—plant ecology. We have not yet reached the limit of improvement in any cultivated species and plant-breeding must be given attention. The relationships of parasites and hosts involving the whole matter of predisposition, resistance and immunity offer a series of problems. The good and bad effects of sprays, quite aside from their insecticidal or fungicidal functions, are worthy of study. Much has been written but very little is really known about the reciprocal influences of stock and graft. The whole matter of stocks needs experimental attention, fruit-growers in particular having little to guide them in the choice of stocks for the several fruits. We know that cultivated plants vary greatly: are any of the variations heritable or do they appear and disappear with the individual? A study of the last problem would bring one to a much-needed investigation of mutations. Acclimatization deserves consideration. There yet remain many native plants worthy of domestication. Forcing of plants brings up many problems; as, the influence of heated soils and atmospheres, soil sterilization, artificial lights in place of sunlight, the use of electricity in forcing growth and the physiological disturbances of the plant brought about by the changed environment. Lastly, those who ship and store horticultural products are calling for experimental aid to solve their many problems.

EXTENSION TEACHING IN HORTICULTURE. Extension work is the effort made by an institution of higher learning to carry outside its own walls and directly to the people, any form of helpful educational influence. A state university, or institution that derives financial support from the state, may legitimately be called upon to give instruction to the people who cannot attend its courses, if means are provided for the performance of this office. Such an institution no longer fulfils its complete function when it confines itself to teaching students who come to it and to the investigation of problems within its laboratories. A strong college of arts and science, necessarily the center of the great university of today, may extend its educational ideals and its higher educational functions to the people of the state as well as to the students who reside within it. The professional schools of law, medicine, education, engineering, journalism, agriculture and others (articulated with the college of arts and science, to make up the university) are each investigating the problems of their respective fields and gathering information that may be carried to the people of the state, through organized extension work. More and more the people are coming to depend upon this information as a basis for better enactment, better municipal functions, better sanitation, better regulations as to health, better civic improvement of all phases, and last, but not least, better agriculture, better roads, and a higher plane of country life.

Extension work in horticulture is that phase of organized extension activity that has to do with better production, better handling and better marketing of horticultural products and the higher efforts of living to which this work contributes.

Horticultural extension is conducted by means of private letters, lectures, publications, correspondence courses, demonstration schools, demonstration experiments, and the like.

Private correspondence.—Every fruit-grower, gardener, florist or other horticultural worker may encounter special problems upon which he needs individual advice. The horticultural department in any of our leading colleges of agriculture is called upon to answer thousands of letters of inquiry every year. Each of these inquiries is referred to the member of the horticultural staff best qualified to handle it. Many of these inquiries entail special letters. Some of them may be more fully answered by sending circulars or bulletins.

Publications.—Departments of horticulture disseminate much information through bulletins, circulars of information and press notices. These bulletins are the published results of the investigation of special problems by the members of the horticultural staff. Circulars of information are more popular treatises of horticultural subjects of interest in the state, and pertaining to which the department has gathered information of interest. Press notices are usually timely topics or seasonal advice furnished the press of the state to publish at the opportune time for their readers. If an insect or disease appears suddenly and promises to become widespread, due to unusual conditions, it often may be checked by prompt action. Unusual weather conditions may sometimes call for unusual methods of management of plants or of crops.

The publication may take the form of an organized reading-course effort without assuming to construct and conduct correspondence courses.

Extension lectures.—Hundreds of lectures on horticultural topics are given by members of the horticultural staff, at schools, teachers' meetings, civic improvement societies, commercial club meetings, nurserymen's conventions, canners' associations, fruit-growers' organizations, florists' clubs, and other gatherings. In this way something of the work of the Department may be carried to every organized body in the state which is interested in a phase of horticulture.

Surveys.—That the department of horticulture may be of special service to a horticultural center, or special horticultural industry, a careful survey of the horticultural conditions as they exist may be desirable. Such a survey may determine what varieties are proving most profitable, which of the prevailing methods of management are yielding the most satisfactory results, what are the difficult problems that need investigation and what are the reasons for successes or failures. The average result may throw much light upon what is already proving best in the neighborhood. A question that is vexing the average grower may have been answered by the work of the best growers, whose results show the answer to the question. As an example of the plan and possibilities of such surveys may

be mentioned the orchard survey of some of the leading apple-growing counties of New York. A measure of the commercial value of spraying is secured by statistical results from sprayed and unsprayed orchards. The commercial value of orchard tillage as compared with orchards growing in sod is shown by the returns from each class of orchard. The best methods of greenhouse construction and management for particular crops may be determined and explained in the same way.

Extension schools.—In many states, extension schools of horticulture are held for the purpose of carrying special horticultural instruction to a neighborhood. Such schools often consist of lectures and demonstrations in a subject of immediate interest. For example, just previous to harvesting a fruit crop a school in fruit-packing may be held. The methods and advantages of proper packing are presented by means of lectures. This is followed by practical laboratory periods in which those in attendance learn to do the work of proper packing. In a similar way, pruning, spraying and other phases of fruit-production are being taught in brief periods of one or two days or a week, the time varying with the needs of the community and the character of the subject taught; or situations with vegetable-growers and florists may be met.

Correspondence courses.—Some schools teach courses in horticulture by correspondence. Certain subjects are capable of being taught in this way. Outlines for the lessons are mailed to the student. Prescribed reading is required and directions for observations and original work and study of plants are formulated. Examinations usually consist of written reports made by the student, embodying a statement of the results secured by him. These reports usually show whether or not the student has grasped the subject and wherein he may need further suggestions and study.

Boys' and girls' clubs.—A movement that is destined to have a very profound influence is the organization of boys' and girls' clubs for the study of subjects relating to horticulture. Often this club work takes the form of contests in gardening or in the production of some special garden crop, such as tomatoes. Organization is best effected through coöperation with the schools or somebody that can direct the work of each local club. Printed sheets are mailed the club members, from time to time, giving instruction in the details of the work and the conditions governing the contest. Prizes are usually awarded at the local contests and sometimes the prize-winners compete in a state contest.

Coöperative demonstrations and experiments.—A very efficient means of promoting the productive growth of any horticultural interest is by means of coöperative demonstrations conducted on the grounds of some energetic grower, whose conditions fairly represent the neighborhood. The ground may be leased by the institution or offered by the local grower. Experiments are carefully outlined to test some problem of interest, such as spraying, comparison of methods of pruning or of cultivation or planting, the use of fertilizers, determination of the merits of particular flowers or vegetables, or other question which the community needs to have worked out. A representative of the horticultural staff visits the grounds as often as is necessary to oversee proper conduct of the work and to record the results of the experiment. Whenever results are secured that are of benefit to the growers, a meeting is held for the purpose of explaining and observing these results and demonstrating the methods for the benefit of those who may profit by adopting them. This form of extension affords the means not only of presenting to the grower facts and methods already known, but it also works new problems out for the neighborhood by securing results that are adapted to their special local requirement. It makes the work convincing; the growers themselves have a hand in it and feel that it is their own; they grow into an understanding of it as the work grows; it gives a new pride and a new power in working for superior methods. While this is perhaps the most productive form of extension work, its scope is, of course, necessarily limited by the fact that working force and funds are not available for handling more than a limited number of the pressing problems in a state at one time.

General considerations.—Incidentally there are other ways by which extension work may be accomplished. Enough already has been accomplished to show that organized extension work has a large and increasing influence upon the horticulture of a state.

Like any other great movement in behalf of human progress, the measure of success of extension work in horticulture depends largely on its proper organization. It offers a multitude of opportunities for work that the world needs to have done. As indicated above, the work is approached in numerous ways. Unless properly organized there is danger of scattered effort, duplication, and failure to follow up results so as to give stability and permanence. It should be a factor in the organized extension work of the entire institution of which it is a part. The question then arises as to whether the work should be undertaken by a separate corps of workers, especially trained for the purpose, and acting under the direction of an extension department head, or whether, since it relates to a special professional field, it should be carried by the officers of the department of horticulture in the college and experiment station. To the writer, the latter seems to be the more rational arrangement. It is no doubt true that if a corps of men do extension work exclusively, with no definitely organized relation to college teaching and experiment station investigation, there will be a tendency to lose touch with higher educational ideals and failure to take to the people the stimulus of productive investigation and the last word in scientific advancement. Undoubtedly there is a tendency, especially on the part of younger men who have the faculty of appealing to the popular audience, to become satisfied with the plaudits of the multitude, and to strive only to enthuse and amuse, unless they are closely connected with college and station work. While one function of extension work may be to inspire and exhort, the day has passed when that alone is sufficient. The commercial horticulturist has reached a plane of development when he needs definite helpful instruction. Attractive letters and lectures are no longer sufficient. He needs, in addition, so far as it is possible to supply it, definite demonstrations of how to do his work according to the most approved methods. The men most closely in touch with strong college teaching and station investigation should be the best fitted to supply this need.

Furthermore, the college teacher or investigator equally needs intimate contact with the commercial grower and his problems. His problems are the problems of the teacher and the investigator. The above conclusions do not dispute the fact that an individual may have especial talent and taste for extension work and lack the plodding patience to make a strong investigator. He may largely devote his time to extension if only the organization keeps him closely linked with college and station men. On the other hand, a productive investigator may not best succeed as a popular lecturer and may give most of his time to investigation. His help may be indispensable in solving some of the difficult problems that arise in the field of extension. The organization of the individuals doing college and station work, ought to afford that union of relationship that will enable the director of extension to call the department of horticulture to his aid. The organization within the department should be best able to supply this need by calling upon the individual best fitted to meet the specific demand.

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