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CONTENTS

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ERRATA

(Gard. Bull. Sing. 33:2)

Contents page	Title 1 : 'genus' reads 'Genus' '*pyrenaria*' reads '*Pyrenaria*'
	Title 2 : '*Longipes*' reads '*longipes*'
	Title 6 : '(Melastomatacea)' reads '(Melastomataceae)'
Page	
264	1st paragraph, line 1 : 'describe' reads 'described'
264	3rd paragraph, line 1 : 'is' reads 'was', 'are' reads 'were'
265	2nd paragraph, last line : 'andd' reads 'and'
266	line 6 : delete 'of' after 'part'
276	line 2 from the bottom : comma to be replaced by semi-colon
277	line 3 : insert 'he' before 'intensively'
289	line 1 : delete 'that'
289	line 8 : 'is' before 'a' reads 'as'
292, 294, 296	top line : '*Longipes* Mass' reads '*longipes* Mass.'
295	6th paragraph, line 4 : 'fiugre' reads 'figure'
296	under Reference, line 7 : 'Bulb.' reads 'Bull.'
298	1st paragraph, lines 5, 6, 7, 8 : '(Mass)' reads '(Mass.)'
298	last paragraph : insert a full stop after the last word
299	last paragraph, line 4 : 'straite' reads 'striate'
300	line 2 : 'spore' reads 'spores'
304	line 3 from the bottom : semi-colon to be replaced by a comma
310	line 7 from the bottom : 'Camberssedes' reads 'Cambessedes'
312, 314, 316, 318, 320, 322, 324, 326	Top line : '(Melastomataceae)' reads '(Melastomataceae)'
318	Under Fig. 4, last line : 'stamens' reads 'stamen'
320	Under Fig. 5, line 1 : 'Korth' reads 'Korth.'
320	line 2 from the bottom : '*malayan*' reads '*malayana*'
321	last paragraph, line 1 : '*stritus*' reads '*strictus*'
321	line 5 : '*now.*' reads '*nov.*'
322	last line : delete one comma after Fig. 6
323	1st paragraph, line 2 : comma after Merr.
323	1st paragraph, line 4 : after 'Veldk.' insert 'or *C. bracteata* (Quis. & Merr.) Veldk.'
325	Under Plate 1, last line : delete one full-stop after 'Leiden'
328	last paragraph, line 5 : delete one bracket after 'Holttum'
353	C., 1st lead : '*Bredelia*' reads '*Bridelia*'

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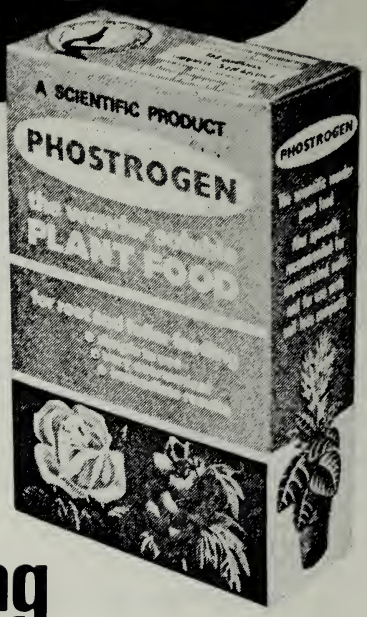

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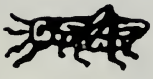

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THE GENUS *PYRENARIA* (THEACEAE) IN MALESIA

(Flora Malesianae Precusores LVIII, Part One)

by

Hsuan Keng

Department of Botany, University of Singapore, Singapore

I. INTRODUCTION

In 1828, C.L. Blume describe a new genus *Pyrenaria*. It was based on a Javanese plant, *Pyrenaria serrata* Bl. He mentioned that it has the general characters of the Rosaceae, notably the 'pomaceous' fruit with 5 locules and each locule possessing two 1-seeded 'pyrenes', hence the generic name *Pyrenaria*, and that the structure of its calyx and the mode of stamen insertion are similar to those of the Theaceae.

The drupaceous fruit of some *Pyrenaria* has a thick, soft-woody wall and remaining green or yellowish on the tree for some time, superficially it resembles a small pear or apple. But it is developed purely from the superior ovary of a hypogynous flower with no receptacular tissue involved, thus different from a true pomaceous fruit which is developed from the inferior ovary of a perigynous flower. Furthermore, the "stones" inside the fruit described by Blume as pyrenes are genuine seeds as there is no endocarpous tissue involved. For these reasons, *Pyrenaria* is classified under the family Theaceae by taxonomists from J.D. Choisy, F.A.W. Miquel, to this day.

Previously it is generally recognized that there are about 15 species of *Pyrenaria* distributed in western Malesia and S.E. Asia (e.g. Airy-Shaw in 7th ed. of Willis Dict., 1966). In 1972, the present writer described two new *Pyrenaria* from Malaysia which differ from other species in their dry, thin-woody or cartilaginous, partially dehiscent fruit. This fruit character has somewhat bridged the gap of *Pyrenaria* and *Tutcheria*. The latter genus with about 10 species is confined to Eastern Asia. its fruit is thin-walled and dehisces ± regularly into 3-5 valves, usually with 3–5, sometimes 2 seeds in each chamber. Apart from the number of seeds per locule, the main difference between these two genera lies in the nature of pericarp. It is understood today that their number of seed is slightly overlapping, and that their nature of pericarp is not basically different. Moreover, their internal seed structures and and seedling characters are not only in common, but also unique among the family Theaceae. Therefore, it has been proposed to merge *Tutcheria* with *Pyrenaria* (see H. Keng, in Gard. Bull. Sing. 26 (1972) 130-133).

I am grateful to the Commissioner and staff of the Botanic Gardens, Singapore for the herbarium and library facilities, to the Director and staff of the Rijksherbarium, Leiden, for the loan of the entire collection of *Pyrenaria* and *Gordonia*, to the Directors and staff of Herbarium Bogoriense, Bogor, Forest Herbarium, Bangkok, Forest Research Institute, Kepong for the loan of some critical specimens, and to the Directors and staff of Royal Botanic Gardens, Kew, the Arnold Arboretum, Harvard University, Cambridge, the University of California Herbarium, Berkeley, and the New York Botanic Garden, New York for supplying photographs of some type specimens or patiently answering my queries.

I also would like to thank Professor Dr. C.G.G.J. van Steenis for going through the manuscript of this paper and for his valuable comments, Dr. Ding Hou for supplying the xerox copies of literature, and my wife, Mrs. Ro-siu Keng for preparing the illustrations of this paper andd for her encouragements.

II. A GENERAL ACCOUNT OF THE TAXONOMIC CHARACTERS

All the Malesian species are of small stature, varying from shrubs to small spreading trees, normally below 10 m, rarely reaching 15 m in height, It is interesting to note that some fruiting herbarium specimens were, according to collectors, collected from bushes as low as 3 m tall.

The terminal buds, in general, are hairy, so are the young branches of most species. The older branches may be hairy or glabrous. The large branches on the trunk are always dense and spreading, thus the crown tends to be broadly rounded.

The leaves are mostly alternate, petiolate, and well-spaced on the branches; sometimes the base of petioles are twisted, thus all the blades are somewhat distichously arranged. In *P. pahangensis* the leaves are so closely spirally arranged in intervals that they are seemingly in whorls. Petioles and the lower side of blades in most species are pubescent in various degrees. One rather constant character is that in some species, the leaves after drying, turn brownish, while in others, remain greenish.

The flowers are borne in the leaf axils. Occasionally if the terminal bud of a branchlet remains dormant, the flower on the uppermost leaf axil becomes seemingly terminal. Truly terminal flowers as found in the genus *Camellia* do not seem to exist in the Malesian species of *Pyrenaria*. In some cases, the internodes are shortened, and the subtending leaves to the flowers are somewhat reduced in size, consequently these flowers, often 2–3 together, appear in a cluster (e.g. in *P. tawauensis* and *P. viridifolia*).

Each flower is usually associated with one bract and two bracteoles. In *P. villosula*, for example, the peduncle is long (to 1–1.5 cm), and the bract is linear lanceolate and is inserted in a short distance away from the bracteoles which are cordate or suborbicular in shape, thus they are clearly differentiated. However, in most of the other species, the peduncles are in general extremely

short, the bract and bracteoles are ± similar and approximate, and are thus indistinguishable. Furthermore, the distinction between bracteoles and sepals which are usually 5–6 in number, is usually not clear. Generally there is a tendency of gradually increasing in size from the lowermost sepal upwards.

Two basic types of flower-buds are found in the Malesian species. In one kind, (e.g. in *P. acuminata, P. villosula, P. johorensis,* etc.), for most part of the petals, except their narrow or broad folded margin, like the sepals, are exposed in bud. Externally the texture, colour and even indumentum of the petals (except their folded margin) are similar to those of the sepals. Superficially they resemble the perulate* flowers of some E. Asiatic species of *Camellia* but in fact they are different. In another kind, (e.g. in *P. serrata, P. tawauensis,* etc.), the petals are usually thin and glabrous and largely enclosed by the sepals in bud, and are thus clearly differentiated.

The petals are usually 5–6 in number, greenish white, white or pale yellow in colour, slightly joined at the base. The number of stamens within a flower is very large. In an extreme case such as in *P. villosula,* the number of stamens per flower is 100–120. They are arranged in 3–6 series and more or less fused at the base and also briefly adnate to the base of corolla. The anthers are divergently attached, and both anthers and filaments are glabrous in all the Malesian species examined.

The gynoecia consist of a hispid ovary and a single style or several styles. The styles are hairy or glabrous, mostly 5 in number, they are either fused to form a simple unit (e.g. *P. johorensis*) or completely free to the base (e.g. *P. tawauensis, P. viridifolia*). Intermediate forms include those of which nearly the lower half of the styles are fused, and the upper half being free, and those of which the lower three fourth or so are fused, and the upper one fourth being free. An extraordinary case was observed in *P. wrayi,* of which the five styles are completely fused below but are partially fused above in the combination of '3 + 1 + 1' or '2 + 1 + 1 + 1' and thus appear in three or four branches, a situation reminding the diadelphous or polydelphous androecium of some Papilionatae and other taxa.

The fruit of the Malesian species, as mentioned earlier, are either drupaceous or capsular. Texture of the pericarp in mature fruits is varying from soft woody, leathery, woody to cartilaginous. Fruits of those species with a soft woody or leathery pericarp tend to remain succulent and indehiscent even after falling on the forest floor. While the fruits of those species with a thick or thin woody or cartilaginous pericarp, on the contrary, tend to dehisce along the loculicidal sutures rom above (sometimes also along the septicidal sutures from beneath) and expose, then discharge the seeds. Judging from the overall situation in the subfamily Camellioideae, it is suggested that the development of succulent drupaceous fruits in many species of *Pyrenaria* is probably an ecological adaptation to delay the process of seed germination or to convert into animal dispersal.

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* Sealy (Rev. Gen. *Camellia,* p. 16) defines the term perulate as follows: "..... the bracteoles and sepals are not distinguishable from one another, but together for a single series of about 10 overlapping scales which protect the rest of the flower until anthesis".

The seeds are semiglobose or wedge-shaped and with a round back or flattened and with a ridged back, often variously angulate as moulded by the confinement of the seed chamber and also due to muture compression. The testa is thick and hard, usually lustrous chestnut except the large prominent scar (the ventral hilum) which is white or greyish. They are exalbuminous. The embryo consists of a pair of thin and very large cotyledons which are tightly folded and contorted and twisted, a partly exposed radicle, and a tiny plumule which is completely buried in the cotyledons. During germination, these two cotyledons gradually emerge from the seedcoat, then rapidly unroll and spread out to perform the function of photosynthesis on the usually gloomy forest floor (see H. Keng in Gard. Bull.Sing. 26 (1972), *plate* 3, *fig. e, f & g,* facing p. 132).

III. TAXONOMIC TREATMENT

Pyrenaria Blume, Bijdr. (1827) 1119 (Type species: **Pyrenaria serrata** Bl. from Java); Choisy in Mém. Soc. Phys. Hist. nat. Genève (Mém. Fam. Ternstroem. Camell.) 14 (1855) 83; Miq. Fl. Ind. Bat. 1 (1859) 493; et Suppl. 1 (1861) 484; Benth. in B. & H. Gen. Pl. 1 (1862) 185; Dyer in Hook. f. Fl. Brit. Ind. 1 (1872) 289; Kurz, Fl. Burm. 1 (1877) 104; King in J. As. Soc. Beng. 59 (1890) 199; Melchior in E. & P. Pfl. Fam. ed. 2, 21 (1925) 138; Back & Bakh. f. Fl. Java 1 (1963) 321; H. Keng in Gard. Bull. Sing. 26 (1972) 127.

Eusynaxis Griff. Notul. 4 (1854) 560, t. 603 (Type species: *Eusynaxis barringtonifolia* Griff. from India = **Pyrenaria barringtonifolia** (Griff.) Seem.).

Tutcheria Dunn in J. Bot. 46 (1908) 324, et 47 (1909) 197; Nakai in J. Jap. Bot. 16 (1940) 708 (Type species: *Tutcheria spectabilis* (Champ.) Dunn from Hong Kong = *Tutcheria championi* Nakai = **Pyrenaria championi** (Nakai) H. Keng).

Shrubs or small trees. Leaves alternate, spirally arranged, serrate, chartaceous or coriaceous. Flowers bisexual, axillary, solitary, sometimes 2–3 congested in a cluster, shortly pedunculate or subsessile; bracteoles usually 2; sepals mostly 5–6, unequal; petals 5–6, shortly fused at the base; stamens numerous, in 3–6 rows, briefly connate at the base and often adnate to the corolla; anthers versatile; ovary mostly 5–6 loculate, 2–3 (–7) ovulate per locule; styles mostly 3–5 free or partly to totally connate. Fruit drupaceous or capsular; pericarp softwoody, leathery or cartilaginous, indehiscent, partly dehiscent or dehiscent. Seeds 2–3, sometimes to 4 or 5 or 1 in each locule, hemispheric or flattened ovoid, often variously angulate, exalbuminous, with a prominent hilum on the ventral side; testa woody or crustaceous; embryo large, with two thin, foliaceous cotyledons clasping and crumpling together.

A genus with about 30 species, occurs from East India, Burma, Thailand, Vietnam, South China to Riukiu and Taiwan, and southwards to Malesia (The Malay Peninsula, Sumatra, Borneo, Java and possibly the Philippines). Most species are described from S. China (formerly under *Tutcheria*) and the Malay Peninsula.

About 8 or 9 species are found in Malesia.

KEY TO THE SPECIES

A. Leaves 3–5 congested into a false whorl, drying brown or dark brown; fruit capsular, partially dehiscent (Malay Peninsula). ..... 3. *P. pahangensis*

A. Leaves spirally arranged on twigs, one at each node, well-spaced, drying greenish yellow or brown; fruit drupaceous or capsular,

B. Bract subtending the flower leafy, lanceolate, 1–2 cm long; branchlets densely covered with brown or yellow hair; leaves drying brown; flowers pedunculate (peduncles 1–1.5 cm long); fruit drupaceous, indehiscent (Sumatra, Malay Peninsula). ..... 6. *P. villosula*

B. Bract subtending flower usually much smaller (less than 3 mm long); branchlets glabrous or pubescent; leaves drying greenish yellow or brown; flowers sessile or pedunculate; fruit drupaceous or capsular,

C. Fruit drupaceous, with succulent, indehiscent pericarp,

D. Branchlets densely covered with brown or dark brown hair; leaves drying brown or dark brown; sepals lanceolate; style solitary, briefly 5-branched near the tip (Sumatra, Malay Peninsula). ..... 1. *P. acuminata*

D. Branchlets glabrous, glabrescent or covered with short yellowish brown hair; leaves drying greenish yellow or brown; sepals deltoid, cordate or ovate,

E. Leaves drying greenish yellow; young branchlets glabrescent; styles 5, free to the base; fruit depressed at the top with 5 bosses around the depression (Malay Peninsula). ..... 7. *P. viridifolia*

E. Leaves drying brownish or dark brown; young branchlets glabrous or adpressed with short, yellow hispid hair; style 1, branched from the middle above or not branched (or 5 or 6 and fused at base); fruit round or flat at the top, with only one style-base in the centre,

F. Style 1, branched or not, if branched, the branches remaining free, not partially fused (var. *serrata* in Sumatra and Java, var. *masocarpa* in Borneo, and var. *kunstleri* in Malay Peninsula). ..... 4. *P. serrata*

F. Style 1, branched, the branches partially and laterally fused (Malay Peninsula). ..... 8. *P. wrayi*

C. Fruit capsular, with dry, cartilaginous or thin woody pericarp, dehiscing loculicidally or partially so; branchlets glabrous or nearly so; leaves drying greenish yellow,

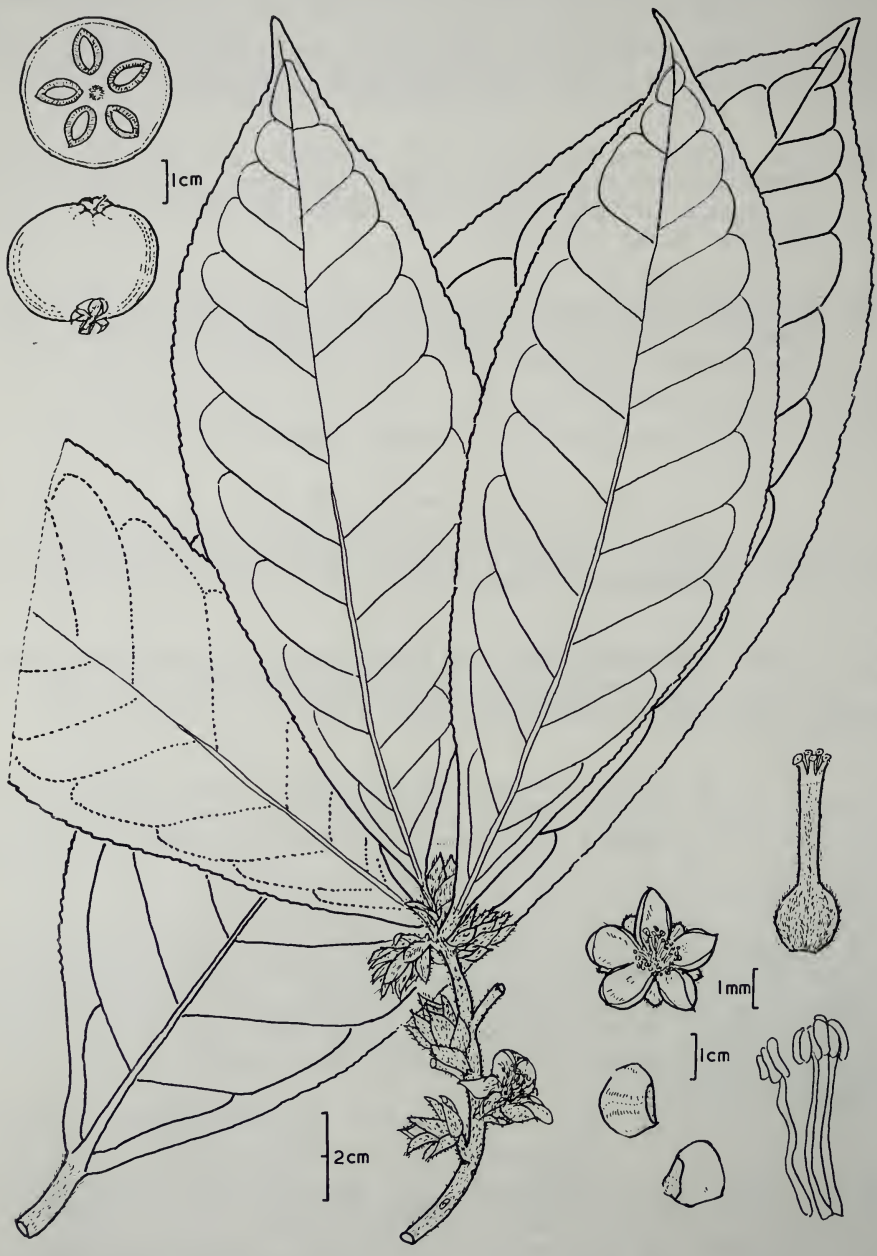

Fig. 1. *Pyrenaria acuminata* Planch. ex Choisy
Flowering branch, flower, floral parts, fruit and seed (based on *Jumali 6027*, supplemented by *Ridley 4798*).

G. Flowers large (corolla 3.5–4 cm across), lower part of petals exposed in bud, thickened; style solitary, not branched (Malay Peninsula). ..... 2. *P. johorensis*

G. Flower smaller (corolla 2.5–3 cm across), petals thin, enclosed in calyx; styles 5, free to the base (Borneo and Sumatra). .... 5. *P. tawauensis*

1. **Pyrenaria acuminata** Planch. ex Choisy in Mém. Soc. Phys. Hist. nat. Genève (Mém. Fam. Ternstroem. Camell.) 14 (1855) 84; Miq. Fl. Ind. Bat. 2 (1857) 493 (excl. *Cuming n. 2423*); Dyer in Hook. f. Fl. Brit. Ind. 1 (1872) 290; King in J. As. Soc. Beng. 59 (1890) 200; Ridl. Fl. Mal. Pen. 1 (1922) 200; H. Keng in Gard. Bull. Sing. 26 (1972) 132, *pl. 3, a-g,* et in Ng, Tr. Fl. Mal. 3 (1978) 290, *f. 6.*

Ternstroemia ? *macrophylla* Wall. Cat. 3663 (in Herb. Linn. Soc.), *nom.* *Gordonia* (*Camellia*?) *acuminata* Wall. Cat. 3664 (in Herb. Kew), *nom.*

Shrub or small tree, 5–12 m tall. Young branches covered with yellowish grey hispid hair; older branches sericeous. Bark greyish brown, smooth or patchy. Leaf-blades narrowly elliptic, sometimes narrowly obovate, acuminate or shortly caudate, base attenuate, 14–24 (–30) cm long, 4–6.5 (–8.5) cm wide, chartaceous, drying brownish, the margin finely surrulate for most part except near the base, the midrib impressed above and elevated below, the side veins 9–12 pairs; puberulous above, sericeous below, with long hispid hair on the midrib; petioles 0.8–2 cm long, hispid. Flowers axillary, solitary or 2–3 congested together; peduncle 2–3 mm long, hispid; bract and bracteoles 3, lanceolate, 3–5 mm long, hispid; sepals 5–6 subequal, broadly lanceolate, 7–8 mm long, apex acute, coriaceous, densely sericeous externally; corolla 3–3.5 cm across, pale yellow; petals mostly 5, broadly ovate to suborbiculate, 1.4–1.7 cm long, apex often abruptly acute, thin coriaceous, concave, sericeous externally except the broad margin which is glabrous and thin. Androecium 5–6 mm long, the filaments glabrous, in 5–6 rows united at the base. Gynoecium 8–10 mm long; style 1, stout, puberulous, briefly 5 (–6) branched near the tip; ovary globose, 3–4 mm across, densely sericeous. Fruit depressed globose, 3–4 cm across, green to blackish, succulent, soft woody, indehiscent.

Distribution. The Malay Peninsula (from Penang, Perak southwards to Johore and Singapore) and Sumatra (Upper Riau Islands).

Malay Peninsula (numerous specimens, only representative ones are cited below). Penang, *Ridley 3115* (SING). Perak, *Dr. King's collector 10141* (SING), *17929* (L). Kelantan, Bukit Baka, *Md. Shah & Ahmad Shukor 3206* (SING), Tamagan, *Md. Shah & Kadim 488* (SING). Pahang, Lesong For. Res. *Y.C. Chan FRI 19826* (L), *Samsuri Ahmad & Ahmad Shukor 413* (SING). Selangor, Kuala Lumpur, *Ridley s.n.* in Dec. 1920 (SING), *C. Curtis 2321* (SING). Negri Sembilan, Sg. Manyala, *Wyatt-Smith KFN 76187* (L), Sembilan *Rahim Ismal KEP 109429* (L). Malacca, *Ridley 1624* (SING), *A.C. Maingay 190* (L). Johore, Kluang, *K.M. Kochummen FRI 2835* (L, SING), Labis, *Md. Shah & Sanvis 2113* (SING). Singapore, Chua Chu Kang, *Ridley 106701* (SING), Bukit Timah, *Nagdiman 34535* (SING).

Sumatra. Upper Riau Islands, Pakanbaru, *E. Soepadmo 16 & 151* (L).

Ecology. In lowland forests, more common below 100 m, occasionally, ascending to 1300 m; ecologically very versatile, in dense jungle, on ridge top, in swamp forest or along stream. Fl. & Fr. year round.

Fig. 2. *Pyrenaria johorensis* H. Keng
Fruiting branch, flower, floral parts, fruit and seed (based on *Burkill 2606*, supplemented by *Ogata 105007*).

Note. This is the commonest species of *Pyrenaria* in the Malay Peninsula. It can be easily recognized by its dense crown, stout branches and branchlets, the large leaves and especially that most parts are beset with dark brown to black hair.

Miquel (l.c.) cited *Cuming n. 2423,* a specimen erroneously said to be from the Philippines as belonging to this species; it was likely collected in Malaya, but is not available for the present study.

2. **Pyrenaria johorensis** H. Keng, sp. nov.

Pyrenaria sp. A. H. Keng in Ng, Tr. Fl. Mal. 3 (1978) 291.

Arbor ad 17 m alta; ramuli primo puberuli. Folia subcoriacea, elliptica vel anguste elliptica, 7–17 (–23) cm longa, 3.5–6 (–9) cm lata, acuta vel acuminata, basi cuneata, supra glabra, subtus puberulosa, nervis lateralibus 7–10; petiolo circ 1 cm longo. Flores axillares, solitarii vel 2–3 congesti, pedunculis subsessilis vel 2–3 mm longis; sepala cordata vel suborbiculata, 6–8 mm lata, coriacea; corolla ad 3.5–4 cm diametro, alba (ex Ogata); petala oblonga vel latiobovata, 1.5–2 cm longa. Stamina 6–8 mm longa, glabra, basi breviter connata et petalis adnata. Gynoecium ad 1 cm longum, stylo 6–8 mm longo. Capsula cartilaginosa, subglobosa, 5-lobata, ad 3.5 cm diametro.

Shrub or small slender tree, to 17 m tall; young branches hispid, tomentose or puberulous; older branches dark brown; glabrescent. Leaf-blades thin coriaceous, drying greenish yellow, elliptic or narrowly elliptic, sometimes narrowly obovate, 7–17 (–23) cm long, 3.5–6 (–9) cm wide, the margin undulate and remotely serrulate, the midrib impressed above, and elevated below, side veins 7–10 pairs, inconspicuous, glabrous above, puberulous or tomentose, sometimes also slightly glaucous beneath; petiole 0.5–1.2 cm long, hispid. Flowers in upper axils, solitary or 2–3 together; peduncles 2–3 mm long or subsessile; bracteoles 2, deltoid, 2–3 mm long, silvery tomentose externally; sepals 5–7, unequal, leathery, cordate to suborbicular, 6–8 mm long; corolla 3.5–4 cm across, white (*Ogata 105007*); petals 5–6, oblong to broadly obovate, 1.5–2 cm long, concave, the central basal part (exposed in bud) thin leathery, sericeous externally, the margin (folded in bud) thin membranaceous, glabrous. Stamens 6–8 mm long, glabrous, the filaments united at the base in several rows, and adnate to the corolla. Gynoecium about 1 cm long; style 1, 6–8 cm long, glabrous; stigmas 5 inconspicuous; ovary globose, shallowly 5-ridged, densely sericeous. Fruit globose, broadly 5-lobed, apex depressed, about 3.5 cm across, green, flushed bronze; pericarp thin (to fairly thick) cartilaginous, dehiscing loculicidally. Seeds mostly 2 in each locule, reddish brown.

Distribution. The Malay Peninsula (Johore).

Type: *K. Ogata KEP 105007* (SING, isotype KEP). Malay Peninsula, Johore, Labis Forest Reserve, March 30, 1968.

Paratypes: Malay Peninsula. Johore, Labis. *Samsuri Ahmad 284* (L, SING); Sungie Kayu, *Kiah SFN 32077* (SING); Gunong Blumut, *Whitmore FRI 8830* (L); G. Pulai, *H.M. Burkill 2606* (SING), *Henderson SFN 28153* (SING), *Sinclair SFN 39521* (SING).

Ecology. In primary forest, on ridge or on steep hill side, alt. 50–600 m. Fl. Nov., Feb.-March; Fr. May-June.

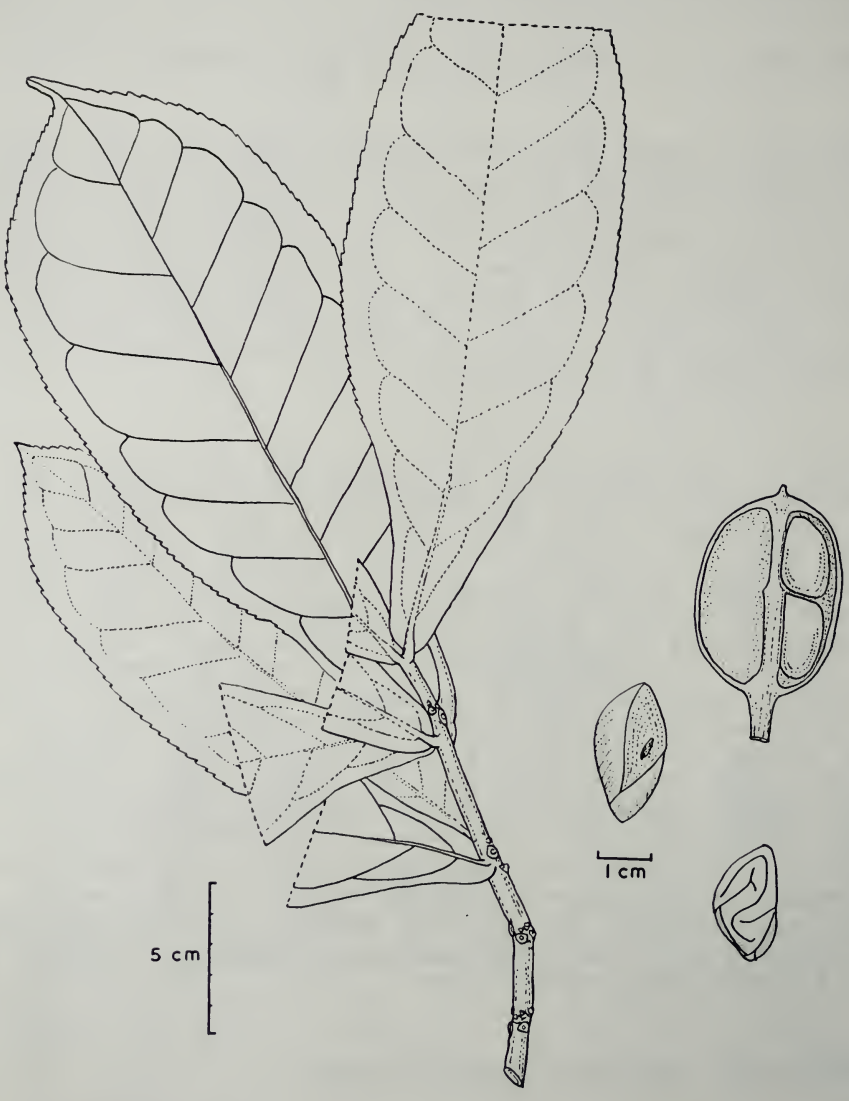

Fig. 3. *Pyrenaria pahangensis* H. Keng
Habit sketch, fruit and seed (Based on *Corner s.n.* in Sept. 9, 1937, supplemented by *Haniff & Nur 8067*). (reproduced from H. Keng, 1972)

Note. This species can be distinguished from others by the relatively large flowers (corolla to 4 cm across, probably the largest among the Malesian species) and by the shallowly 5-lobed fruit with thin cartilaginous pericarp, dehiscing loculicidally and exposing the reddish brown seeds inside. Confined to S. Johore of the Malay Peninsula.

3. **Pyrenaria pahangensis** H. Keng in Gard. Bull. Sing. 26 (1972) 129, *pl. 2, fig. 2,* et in Ng, Tr. Fl. Mal. 3 (1978) 291.

Shrub or small tree, 3–4 m tall; young branches stout, glabrescent. Leaves 3–5 in a false whorl, on and near the upper part of branches; leaf-blades membranaceous, drying brownish, elliptic to narrowly oblong-oblanceolate, 23–38 cm long, 8–15 cm wide, acute or shortly caudate, the base cuneate and subcordate; shining, glabrous above, puberulent or glabrescent beneath; lateral veins 7–9 pairs, oblique to nearly perpendicular, curved and merged into the submarginal vein, rather faint above, distinct and slightly elevated beneath, margin remotely serrulate, nearly entire below the middle; petiole pulvinoid, 2.5–5 mm long. Flowers not seen. Fruits broadly ovoid or subglobose, 3–4.5 cm long and 2.5–4 cm across, usually 3-loculate; pericarp very thin, cartilaginous, partly dehiscent along the sutures. Seeds usually 2 in each locule, 1.5–2 cm long, 1.2–1.8 cm broad, dorsally convex-rounded, shining chestnut brown.

Distribution. The Malay Peninsula (Pahang).

Malay Peninsula. Pahang, Sungei Tahan, E.J.H. Corner s.n. (Type SING), Teku, Gunong Tahan, *Mohd. Haniff & Mohd. Nur SFN 8067* (SING).

Ecology. In lowland forest, near stream. Fr. Sept. (One collection).

Note. This species is characterized by its sub-verticillate, short petiolate leaves with a subcordate base, and by its 3-loculate fruit with thin cartilaginous and partly dehiscent pericarp.

4. **Pyrenaria serrata** Bl. Bijdr. (1827) 1120.

3 varieties are recognized.

KEY TO THE VARIETIES

A. Corolla 1.5–2 cm across; fruit 3–4.5 cm across,

  B. Fruit 4–4.5 cm across; young branchlets covered with yellow or yellowish brown hair (Sumatra and Java) ..... 4a. var. *serrata*

  B. Fruit 3–3.5 cm across; young branchlets glabrous or glabrescent (The Malay Peninsula) ..... 4b. var. *kunstleri*

A. Corolla 1–1.2 cm across; fruit 2–2.5 cm across; young branchlets puberulous (Borneo) ..... 4c. var. *masocarpa*

4a. var. **serrata**

Pyrenaria serrata Bl. Bijdr. (1827) 1120; Korth. Kruidk. (1842) 146, *t. 30;* Miq. Fl. Ind. Bat. 2 (1857) 493; K. & V. in Med. Lands P. Tuin 16 (1896) 297; Koord., Exk. Fl. Java 2 (1912) 610, et Atlas 3 (1915) t. 582; Merr. Contr. Arn. Arb. 3 (1934) 106; Back. & Bakh. f. Fl. Jav. 1 (1963) 321.

Fig. 4a. *Pyrenaria serrata* Bl. var. *serrata*
Flowering branch, flower, floral parts, fruit and seed (based on *Koorders 27983,* supplemented by *Kosterman 23898*).

Pyrenaria lanceolata T. & B. in Tijd. Ned. Ind. 27 (1864) 40.

P. lasiocarpa Korth. Kruidk. (1842) 147.

P. oidocarpa Korth. Kruidk. (1842) 147.

Small tree to about 15 m tall; young twigs slender, covered with yellow or yellowish brown hair; older branches greyish brown, glabrescent. Leaf-blades narrowly obovate to oblanceolate-elliptic, 8–20 (–24) cm long, 3–7 (–10) cm wide, acuminate or obtuse, base attenuate, chartaceous or thin coriaceous, during brown, glabrescent above, puberulent or glabrescent beneath, the margin serrulate or serrata except both ends, the midrib impressed above and elevated below, the side veins 9–13 pairs, conspicuous below; petiole 1–1.2 (–1.5) cm long, puberulous. Flowers in upper axils, solitary or 2–3 crowded together; peduncles 2–4 mm long, puberulous; bracteoles 2, silvery puberulous, deltoid, 2–3 mm long; sepals 5–6, broadly orbicular to reniform, subequal, 5–7 mm long, coriaceous, sericeous externally; corolla about 2 cm across, white, with orange yellow centre; petals 5–6, orbicular to ovoid, 8–10 mm long, thin leathery, concave, sericeous externally. Androecium 5–7 mm long, the filaments glabrous, connate below. Gynoecium 6–7 mm long; styles 5, connate at the base, hispid; stigmas 5–6, very short; ovary globose, 3–4 mm across, densely sericeous. Fruit ovoid-globose, 4–4.5 cm across, glabrescent, bluntly 5–6-ridged, indehiscent.

Distribution. Sumatra and Java.

Sumatra. Sumatra, *H.O. Forbes 1968, 2462, 2479, 2896* (L); Palembang, *Forbes 2850* (L); Lake Ranau, *Forbes 2109* (L); Palembang, N. side of Lake Ranau, *Steenis 3398* (L); Atjeh, Gajo Lands, *Steenis 9982* (L); Benkoelen, Kapahiang, *De Voogd 1245* (L).

Java. G. Salak, *Blume s.n.* (Herb. Lugd. Bat. no. 925, 250-501, Lectotype.) (L); Preanger, G. Karang, *Buwalda 3665* (L); Tjisalak, Tasih, *Dransfield 1173* (L); W. Java, *Forbes 1081* (L); Tjibodas, G. Gede, *Forman 93* (L); Java, *Junghuhn 94, 231, 415, 418, 433, 444, 445* (L); *G. Salak, Koorders 24184, 24353* (L); Java, *Koorders 8184, 8185, 8187, 8188* (etc) (L); Java, *Koorders & Valeton 8184, 8185, 8187, 8188* (etc) (L); Poeloesari, Bantam, *Koorders 8193* (L); Kedoe, G. Andoeng, *Koorders 27983* (L); Tjiandjur, G. Besar, *Kostermans s.n.* (in May, 1968) (L), Puntjak Pass, *Kostermans 23898* (L); Tjibodas, *Pleyte 24* (L); *Meijer 1452* (L); G. Salak, *Reinwardt s.n.* (in Dec. 1822) (L); Preanger, G. Patoeha, *Steenis 6999* (L); Preanger, G. Besar, *Winckel 292* (L); Java, *Zollinger 2123* (L).

Ecology. From lowland to hill forest, alt. 200 to 2,500 m. Fl. & Fr. Jan.-Dec.

Note. About a dozen specimens of this plant, collected by Reinwardt, Hasselt and Blume, on loan from Leiden, bear Blume's handwritings. Among them, I selected the one collected by Blume himself from Gunong Salak (spelt as Sallak) (Herb. Lugd. Bat. No. 925, 250-501) as the lectotype. It is interesting to note from the early labels, Blume originally intended to name this plant *Melodendrum montanum* Bl. (variously spelt as *Melodendron montana* Bl.), a binomial apparently was never published.

Three other names, viz. *Pyrenaria lanceolata* T. & B., *P. lasiocarpa* Korth. and *P. oidocarpa* Korth., were all based on specimens collected from Java. S.H. Koorders, after intensively studied the living and herbarium materials, reached

Fig. 4b. *Pyrenaria serrata* Bl. var. *kunstleri* (King) H. Keng
Flowering branch, young flower, floral parts and fruit (based *King's collector 3948*, supplemented by *Guard s.n.* in May 1904).

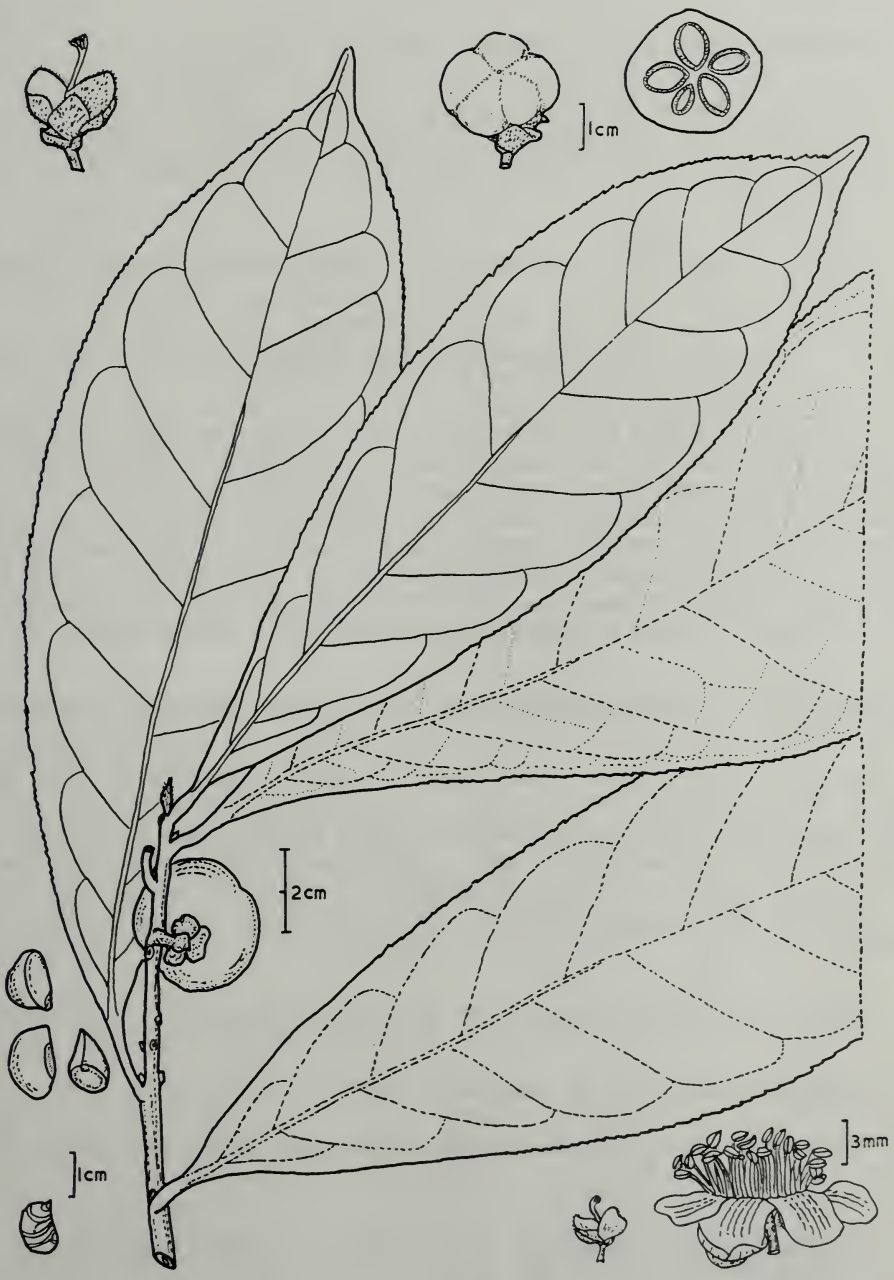

Fig. 4c. *Pyrenaria serrata* Bl. var. *masocarpa* (Korth.) H. Keng
Fruiting branch, flower, floral parts, fruit and seed (based on *Ahmad Damit 27041*, supplemented by *Anderson & Ilias 28700*).

the conclusion (Exk. Fl. Java 2 (1912) 610) that "Nur 1 ziemlich vielgestaltige Art in Java, dort nicht bis in das Hochgebirgsgebiet aufsteigend", thus reducing all these three names to *Pyrenaria serrata* Bl. This view is accepted by Backer and Bakhuizen van den Brink f. and others.

4b. **Pyrenaria serrata** Bl. var. **kunstleri** (King) H. Keng *stat. nov.*

Pyrenaria kunstleri King in J. As Soc. Beng. 59 (1890) 200, et in Ann. Bot. Gard. Calc. 5 (2) 146, pl. 177; Ridl. Fl. Mal. Pen. 1 (1922) 201, *excl. syn. P. wrayi;* H. Keng in Ng, Tr. Fl. Mal. 3 (1978) 291, *excl. syn. P. wrayi.*

Shrub or small tree, 5–15 m high. Young branches angular, glabrous; older branches stout, glabrous. Leaf-blades membranaceous, drying brown or dark brown, elliptic, narrowly elliptic or obovate, 10–24 (–28) cm long, 3–9 (–10) cm wide, acuminate, sometimes obtuse or shortly caudate, base cuneate or attenuate, glabrous or glabrescent on both surfaces, the margin serrulate, the midrib impressed above and elevated beneath, the side veins 7–11 pairs, conspicuous beneath; petiole 0.8–1.5 (–2) cm long. Flowers in upper axils, solitary, subsessile, peduncles 3–4 mm long; bracteoles 2, leathery, cordate; sepals 5–6, subequal, leathery, deltoid to suborbicular, 2–3 mm long; corolla white, 1.5–2 cm across; petals 5–6, ovate to orbicular, membranaceous, 6–10 mm long, briefly connate at the base. Stamens 7–8 mm long, numerous, in 3–4 rows, filaments glabrous, connate below and adnate to the corolla. Gynoecium 5–6 mm long; style simple; stigmas 5, inconspicuous; ovary spherical, shallowly sulcate, hirsute. Fruit indehiscent, globose or slightly depressed, 3–3.5 cm across, broadly 5-lobed.

Distribution. The Malay Peninsula (Kedah, Prov. Wellesley & Perak).

Malay Peninsula. Kedah, 48 miles of Jeniang Road, *Kiah SFN 36151* (SING). Prov. Wellesley, Bukit Panekor, *F. Guard s.n.* in May, 1904 (SING). Perak, Larut, *Dr. King's collector 3948* (SING, isotype), March, 1883 (A tree with spreading branches, leaves light green; flowers white with bright yellow stamens, alt. 100 m.); Waterloo, *C. Curtis 2713* (SING); Tasekfelegur, *Ridley 7025* (SING); Tea Garden, *Ridley s.n.* in 1891 (SING); Larut, *L. Wray 3059* (SING).

Ecology. In lowland forests. Fl. March (one collection); fr. May-Dec.

4c. **Pyrenaria serrata** Bl. var. **masocarpa** (Korth.) H. Keng, stat. nov.

*Pyrenaria masocar*pa Korth. Kruidk. (1842) 147; Masamune, Enum. Phan. Born. (1942) 473.

Pyrenaria kunstleri Auct. non King: Merr. Fl. Elmer Born. in Un. Cal. Publ. Bot. 15 (1929) 198; Masamune, l.c. 472.

Pyrenaria parviflora Ridley in Kew Bull. (1933) 487; Masamune, l.c. 473. Syn. nov.

Shrub or small tree. 6–10 m tall. Young branches stout, angulate, puberulous; older branches glabrous. Leaf-blades membranaceous, drying brown or dark brown, elliptic or narrowly elliptic or narrowly obovate, 10–20 (–28) cm long, 3–6 (–10.5) cm wide, acute or abruptly acuminate, base acute or abruptly attenuate, the margin finely serrulate, the midrib impressed above and elevated beneath, side veins 9–11 pairs. glabrous above, puberulous with scattered hair on the veins beneath; petiole 1–1.2 cm long, puberulous. Flowers in upper axils, solitary; peduncles 2–4 mm long, velvet; bracteoles 2, ovate, coriaceous, about 2 mm long; sepals 5, cordate to suborbiculate, 3–4 mm long, sericeous externally; corolla 1–1.2 cm across, white tinged green or yellowish white. Stamens 4–5 mm long, briefly connate below and adnate to the corolla. Gynoecium 4–5 mm long; ovary ovoid, 2 mm long, densely sericeous; style stout, sparsely puberulous, briefly 5 branched near the top into 5 stigmas. Fruit subglobose or turbinate, succulent, indehiscent, 2–2.5 cm across, 4–5 loculate, usually with 2 seeds in each locule.

Distribution. Borneo (Kalimantan, Sarawak, Brunei & Sabah).

Borneo. Kalimantan, no locality, *Korthals s.n.* (L) (*Herb. Lugd. Bat. no. 908251-14*, lectotype of *Pyrenaria masocarpa* Korth.); Central Kutei, Pedohon River, *A. Kostermans 10615* (L); Belanjan River, near Tabang, *A. Kostermans 10662* (L). Sarawak, Kapit, Bt. Tiban, *Anderson & Ilias S 28700* (L); Kalabit Highlands, *Nooteboom & Chai 02075* (L). Brunei, *P.S. Ashton BRUN 5222* (L). Sabah, Tawao, *A.D.E. Elmer 21148* (L, isotype of *Pyrenaria parviflora* Ridley), *211453* (L, SING), *20422* (SING), *21377* (SING). *J. Singh SAN 22837* (L), Lahad Datu, *Ahmad Damit SAN 27041* (L), *Muin Chai SAN 31740* (L).

Ecology. In lowland forests below 100 m; ascending to 1300 m in Bukit Tibang, Kapit in Sarawak (*Anderson & Ilias S 28700*). Fl. July (one collection); Fr. Feb.-May & Sept.

Note. *Nooteboom & Chai 02075* from Kalabit highlands, Sarawak, possess sharply ridged fruit and smaller leaves.

5. **Pyrenaria tawauensis** H. Keng in Gard. Bull. Sing. 26 (1972) 129, *pl. 1, & fig. 1.*

Thea sp. Merr. Un. Cal. Publ. Bot. 15 (1929) 198.

Shrub or small tree, 3–10 m tall. Young branches slender, covered with greyish short hair; older branches greyish brown, glabrescent. Bark greyish brown, smooth. Leaf-blades elliptic or narrowly lanceolate, acuminate or caudate, base attenuate or cuneate, 9–15 (–28) cm long, 2.5–5 (–10) cm wide, chartaceous, glabrescent above, verrucous and puberulous beneath, drying green, the margin finely serrulate except near the base which is entire, the midrib impressed above and elevated below, the side veins 8–12 pairs, merged near the margin; petioles 0.6–1 cm long, slender, puberulous. Flowers subterminal and in upper axils, solitary or 2–3, (rarely more) congested together; peduncles 2–3 mm long, hispid; bract and bracteoles 2–3, orbicular deltoid, 2–3 mm long; sepals 5–6, subequal,

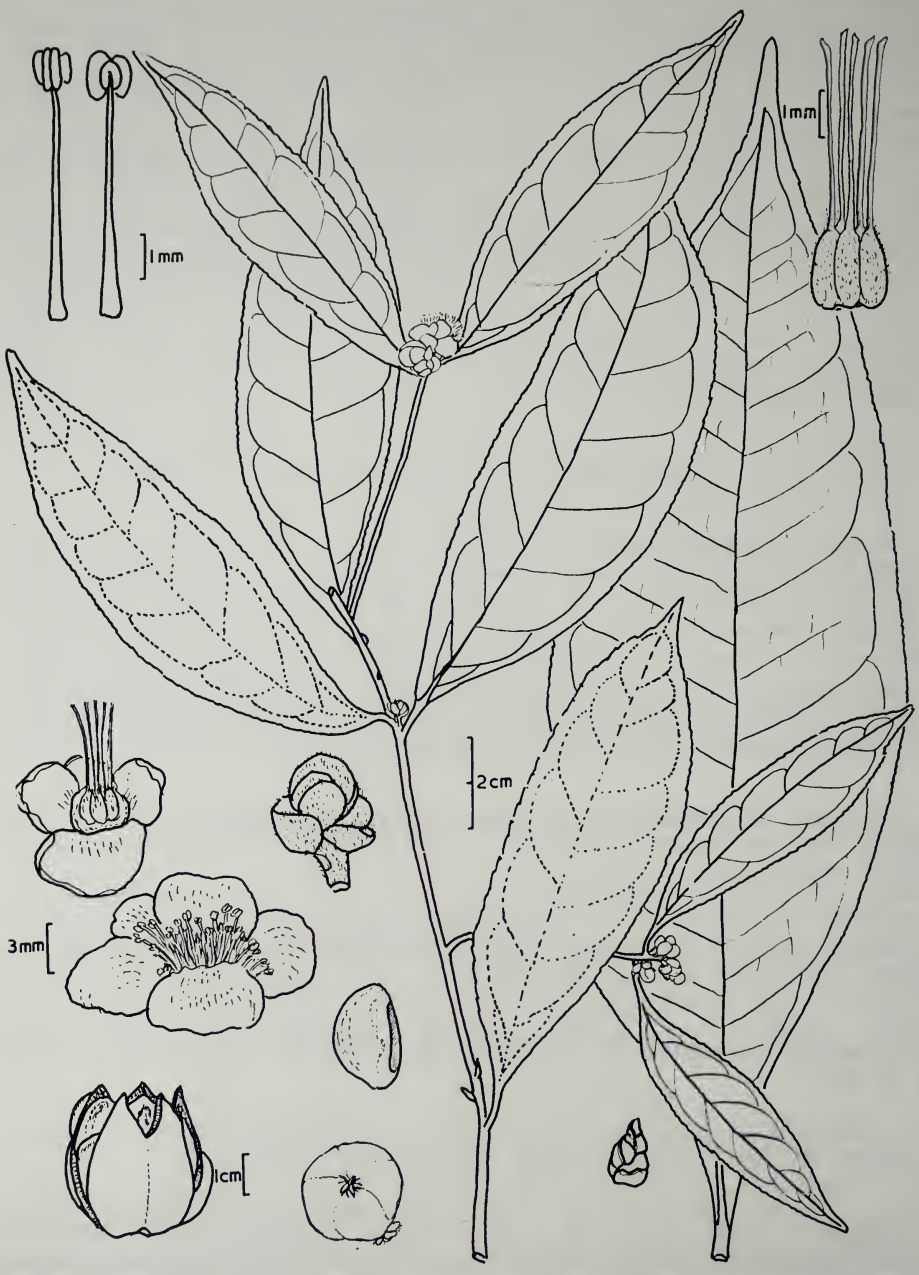

Fig. 5. *Pyrenaria tawauensis* H. Keng
Flowering branch, flower, floral parts, fruit and seed (based on *Shea & Chow 75725*, supplemented by *Singh 24163*).

deltoid to suborbicular, 4–6 mm long, coriaceous, densely sericeous externally; corolla 2.5–3 cm across, white; petals 5–6, broadly oblong to suborbiculate, 1.2–1.5 cm long, thin membranaceous, concave. Androecium 7–8 mm long, the filaments very slender and delicate, glabrous, in 2–3 rows and united beneath.

Gynoecium about 1 cm long; styles 5, long and slender, completely free at the base, each arising from a protuberance near the top of the ovary, glabrous except near the base; ovary globose, 3 mm across, densely sericeous. Capsule broadly ovoid to depressed globose, 3–4.5 cm across, fruit wall thin woody, finally loculicidally dehiscing from the top downwards.

Distribution. Sumatra and Borneo (Sabah & Kalimantan).

Sumatra. Loendoet, Koealoe (E. Coast) *H.H. Bartlett 7630* (L).

Borneo. Sabah (numerous specimens, only representative ones are cited below), Kalabakan (Gunong Rara), *Shea & Chow SAN 75723, 75725* (L); Kundasan, *K. Cox 908* (L); Mt. Kinabalu, *Chew, Corner & Stainton 1902* (L), *Chew & Corner RSNB 4653* (L), *J. & M.S. Clemens 29619, 31968* (L); Ranau, *H. Taipin SAN 42503* (L), *J. Singh SAN 24163* (L); Sandakan, *J.A. Wing, SAN 39013* (L), *Leopold & Kokoh SAN 76654* (L), *G.H.S. Wood SAN 16005* (L), *W. Meijer SAN 21219* (L); Tawau, *G.H.S. Wood SAN 16482* (SING, type, L, isotype), *A.D.E. Elmer 21628, 21832* (L), *A. Baker SAN 17350* (L); Tenom, *Masirom SAN 43242* (L). Kalimantan, Tarakan, *W. Meijer 1860, 2460* (L).

Ecology. In primary forest, often in humid ravines; common in lowland, but also collected from subalpine forest as high as 2800 m (*Chew & Corner RSNB 4653*). The alpine form, however was said to have light yellow flowers (*K. Cox 908, Chew, Corner & Stainton 1902*), also their leaves are smaller and with thicker fruit wall (*Chew & Corner RSNB 8023*). Fl. & Fr. year round.

Note. Merrill (l.c.) referred two fruiting specimens, *Elmer 21628, 21832*, both collected from Tawau (as Tawao) to *Thea* sp. He noted that their fruits were different from those of *Thea lanceolata* Pierre and was not sure about the genus.

My previous description was based on fruiting material only. A large number of good flowering specimens, incl. *Shea & Chow 75725, Wood SAN 16005* and others (all from Leiden) became available for this study. Based on them the description and illustration are prepared.

6. **Pyrenaria villosula** Miq. Fl. Ind. Bat. Suppl. (1861) 484.

Shrub or small tree, 3–10 m tall; young branches covered with yellow or brown hispid or velutinous hair; older branches dark brown, sericeous; bark brown or black, smooth, eventually cracked. Leaf-blades membranaceous, drying brownish, elliptic or narrowly elliptic, 15–20 (–23) cm long, 4–6.5 (–9.5) cm wide, acute or acuminate, sometimes caudate, base cuneate, margin finely serrulate, the midrib slightly impressed above, elevated below, the side veins 9–11 pairs; papillate and puberulous above, sericeous and pilose below, especially on the midrib and nerves; petiole 1–1.5 cm long, hispid, swollen. Flowers axillary, solitary; peduncles 1–1.5 cm (to 2 cm in fruit) long; bract 1, linear lanceolate, to 1 cm long; bracteoles 2; sepals 5–6, unequal, broadly lanceolate cordate to suborbicular, 2–4 cm long, coriaceous, densely sericeous externally; corolla 1.5–2 cm across, creamy white (*Mohd. Shah 1316*); petals 5–6, suborbiculate, 7–8 mm

long and wide, slightly clawed at base, concave, thick coriaceous in the centre, sericeous on the back, the margin glabrous, thinner and with irregular projections. Stamens 4–6 mm long; filaments glabrous, in 4–5 rows united at the base and adnate to the base of corolla. Gynoecium 5–6 mm long; style 1, pubescent, 5-branched near the top for about one-fourth of its length; ovary

Fig. 6. *Pyrenaria villosula* Miq.
Flowering branch, flower, floral parts, fruit (based on *Mohd. Shah 1316*, supplemented by *H. Keng et al. 8834*).

depressed globose, 3–4 mm across, densely sericeous. Fruit depressed globose or ovoid, the apex either slightly flattened with a small apical point or conical, succulent, indehiscent. Seeds usually 2 in each locule, chestnut brown, shining.

Distribution. Sumatra and the Malay Peninsula.

Sumatra. Pasumah, 1200 m, *H.O. Forbes 2191, 2973, 2470b* (L); Landaran Agong, Korinchi, 800 m, *Robinson & Kloss 186* (SING); Sungei Pagu, *J.E. Teysmann 657 HB* (isotype, BO); Asahan, *B.A. Krukoff 4228* (SING).

Malay Peninsula. Pahang, Taman Negara (formerly King George V Nat. Park), *Balgooy 2449* (L), *Everett FRI 14430* (L, SING), *Keng et al. 8834* (SING), *Mohd. Shah 1316, 1502* (L, SING), *Mohd. Shah & Md. Noor 1877* (L), *Ahmad Shukor & Samsuri Sarih 2707* (L, SING), *Whitmore FRI 20129, 20166* (L), *Wyatt-Smith KEP 71957* (L); Raub, *Burkill & Md. Haniff SFN 16809* (SING). Kelantan, near Tarang, *Whitmore FRI 4470* (L). Malacca, Bukit Bruang, *R. Denny 1191* (SING).

Ecology. In lowland and hill forests, by river or along ridges, or in disturbed forests; alt. 50 to 1200 m. Fl. & Fr. year round.

Note. Young branches and underside of the leaves of this species are beset with brown to black hair; superficially they resemble those of *P. acuminata*. Most of the Malayan specimens of this plant were in fact identified under that name. While preparing an illustration of *P. acuminata*, my wife first drew my attention to the differences. Further examination reveal that this plant can be readily distinguished from *P. acuminata* by the following features: (1) Leaves are comparatively smaller, and branches more slender; (2) peduncles are of 1–1.5 cm (in fruit to 2 cm) long; (3) sepals are broadly lanceolate, cordate to orbiculate; and (4) the style is slender, branched at the top for about one fourth of its length. In my original manuscript, it was described as a new species.

At my request, Dr. Kuswata, keeper of the Herbarium Bogoriense, kindly lent me the type-duplicate of *P. villusola* Miq. Although it is a sterile specimen, yet the vegetative characters match extremely well with the Malayan material. Several other old collections from W. and S.W. Sumatra cited above (formerly identified under different names) are also proved to belong to this species.

Variations in leaf venation (especially the angles between lateral vein and midrib) and shape of fruit (from depressed globose to almost ellipsoid) of some specimens are notable.

7. **Pyrenaria viridifolia** Symington ex H. Keng, sp. nov.

Pyrenaria garrettiana Auct. *non* Craib: H. Keng in Ng, Tr. Fl. Mal. 3 (1978) 290.

Frutex 3–10 m altus; ramulis glabratis. Folia ellitica vel angusti-elliptica, apice acuminata vel acuta, basi attenuata vel cuneata, 10–20 cm longa, 3.5–6 cm lata, membracea, margine serrulata, nervis lateralibus circa 10–12; petiolo 5–7 mm longo. Flores axillaris, solitarii, sessilis; sepala 5–7 deltoidea vel suborbiculata,

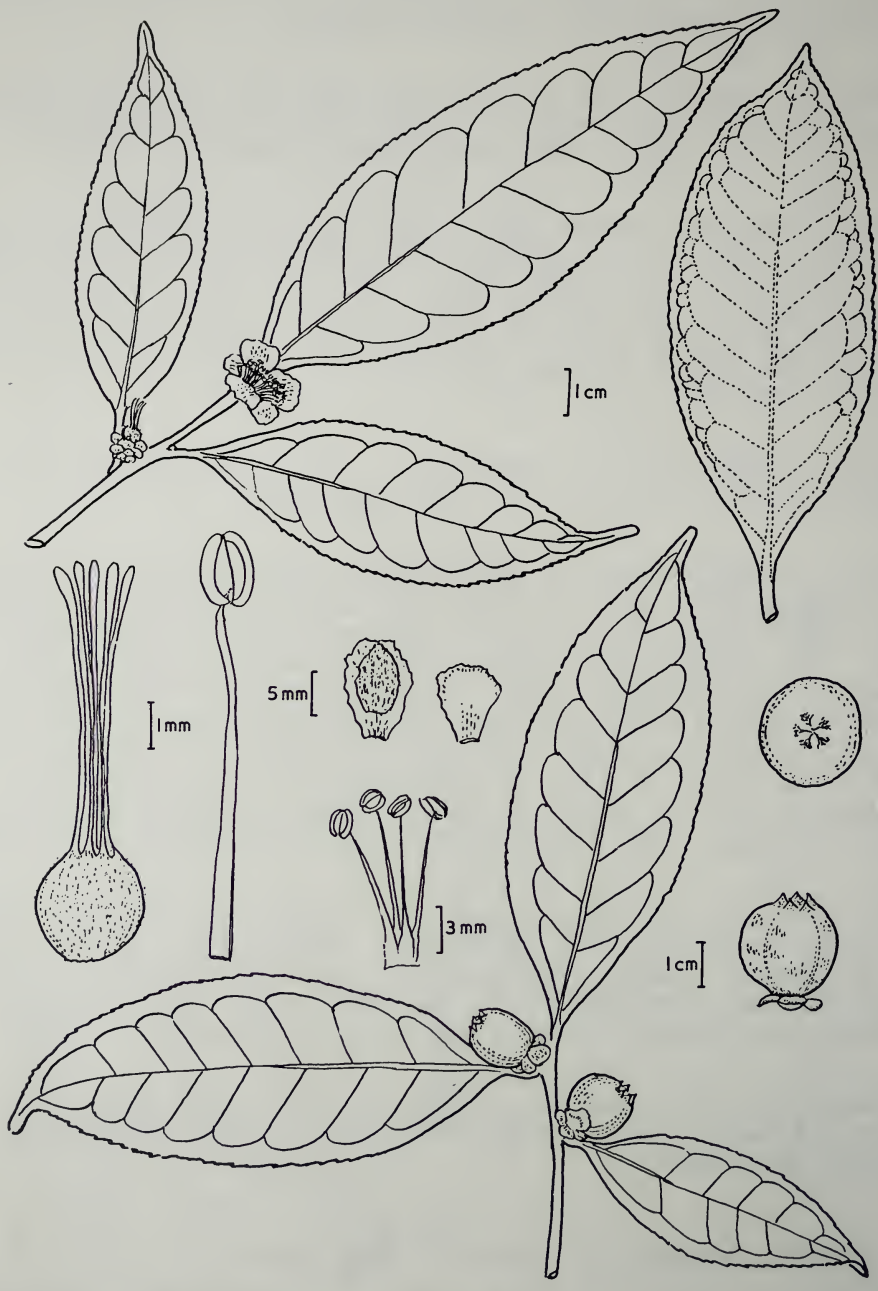

Fig. 7. *Pyrenaria viridifolia* Symington ex H. Keng
Flowering and fruiting branches, floral parts and young fruit (based on *Jaamat 28126, 27579*).

4–5 mm longa, coriacea; corolla ad 2–3 cm diametra, creamea; petala obovata, 1.2–1.4 cm long; stamina 1–1.2 cm longa, glabra, basi breviter connata et petalis adnata; gynoecium 8–10 mm longum, stylis libris approximatis, circa 5–6 mm longis, ovario globoso, 2–3 mm diametro, externe sericeo. Fructus immaturus, globosus, apice convacus.

Shrub or small tree, 3–10 m tall. Young twigs very slender, bluntly angulate, glabrescent. Leaf-blades elliptic or narrowly elliptic, acuminate or acute, 10–20 cm long, 3.5–6 cm wide, the margin finely serrulate or sometimes crenate for most part except near both ends which are entire, membranaceous, drying green, the midrib impressed above and elevated below, the side veins 10–12 pairs, merged near the margin, glabrous above, pubescent beneath; petiole 5–7 mm long, adpressed with short hair. Flowers in upper axils, solitary, sessile or subsessile; bracteole 2, deltoid, 2–3 mm long; sepals 5–7, subequal, deltoid to orbicular, 4–5 mm long, coriaceous, sericeous externally; corolla 2-3 cm across, light yellow; petals 5–6, obovate or broadly oblong, 1.2–1.4 cm long, membranaceous, concave; androecium 1–1.2 cm long, the filaments slender, glabrous, in 3–4 rows, united at the base; gynoecium 8–10 mm long; styles 5, 5–6 mm long, completely free, glabrous; ovary globose, 2–3 mm across, densely sericeous. Immature fruit globose, apex depressed, with 5 bosses (of stylar bases) bordering the depression.

Distribution. The Malay Peninsula (Pahang).

Type: Malay Peninsula. Pahang, Sungie Lemoi, Tanah Rata, *Jaamat FMS 28126* (KEP), Sept. 9, 1931 (flowers yellow).

Paratypes: Malay Peninsula. Pahang, S. Trolak, Ulu Telom, *Jaamat FMS 27576* (KEP); S. Telom, *Jaamat FMS 27598* (KEP); Ulu Telom, *H.C. Dolman 27601* (KEP).

Vern. Names: *Kebit* (Sakai), *Segachok* (Sakai).

Ecology. In jungle near stream, alt. around 1,500 m. Fl. Aug.-Sept. (two collections).

Note. In my treatment of the Theaceae for the Tree Flora of Malaya, vol. 3 (1978), this plant was tentatively identified as *Pyrenaria garrettiana* Craib, a species of Thailand, mainly because of the young fruit on *Jaamat FMS 27576* with five separate bosses around the depressed top. After comparing the authentic specimens of the latter species on loan from Thailand, it is realized that they are different. In *P. viridifolia*, the young branches are glabrescent, the flowers are sessile or subsessile, and the bract and bracteoles subtending the flowers are smaller than the sepals; while in *P. garrettiana*, the young branches are beset with yellowish brown hair, the flowers are distinctly pedunculate (to 5 mm long) and the bract and bracteoles are leafy, lanceolate, often much larger (1–2 cm long) than the sepals.

8. **Pyrenaria wrayi** King in J. As. Soc. Beng. 59 (1980) 201, Ann. Roy. Bot. Gard. Calc. 5 (1896) 147, *pl. 178*.

Pyrenaria kunstleri Auct. *non* King: Ridl.. Fl. Mal. Pen. 1 (1922) 201, p.p.; H. Keng in Ng, Tr. Fl. Mal. 3 (1958) 291, p.p.

Shrub. Young branches adpressed with yellow hispid hair or merely puberulent towards the tip. Leaf-blades mostly narrowly elliptic or oblanceolate, acuminate, base attenuate or cuneate, 10–17 (–20) cm long, 4–5.5 (–6) cm wide,

Fig. 8. *Pyrenaria wrayi* King
Flowering branch, flower, floral parts and immature fruit (based on *Burkill & Haniff 12870*).

thin coriaceous, drying brownish, glabrous above, hispid or puberulous beneath, the margin remotely serrate for most part except both ends which are entire, the midrib slightly impressed above and elevated below, the side veins 6–9 pairs; petioles 0.6–1 cm long, hispid or puberulous. Flowers axillary, solitary, peduncles 2–5 mm long; bracteoles 3, deltoid, 2–3 mm long; sepals 5–6, subequal, deltoid to suborbicular, 4–5 mm long, coriaceous, sericeous externally; corolla 1.5–1.8 cm across; petals 5–6, broadly ovate or orbicular, concave, 6–8 mm long, thinner than the sepals, puberulous externally, but with broad glabrous edges; androecium 4–5 mm long, the filaments glabrous, united at the base. Gynoecium 8–10 mm long; styles 5–6, completely fused into one unit for the lower half of their length, the upper half 3–4-branched; ovary globose, sericeous. Immature fruit depressed globose, 2.5 cm across, apex depressed.

Distribution. The Malay Peninsula (Perak).

Malay Peninsula: Perak. Without locality, *Scortechini 634* (L), *637* (SING) (type duplicates), *Wray 3241* (SING) (type duplicate); Gunong Hijau, Maxwell's Hill, *Burkill & Md. Haniff 12870* (SING), *Md. Shah & Sidek 1091* (SING).

Ecology. In hill forest at about 1000–1400 m. Fl. Dec.-Feb.

Note. The duplicates of type specimens of this species available for study are all with small flower buds only. The general appearance of their branches and leaves resembles closely those of *P. serrata* var. *kunstleri*. King's statement that the style is 3-branched, and the ovary is 6-loculate seems rather improbable, and his illustration of the style (l.c.) was obviously based on the dissection of a tiny bud. For these reasons, in my previous treatment (in Ng, Tr. Fl. Mal. 3: 291, 1978), I followed Ridley to reduce *Pyrenaria wrayi* to a synonym of *P. kunstleri*.

Recently we examined a good flowering specimen collected by Burkill & Md. Haniff from Perak. Although it is more hairy than the type specimen, its flower structure, especially the gynoecium fits well with King's description: it has a 5–6 loculate ovary, as shown in the sections of young fruits, but the style is 3- or sometimes 4-branched for about half of the total length. Close examination reveals that the branches are of different diameters: some being simple, while others being a result of fusion of 2 or more branches. This unusual situation somewhat reminds the diadelphia and polyadelphia in the androecia of Leguminosae. Its specific status is therefore restored.

DOUBTFUL AND IMPERFECTLY KNOWN SPECIES

Pyrenaria mindanaensis Merr. in Philip. J. Sc. 20 (1922) 407, En. Philip. 3 (1923) 71.

This species was described on the basis of the following two specimens from the mountains of Mindanao, the Philippines: *Alvarez F.B. 25181* (type) and *Ramos & Edanao B.S. 38839;* both are not available to me. The holotype specimens were obviously destroyed during the War and efforts to locate their duplicates from various institutions were in vain.

In Merrill's original description, he stated that "Fruits ..... usually 2- or 3-celled and with a single seed in each cell, the seeds smooth, slightly compressed, narrowed at both ends, about 1.5 cm long.". It is generally understood that in *Pyrenaria*, the number of seeds per locule is usually 2, very rarely 1, although in the temperate species (which formerly under *Tutcheria*) it may be 3–5; while in *Camellia*, the number of seeds per locule is 1 or sometimes 2. Until the seed character (cotyledons thick, hemispheric in *Camellia*, and thin, crumpled and folded in *Pyrenaria*) is known, it is better to leave it is a doubtful species.

In this connection, it is interesting to note that in his treatment of *Camellia lanceolata* (Bl.) Seemann, Sealy (Rev. Gen. Camellia, p. 144) noted that "the single specimen from Mindanao (i.e. *Ramos & Edanao 36566*, BM) is rather different from the rest in its leaves which are oblong acuminate with blades 9–13.5 cm long and 2.6–4.5 cm wide". This specimen is likely referable to the present species.

BOLETUS LONGIPES MASS., A CRITICAL MALAYSIAN SPECIES

by

E. J. H. Corner

91 Hinton Way, Great Shelford, Cambridge CB2 5AH, England

SUMMARY

Boletus tristis Pat. et Baker is a synonym of *B. longipes* Mass. and is based on young specimens. The taxonomic position of *B. longipes* is problematic but it is retained in *Boletus* subgen. *Tylopilus* Karst. *Austroboletus* (Corner) Wolfe is not considered a satisfactory genus.

This species, described from specimens collected in the Gardens' Jungle in Singapore, is common in the Malay Peninsula and is evidently abundant in Sarawak (Corner 1972a, 1974). Its small and inconspicuous fruit-bodies, with smoky umber pileus, develop at the beginning of every agaric season. It is difficult to classify, however, because it does not fit well into any genus or subgenus. Notably the fresh spore-print is deep blood-red; with a touch of dilute potash it blackens. This colour, which is unusual in agarics, is the more remarkable because the tubes and pores, at first pallid white, become pale olivaceous and suggest that the spores should be olivaceous; eventually the pileus and stem become roseate from the spore-deposit. I put the species in *Boletus* subgen. *Tylopilus* Karst. with pink spores because the red colour seemed but an intensification. Moreover, there are two other Malaysian species of similar appearance, namely *B. atripurpureus* Corner and *B. griseipurpureus* Corner, the spore-prints of which are pinkish ochraceous and reddish pink respectively, though they do not darken with potash. The problem has recently been intensified through the work of Wolfe (1979) who finds an ultramicroscopic roughness on the spores of *B. longipes*, for which reason he transfers it to the new genus *Austroboletus* (Corner) Wolfe, which I had described as a subgenus of *Boletus*. He also treats *B. tristis* Pat. et Baker as a different species from *B. longipes*, of which I had regarded it as a synonym. Both decisions are questionable, and I take the second first.

B. TRISTIS AND *B. LONGIPES*

According to Wolfe (1979, p. 78, for there is no index to this work) *B. tristis* is to be distinguished by:—

1. relatively narrower spores with the mean (? average) value of E greater than 3.0, where E is the ratio of length to width, as a measure of ellipticity (Corner 1947): in *B. longipes*, E is less than 3.0.

2. subhymenium not wider than the hymenium; in *B. longipes* 1.5–2.0 times as wide.

Regarding the spores, I had commented on their variability in *B. longipes* and had made var. *latisporus* for collections with wide spores (Corner 1972a, 1974), but this is omitted by Wolfe. The reliable spore-measurements for the two species are given in Table 1.

TABLE 1. SPORE-SIZE IN *B. LONGIPES* AND *B. TRISTIS*

Species	Spore-size (μm)	E (mean)	Authority
B. longipes			
v. *ablus*	12–15 x 4.2–4.5	3.1	Corner (1974)
v. *longipes*	11.5–17.5 (–19) x 4.3–5.5	3.0 (–3.1)	Corner (1972a)
v. *longipes*	11.5–16 x 4.5–5.3	2.8	Corner (1974, P-143B)
v. *longipes*	12–14 x 4.5–5.7	2.6	Corner (1974, P-143A, C)
v. *latisporus*	13–16 (–17) x 5–6.5	2.5	Corner (1972a)
v. *longipes*	10–13 x 4.5–5.2	2.4	Corner (1974, P-143)
v. *longipes*	15.5–19.5 x 5–6.5 (–8)	2.0–3.5	Wolfe 1979, type)
v. *longipes*	10.3–11.7 x 4.3–4.5	2.5	Wolfe, Petersen (1978, type)
B. tristis	12–14 x 4	3.3	Patouillard, Baker (1918)
B. tristis	14–17 (–19) x 4–5.5	3.3 (–3.5)	Singer (1945, type)
B. tristis	12.5–15.5 x 4–4.5	2.7–3.9	Wolfe (1979, type)
B. tristis	8.7 x 4.5	1.9	Wolfe, Petersen (1978, type)

I conclude as follows:—

1. Since there are no other differences in the numerous collections of *B. longipes* which I studied except for the lack of colour in the fruit-body of var. *albus*, the spores of *B. longipes* are very variable. The spore-width is related to the narrow limits of the basidium-width (10–12 μm for living basidia, Corner 1972a). The variation in length is connected with the amount of cytoplasm available which will depend, if initial vacuolaton is constant, on the length of the basidium which varies 25–45 μm in living basidia. It is possible that the longer basidia, giving longer spores, may be the primary basidia of young fruit-bodies or of young parts of the tubes, whereas the short basidia, giving short spores, may be the subsequent intercalations. Thus young fruit-bodies may give relatively narrower spores than the mature. The small size of the basidia given by Wolfe (26–31 x 6.5–9 μm, p. 103) must refer to immature or collapsed basidia.

2. The spores of *B. longipes* seem absolutely wider (4.3–6.5 μm) than those of *B. tristis* (4–5.5 μm), but the difference is slight and may be connected with the age of the fruit-bodies, those of *B. tristis* being young. The size of the fruit-bodies and their colour, as given by Patouillard and Baker (1918), suggest that they were young. This is confirmed by Wolfe's description of the pile of hyphal ends on the pileus as not yet disrupted by expansion.

3. Different authors, having examined the type of *B. tristis*, give different spore-measurements. Those cited for Wolfe and Petersen (1978) were taken from their figures and the magnification given for them. Their spores are unaccountably short, though seemingly of mature width; there is the same discrepancy in their Fig. 5 for *B. dictyotus*. Wolfe does not explain this and he omits Singer's measurements.

4. The variations in the value of E are not sharply delimited.

5. Possibly *B. tristis* is a variety of *B. longipes* with absolutely narrower spores. For proof, this will require the study of more collections and a study of spore-variation in fruit-bodies of different ages.

With respect to the relative width of hymenium and subhymenium, it is necessary to be clear what these terms refer to. If the hymenium is the layer of basidia to the exclusion of the pleurocystidia, which project further, then its thickness cannot be measured exactly because some basidia project more than others and some arise more deeply in the tissue; neither external nor internal boundary is precise. For subhymenium I have always taken the layer of interweaving or interlocking hyphae from which the basidia arise. Others, however, may consider that the subhymenium includes the layer of hyphae divergent from the longitudinal hyphae (medulla) in the middle of the trama; that is, the cortex of the multifilamentous soma is to be included. Wolfe is not explicit, but it seems that he must intend the second meaning. Both features, however, change in the life of the fruit-body, and thicken. The subhymenium, as the layer of interwoven hyphae, thickens as these hyphae branch and introduce more basidia, and this lateral extension of the hymenium stretches the divergent hyphae (of the cortex) so that they diverge more widely from the medulla and from each

other. Both layers are thicker in old fruit-bodies and in the upper parts of the tubes. For *B. tristis*, Wolfe (p. 126) gives the trama as 'slightly boletoid', which implies that it is immature with, as yet, slightly divergent cortical hyphae. The detail confirms the suspicion that the type-collection of *B. tristis* consists of young fruit-bodies. Presumably, if they had grown larger, the trama would have become as boletoid as in *B. longipes*. Thus I see no specific criterion in this distinction. For *B. longipes* I find that the subhymenium of interwoven hyphae thickens gradually from some 10–12 μm in young specimens and from near the pore-mouths to 20–25 (–30) μm in the upper parts of the tubes of old specimens; the hymenium is about 30–40 μm thick.

Lastly in this matter of specific distinction, there is the obvious question why Patouillard and Baker did not find the common *B. longipes* in the small area of the Gardens' Jungle where they collected their material, where H.N. Ridley had collected and first found *B. longipes*, and where I found it repeatedly from 1929 to 1944. Of the sixteen species of boleti which they described as new from the Gardens' Jungle, eleven had already been described by Massee. As he had described the pileus of *B. longipes* erroneously as viscid, doubtless this misled Patouillard and Baker.

AUSTROBOLETUS (CORNER) WOLFE

On making *Boletus* subgen. *Austroboletus*, I was cautious because, as I explained at some length, there seemed to be connections with subgen. *Tylopilus*, especially with species of *Porphyrellus* Gilbert which, with other mycologists, I regarded as part of *Tylopilus*. My point was that the species placed in *Austroboletus* were a distinct and natural alliance within the wide concept of *Boletus*. In raising the subgenus to a genus, Wolfe (p. 64) had remarked earlier (p. 62) that 'I believed that it had little in common with *Porphyrellus* sect. *Porphyrellus*', which is practically the opposite of my published conclusion. On p. 14, Wolfe gives a generic description of *Tylopilus* under which he includes *Porphyrellus;* on p. 66 he gives a generic description of *Austroboletus*. Both descriptions are variously inaccurate by omission and misrepresentation, but it is not clear whether the descriptions refer only to North American species or include those of the world; in any case a genus should not vary geographically. It seems that not until p. 130, in the summary, that *Tylopilus* and *Austroboletus* are actually compared. Here *Austroboletus* is distinguished by its ornamented spores, short and narrow pleurocystidia 'devoid of any microchemically positive contents', and subclavate cheilocystidia 'as fingers hanging from the tube-edge'. The marginal veil (mistakenly desecribed by Wolfe on p. 66 as unrolling), the colour of the spore-print, and the characteristically strong gelatinisation of the tubes in alcohol-formalin (as a physicochemical test) were omitted by him.

Regarding the pleurocystidia, I find no sharp distinction for I have measurements up to 90 μm long and 18 μm wide for the species which I placed in *Austroboletus*, and Wolfe gives measures of 40–105 (–120) x 9–20 (–27.5) μm for *Tylopilus* subgen. *Porphyrellus*. I gave shorter values for several species of *Tylopilus* in Malaya (Corner 1972a) and from some the pleurocystidia were absent. As for the cheilocystidia, I never observed in *Austroboletus* such 'fingers'. His distinction between the two genera must rest, therefore, solely on the spores.

There enters now a practical problem that will become more acute as the spores of more species are examined with the electron-microscope. It reveals that spores that appear smooth under the light-microscope may be very minutely rough, verrucose, or reticulately marked. Why, then, does a spore become smooth or rough ? I considered the question in my article on the Boletus-spore (Corner 1972b), which was written several years before the book on the Malayan species of *Boletus,* but long delayed in publication; hence there are some uncertainties about the names that were used. I pointed out that some species have extremely fine markings on the spore, barely visible under the light-microscope, and drew attention to the smooth spores of *B. nanus* Mass., *B. ablo-ater* Schw., and *Boletus* 18b of my notes (which is *B. griseipurpureus*), all of which belong to subgen. *Tylopilus,* and to those of *B. phaeocephalus* Pat. et Baker in subgen. *Boletus.* These spores are endospores, still very finely marked, from which the exospore has dissolved. Similarly I drew attention to the very finely striate spores of *B. fallax* Corner, *B. obscurecoccineus* Hoehn., and *B. ridiculus* Corner in subgen. *Boletellus.* I concluded in that paper that the smooth, narrow, typically boletoid spore was an endospore caused by compression of the spore in its development. The markings on the spores of *Austroboletus, Boletellus, Heimiella* and *Strobilomyces* lie internal to the smooth exospore and may be deposits from the mesospore or the endospore. Thus, boletoid spores which appear smooth may have vestigial markings in all degrees from that barely visible under the light-microscope to that barely visible under the electron-microscope. The problem may well come to decide at what magnification a spore is to be considered smooth.

B. longipes is a case in point. Under the electron-microscope its endospore is minutely and irregularly creviced (Wolfe and Petersen 1978). Their Fig. 1, for *B. tristis,* shows these crevices more as pits in a close and minute reticulum. If one was looking for an intermediate between the coarsely marked spore typical of *Austroboletus* and the smooth spore of *Tylopilus,* then *B. longipes* is an instance. It confirms my suspicion that *Austroboletus* cannot be separated generically. However, there are other features of *B. longipes* to be considered which lead me to doubt Wolfe's remark (p. 105) that *B. longipes* 'clearly belongs in *Austroboletus*'; he has not amended the description of this taxon to include *B. longipes.* My reasons are as follows:—

1. The colour of the spore-print, blackening in potash, is not that of *Austroboletus.*

2. The spore-shape is not amygdaliform as in *Austroboletus,* but typically boletoid as in *Tylopilus.* This is shown by the mean value of E (spore-length to spore-width); in *Austroboletus* it is 1.9–2.3, in *B. longipes* 2.4–3.3, and in *Tylopilus* 2.2–4.0. The compression of the boletoid spore is shown by the relation of the spore-width to the basidium-width; in *Austroboletus,* with least compression, it is 0.50–0.60, in *B. longipes* 0.45, and in *Tylopilus* 0.35–0.50 (Corner 1972b).

3. The pleurocystidia are not short and narrow, and they have vitreous-oily contents which often turn red-brown in alcohol-formalin (as a microchemical reduction), as in *Tylopilus.*

4. The cheilocystidia are large and clavate as in *Tylopilus.*

5. The tubes are adnato-decurrent to sinuato-adnexed as in *Tylopilus.*

6. The tube-trama is firmly subgelatinous in alcohol-formalin as in *Tylopilus,* not sloppily gelatinous as in *Austroboletus.*

7. The stem is not lacunoso-reticulate as common in *Austroboletus,* but longitudinally rugulose with shallow elongate meshes as in *Tylopilus.*

8. The pileus lacks the marginal veil, as in *Tylopilus.*

I conclude that *B. longipes* fits for all practical purposes with *Tylopilus* and that it does not have the distinctive features of *Austroboletus.* Nevertheless, its spores are peculiar and it is to be hoped that allies of it will be discovered in the forests of south-east Asia. I note that the SEM fiugre of the spore of *B. longipes,* shown by Wolfe and Petersen, reveals a slight smooth adaxial patch such as occurs more noticeably in *Austroboletus* and *Strobilomyces;* and this may indicate another line of boletus-evolution from the primitive state with uncompressed spore.

SYSTEMATIC POSITION OF *AUSTROBOLETUS*

On turning to the recent contributions of other mycologists, I find that Romagnesi (1977) recognises but one family of Boletaceae with three genera, namely *Boletus, Gyroporus,* and *Strobilomyces;* other genera are regarded as subgenera of *Boletus.* This work is not cited by Wolfe who follows mainly the classification of Singer (1975). This author peremptorily dismisses *Austroboletus* as a synonym of *Porphyrellus* without the least consideration, omits the type-species *B. dictyotus* (Boedijn) Corner as well as *B. mucosus* Corner, neither of which fits his diagnoses, gives 19 species for *Porphyrellus* and lists 24, and refers *B. malaccensis* (Pat. et Baker) Corner, *B. rubiicolor* Corner and *B. rarus* Corner to sect. *Graciles* Singer subsect. *Subflavidini* Singer. Thus he writes that the development of the fruit-body in *Porphyrellus* is unknown, though I described and figured it for the type-species of *Austroboletus.* He puts the disputed *B. tristis* in sect. *Porphyrellus* without mention of *B. longipes,* and assigns it thereby to Strobilomycetaceae, whereas I put *B. longipes* in *Boletus* subgen. *Tylopilus* which, as a genus or subgenus, has always been assigned to Boletaceae; and there its sect. *Porphyrellus* is now placed. Thus, as I maintained in 1972, the two families cannot be distinguished. The attempt by Singer in his key (p. 166) leaves the position of *B. longipes* completely in doubt.

Horak (1976), in recording *Porphyrellus gracilis* (Peck) Singer from New Guinea, follows Singer but diverges in the foreword by dissociating subgen. *Austroboletus* from *Porphyrellus,* with the remark that it should be made a genus. He also dissociates *Heimiella* from *Boletellus,* with which I would agree, and I would add it as a fourth genus to Romagnesi's concept of Boletaceae.

CONCLUSION

This account reveals the shortcomings of relying solely on type-specimens when dealing with the fleshy basidiomycetes. It is generally acknowledged that the characters of their species and genera must relate to the features of the living fungi; it is the practice of specific or monographic works. The shortcoming is particularly troublesome with tropical species which have usually been described in the first place from inadequate field-notes. Such species need to be re-discovered and re-described from ampler and living material. So *B. tristis* is found to represent merely young fruit-bodies of *B. longipes*, even though the two species have been referred to different families. To understand the mature fruit-body, knowledge of its development is essential, and this can be obtained only by the collection of living primordia which must be identified. In tropical countries where the study of these basidiomycetes is still so much handicapped by these inadequate descriptions, the local mycologist must be helped with a classification as simple as possible. Reliance on electron-microscope introduces a method usually unavailable to the amateur, especially in the tropics, and frustrates that old-fashioned and direct means of identification with the light-microscope on which mycology has relied and will continue to need. I cannot see the use of *Austroboletus* as an SEM genus; indeed, there is insufficient knowledge to delimit it.

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ENTOLOMA (Fr.) KUMMER IN THE MALAY PENINSULA

by

E. J. H. Corner

91 Hinton Way, Great Shelford, Cambridge CB2 5AH, England

A recent monograph by the Swiss mycologist E. Horak (1980) deals with those pink-spored toadstools assigned to *Entoloma* (Fr.) Kummer which have been found in south-east Asia and Australasia. That is from India to New Zealand, and he records the astonishing number of 220 species. It is a fundamental work in which the author supplies full taxonomic details and for which he has studied all the type-specimens that could be discovered. He himself has explored particularly the agaric flora of New Guinea and New Zealand, whence he has described a large number of new species. He has also studied the collections which I made from 1929 to 1944 in the Malay Peninsula, as well as those made on later expeditions to Borneo and the Solomon Islands. The Peninsula supplies 55 species and Borneo 34, most of them new; yet they have merely 13 in common. This is the first time that such a work on *Entoloma* has been available and it should give a great stimulus to the professional and the amateur, for there is still very much to be learnt.

The book is well written in plain English, well printed, and astonishingly light in weight for its 352 pages. The keys to identification are straightforward with number references to the descriptions where critical remarks are given on allied species. For most, line-drawings of the fruit-bodies and of microscopical details accompany the descriptions, and there are eight colour-plates for 31 Malayan species. I note that the figure of *E. limosum* (Plate 6b) should be *E. lineum,* as on p. 216.

Entoloma is now used in a wide sense and becomes an easy genus to recognise. The fruit-bodies lack ring and volva; the gills are never free as in *Pluteus;* and the pink spores, revealed by the pink gills or pink powder at the top of the stem, are characteristically angular. Little toadstools, formerly classified with some uncertainty as *Leptonia* and *Nolanea,* even with *Claudopus* and *Clitopilus,* are now dispersed among the larger ones of *Entoloma* s. str. according to their affinity. The fruit-bodies may be white, grey, yellow, brown, or blue — some intensely blue — though rarely red. The colouring is specific and, with the exception of the white species which appear as albinos, distinctive of alliances. A few have striking colour-changes on bruising.

Actually this substantial work is but a beginning. Some species are widespread in both temperate and tropical countries, even cosmopolitan. Others are known with wide gaps in their distribution; for instance there are species from Singapore and the Solomon Islands without intermediate record. Many are described from single gatherings. Some are common and appear regularly every

fungus season, often in the same place in the forest, while others are sporadic or rare though, in such cases, they may be wide-spread but reluctant to fruit. Among the species of the Malay Peninsula there are four which were collected by H.N. Ridley and described by G. Massee but have not been found again. These four species are: *E. bicolor* (Mass) Horak, described as *Leptonia* from Singapore, *E. curtipes* (Mass) Horak, described as *Clitopilus,* from Singapore, *E. longipes* (Mass) Horak, described as *Inocybe,* from Singapore and *E. tricolor* (Mass) Horak, described as *Leptonia,* from Penang. Collecting has been largely a matter of luck. The *Entoloma*-flora of the eastern tropics is by no means fully known. It is likely that the specific totals from the Peninsula and from Borneo are nearer to 100 than to 50 and that most of these they will have in common.

Because in this field-work, concentrated on collecting and describing, one is apt to disregard the biology of the species, I contribute a few notes on the growth and seasonal appearance of the fruit-bodies. My impression is that the fruit-bodies do not become fly-blown or beetle-ridden and, thus, they last longer in the tropical forests than those of many other agarics. Some appear early in the agaric season along with *Amanita, Russula,* and *Boletus,* but others are tardy, and some sporadic (Corner 1935). In its great abundance of tropical species, none of which appear to be mycorrhizal, *Entoloma* displays the myriad of micro-habitats available in the tropical humus. One such I found to be in the soil under the *bertam* palm (*Eugeissona*).

GROWTH OF FRUIT-BODIES

Entoloma flavidum (Massee) Corner et Horak

This fungus is fairly common in the forest of the Malay Peninsula but it has not been found elsewhere. It fruits rather late in the agaric season, generally with *Hygrophorus firmus* B. et Br. about a month or two after the beginning. In October-November 1934, I watched the development of two clusters of fruit-bodies in the Gardens' Jungle, Singapore. As usual with more or less caespitose fruit-bodies, many primordia begin; most abort at some early stage; and few come to maturity. Five of those which I marked matured and spored. The largest developed a pileus 6 cm wide with stem 6.4 cm long, but the smallest had a pileus merely 1.9 cm wide with stem 2.7 cm long. The largest specimen that I ever found had the pileus 10 cm wide with the stem 10 cm long.

Development was gradual. From a size of pileus/stem of 1.0/2.0 cm, the largest fruit-body took 13 days to reach full size; the smallest took 4 days. The five fruit-bodies then lasted and spored for a further 6–11 days; eventually they collapsed without becoming fly-blown. On plotting graphically the daily measurements, made about 8 a.m., and extending the curve backwards, I concluded that the primordia took 6–7 days to reach the stage with the pileus 1.0 cm wide. The total life of the fruit-body would, therefore, be about 28 days, which accords with the delayed appearance of the species in the agaric season. Most rapid growth occurred when the pileus extended from 2 cm to 5 cm wide in some 5 days, roughly the 10th to the 15th day in the life of the average fruit-body

Entoloma burkillae Massee

This striking fungus with intensely blue pileus and stem is common in Malayan forests and is known also from Borneo and New Guinea. It sometimes fruits earlier in the agaric season than *E. flavidum* but sporadic fruit-bodies may be found a month or two later; as with *E. flavidum,* it does not become fly-blown. I studied the growth of a single fruit-body in November 1934 in the Gardens' Jungle. The primordium which I found had the pileus 1.9 cm wide with a total height of 2.4 cm. In 4 days it reached full size with pileus 6.5 cm wide and total height of 5 cm. It lasted sporing for another 4 days. Other fully grown fruit-bodies, which I observed at other times lasted for 7–10 days. The largest that I found had the pileus 10 cm wide.

Entoloma sercellum (Fr.) Kummer

This fungus, for which I take the responsibility of identification, used to be common in the lawns of the Singapore Botanic Gardens. Either I failed to make dried specimens or they have been lost; hence this wide-spread species is not recorded by Horak for the Malay Peninsula. I could detect no difference from *E. sericellum* which was well known to me in England, but I append the description of the Singapore fungus.

From 9–26 April 1930, when the heavy rains had begun about 7 March (Corner 1935), I watched the development of 23 fruit-bodies. A few of these I was able to trace from primordia with the pileus 1–2 mm wide and a total height of 2–4 mm. From this size the fruit-bodies took about 5 days to become fully grown; the mature pileus varied 5–23 mm wide and the total height 12–30 mm. The fruit-bodies then lasted a further 2–4 days before beginning to collapse, mostly in the late afternoon. Generally the larger fruit-bodies had the longer life. If 2 days (48 hours) are given to the primordium to develop the pileus 1–2 mm wide, then the average fruit-body takes about 7 days to reach full size, when it persists for 3 days. The maximum period of growth occurred from the 4th to the 6th day when the pileus grew from 4–5 mm wide to 12–20 mm and the stem lengthened from about 10 mm long to about 25 mm Where two to three primordia developed close together, though not caespitose, only one survived to maturity.

E. sericellum in Singapore:—

Pileus 8–23 mm wide, convex, *very soon umbilicate,* not flattening, undulate, minutely scurfy, inclining to fibrillose at the margin and squamulose in the centre, *white then pale straw-colour,* finally dingy isabelline or dingy buff, dry, *not straite*: margin incurved at first, persistently inflexed. *Stem* 15–30 x 1.5–2.5 mm, cylindric, often compressed or twisted or thickened upwards, hollow, waxy-soft, cartilaginous, smooth or slightly fibrillose, apex pruinose, *watery white,* base white villous. *Gills* adnate or sinuate with or without a short decurrent tooth, varying subdecurrent, subdistant, sometimes connected by veins, *waxy-soft,* 18–26 primaries 2–3 mm wide, 2–3 ranks, *white then pinkish. Flesh* 1–1.5 mm thick in the centre of the pileus, *waxy-soft,* white, Smell waxy.

On lawns in the Singapore Botanic Gardens.

Spore 10–13 x 6.5–9.5 μ, angular ellipsoid, 1–3 guttate, pink. Basidia 35–55 x 10–12 μ, with 3–4 sterigmata 4–5 μ long. Cheilocystidia 25–50 x 7–15 μ, clavate to ventricose, possibly merely sterile basidia, but some longer cystidia –80 μ more or less decumbent. Surface of the pileus in the centre with a pile of hyphal ends projecting more or less perpendicularly, the end-cells 28–150 x 10–25 μ, cylindric, subclavate or subventricose, often with 1–3 subterminal cells strongly inflated, more or less decumbent over the limb.

Entoloma discophorum Corner et Horak

This fungus comes up quickly after the rains have begun.

Entoloma stylophorum (B. et Br.) Sacc.

The appearance of this fungus in the agaric season may be as early as with *E. discophorum* or tardy as with *E. flavidum*. It is a common species in the Peninsula and often has caespitose fruit-bodies. The pileus and stem vary pale yellowish to pale pinkish and, in the mountains, there is what I took to be a variety with fuliginous violaceous pileus but my specimens seem to have been lost; it used to be common by the walks on Fraser's Hill.

REFERENCES

Corner, E.J.H. 1935 The seasonal fruiting of agarics in Malaya. Gdns' Bull. Straits Settlements IX: 79-88.

Horak, E. 1980 *Entoloma* (Agaricales) in Indomalaya and Australasia. Nova Hedwigia Beiheft 65: 1-352. J. Cramer: FL-9490 Vaduz.

CAETANO XAVIER FURTADO
1897 - 1980

Photo taken in 1972

CAETANO XAVIER FURTADO

1897 - 1980

AN OBITUARY

It is with deep regret that we have to record the sad demise of Dr C. X. Furtado. Dr Furtado passed away on 13th June 1980 at the Singapore General Hospital after a short illness. Caetano Xavier Furtado was born in Goa, India on 14th October 1897. Upon his graduation at the Poona Agricultural College in 1921 he was employed in Burma for some time before he joined the Singapore Botanic Gardens as Field Assistant in 1923. He was later promoted to the post of Botanist. He was awarded the Doctorate of Science by the University of Bombay just before the outbreak of the war.

Dr Furtado is the author of many papers especially on nomenclature and on the systematics of the Palmae and Araceae. Outstanding are his papers on the complex genera of rattan palms (Calamus and Daemonorops) which are so important in local use and so elaborately varied in their structure. He added greatly to our knowledge of these plants and also corrected many errors in earlier statements upon them. Most of his works have been published in the Gardens' Bulletin, as well as in Sonderalbdruck aus Fedde Repertorium, the Philippine Journal of Science and Taxon. He has contributed much towards the work at the Gardens' Herbarium and as an adminstrator he managed the Gardens well. During the critical period of the war years under the Japanese occupation forces, Furtado together with Dr R. E. Holttum, Dr E. J. H. Corner and the Gardens' Staff, worked unselfishly to preserve the herbarium and maintain the living collections in the Gardens.

Although Furtado retired from service in 1952 he was re-employed in the same post until August 1960. Thereafter he visited the Gardens regularly to continue his botanical work, until a few years back when his health deteriorated and we saw little of him. In the years after 1960 he supervised the work of Colombo Plan students from other countries in South East Asia.

Furtado took a keen interest in things historical and he wrote a number of articles in connection with the history of Malacca especially the era when Malacca was under Portuguese rule.

Being a very religious and devout Catholic, he was awarded a Papal Medal in 1964 for his contributions to the Catholic press.

In recognition of his work on the family, a palm **Maxburretia furtadoana** was named after him by Dr John Dransfield (Gentes Herbarium, 11 (4) p. 191. 1978) to mark the occasion of his eightieth birthday.

Furtado was a gentle and kindly man. It was both a pleasure and honour for me to have been associated with him for over 30 years in the work of the Singapore Botanic Gardens.

He is survived by his wife, three daughters and two sons, one of whom is Professor J. I. R. Furtado of the Department of Zoology, University of Malaya.

To his widow and family we extend our deepest sympathy.

A G ALPHONSO

ON THE UNIFICATION OF *LAPLACEA* AND *GORDONIA* (THEACEAE)

HSUAN KENG

Department of Botany, University of Singapore

SUMMARY

Laplacea Kunth and *Gordonia* Ellis, generally treated as two separate genera, are not distinct and therefore do not merit full generic status.

Kobuski (1950), in his treatment of the Central and South American species of *Laplacea* Kunth (Theaceae — Theoideae), considered that this genus was represented by about 10 species in the Malayan and Indonesian region, but his promised treatment of these species never eventuated. Most authors have considered the two genera, *Laplacea* and *Gordonia* Ellis, to be distinct (e.g., Melchior 1925, Kobuski 1950, Backer & Bakhuizen f. 1963), but Burkill (1917), in a preliminary study of the genus *Gordonia*, listed all the species of *Haemocharis* Salisb. ex Mart. & Zucc. (synonymous with *Laplacea*) as probably belonging to *Gordonia*, although he did not formally recombine them. Sealy (1958) also considered that the two genera were probably inseparable. In preparing an account of the Theaceae for the 'Tree Flora of Malaya' (Keng 1978) and for the 'Flora Malesiana', study of the literature and of the specimens available convinced me that *Laplacea* was in fact inseparable from *Gordonia*.

For the purpose of discussion, two main series of evolutionary trends in the flowers of subfamily Theoideae (or Camellioideae, Keng 1962) of Theaceae, can be traced:

Series I. From a flower with a large number of 'bracteoles' (perules) gradually increasing in size and passing into the sepals, which in turn, by degrees, increase in size and change in texture and colour and pass into petals (Fig. 1, type A), to flower with three clearly differentiated and definitely numbered appendicular parts: 2 'bracteoles', 5 sepals and 5 petals (Fig. 1, type B).

Series II. From a flower with 5 totally free, slender styles (Fig. 1, type C), to one with a style base and 5 branches, and finally to one with a single stout style which has a shallowly 5-lobed stigma (Fig. 1, type D).

In addition to these two, other plausible trends include the following:

(a) From a flower with free stamens to one with various degrees of fusion of its filaments or to another with different grades of adnation of its filaments to the corolla.

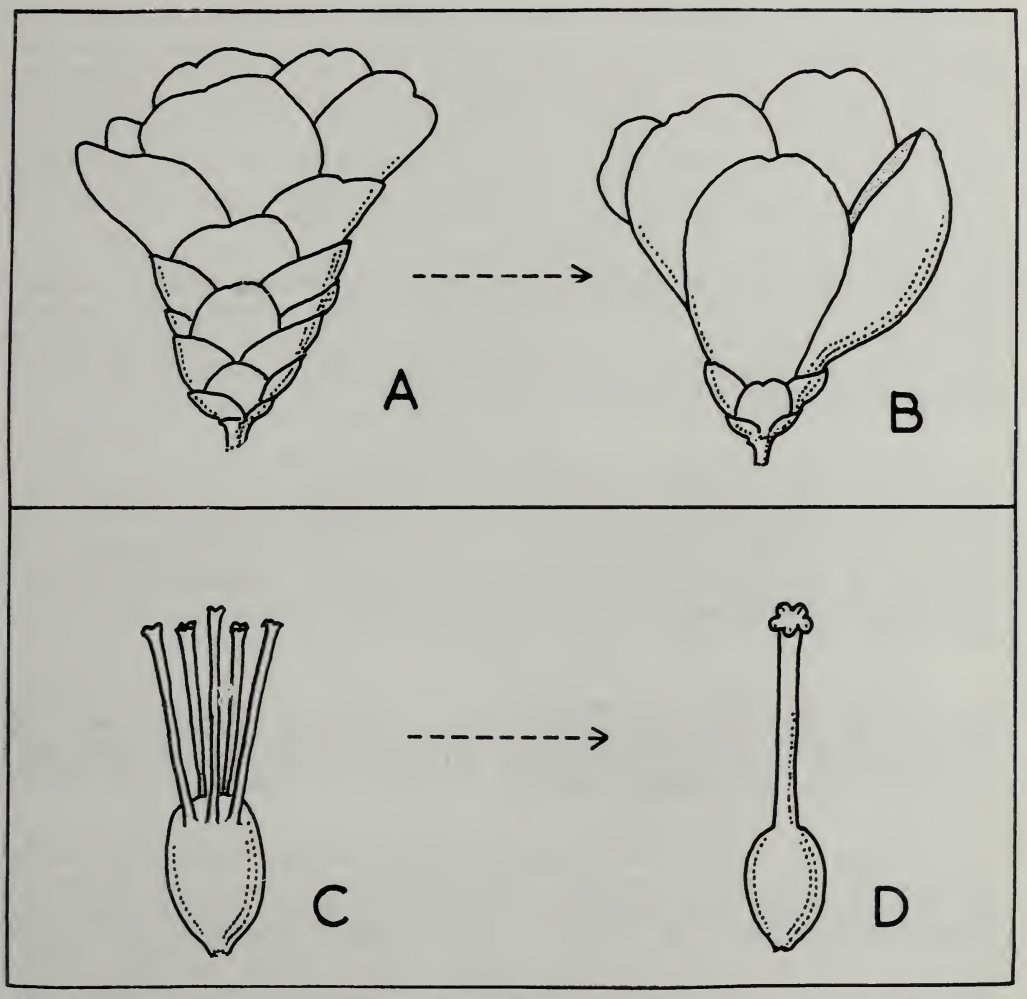

Fig. 1. Diagrammatic representation of two series of evolutionary trends in the Theaceae-Theoideae, showing four basic types of flowers: A. With successive but not clearly differentiated appendicular parts; B. With clearly differentiated appendicular parts: 2 bracteoles, 5 sepals and 5 petals; C. With 5 free styles; D. With a single style which is a complete fusion of 5 units. Intermediate stages between A & B, and between C & D are omitted.

(b) Progressive reduction of the number of ovary locules (from 5 to 3) and of the number of ovules (from several to 2) in each locule.

(c) Progressive reduction of the length of peduncles.

A full range of variation, from presumably the extremely basic form to the highly modified form, and also almost every possible combination of these varied features, can be found in the flowers of different species of *Camellia* (cf. Sealy 1958), and to a lesser extent, in those of *Pyrenaria* (Keng 1981); both genera, like the *Gordonia-Laplacea* complex, belonging to subfamily Theoideae of the Theaceae.

When the earlier collections of Asiatic theaceous plants reached Europe, the tea-plant, with the flowers approximately as in Type B in Fig. 1, and the camellia plant, with flowers approximately as in Type A in Fig. 1, were described by Linnaeus in 1753 as two different genera, *Thea* and *Camellia.* A series of intermediate forms has since been observed among the subsequently described Asiatic species which almost bridge the gap between *Thea* and *Camellia,* leading Sweet as early as 1818 to unite them into a single genus under the name of *Camellia.* This reduction has been accepted almost universally.

The character of the styles whether completely free or fused in various degrees, was employed as the basis of subgeneric division of the genus *Pyrenaria* by Melchior (1925). The skilful application of the combination of the characters of perianth and style forms the very foundation of Sealy's (1958, p. 28) classification of the genus *Camellia.*

With this broad picture in mind, we can discuss the classification of the *Gordonia-Laplacea* complex. The type species of *Gordonia,* viz. *G. lasianthus* Ellis, occurs in coastal plain areas from North Carolina to Florida in the south eastern United States (Kobuski 1951). It is characterized by the following floral features: (1) peduncle relatively long (5–8 cm), with 4 caducous bracteoles; (2) sepals and petals usually 5 each, rather clearly differentiated; (3) style single, stout, with a 5-lobed stigma.

On the other hand, the type species of *Laplacea,* viz. *L. speciosa* Kunth, occurs in S. America (Ecuador, Venezuela and Colombia) (Kobuski 1950). It is characterized by the following features: (1) peduncle relatively short (less than 1 cm); (2) sepals 5, gradually passing in to petals; (3) styles 5, free.

In addition to *Gordonia* and *Laplacea* species in the New World, some Asiatic species belonging to this complex have been placed in other genera, e.g., *Polyspora* (by Sweet in 1826), *Haemocharis* (by Salisbury in 1806), *Antheeischima* (by Korthals in 1840), *Closaschima* (by Korthals in 1840) and *Nabiasodendron* (by Pitard in 1902) (For details see Burkill 1917, Melchior 1925, and Sealy 1958). Among numerous rather confusing binomials, *"Polyspora" axillaris* (Roxb. ex. Ker) Sweet and *"Haemocharis" integerrima* (Miq. Koord. & Val. single out as examples. The former species was originally described from cultivated plants in India, its native home as later studies revealed, is S. China and Hong Kong. It is characterized by the following: (1) peduncle subsessile; (2) bracteoles (perules) gradually passing into sepals, about 10 in all; (3) petals 5 or 6; (4) style single, stout, shallowly 5-lobed at summit. The latter species was described from Java, although the floral structure in general agrees with the former species, the five distinct styles are almost totally free at the base.

Thus the floral structure of the four above-mentioned taxa, approximate the following combinations of the four basic types in Figure 1.

Gordonia	BD
Laplacea	BC
"Polyspora"	AD
"Haemocharis"	AC

Although the floral characters of *Camellia, Pyrenaria* and the *Gordonia-Laplacea* complex as described above are so variable, paradoxically their fruit and seed characters, especially the latter, are remarkably constant. These can be summarized below (Sealy 1958; Keng 1962, 1972; Corner 1976).

I. *Camellia* (Fig. 2, A, B)

Fruit usually subglobose or tricoccate, mostly woody capsular, thin- or thick-walled, splitting from the apex into 3–5 valves which remain attached to the central column at base.

Seeds globose, hemispheric or rounded dorsally and wedge-shaped ventrally, no endosperm; embryo large, with a pair of thick, flat and closely adpressed cotyledons.

II. *Pyrenaria* (Fig. 2, D, E)

Fruit usually globose, subglobose or 3–5-grooved, the wall either thick, soft-woody and indehiscent, or thin, cartilaginous and dehiscing from the base into 3–5 valves which usually remain attached to the top of the central column for some time and then falling off eventually.

Seeds laterally compressed, elliptic in side view, often irregularly angular and plane due to mutual compression; endosperm absent; embryo large, with a pair of very large, thin cotyledons folded and twisted within the seedcoat.

III. The *Gordonia-Laplacea* complex (Fig. 2, G, H)

Fruit ellipsoid oblong, mostly 5- or sometimes 3-grooved, woody capsular, splitting from the apex downward into 5 or 3 sharp valves which remain attached to the central column.

Seeds relatively small, ellipsoid, flattened, with a large obliquely attached apical wing; endosperm of a thin layer; embryo fairly large, slightly curved; cotyledons lanceolate, flat and closely adpressed.

Furthermore, although the seedling characters of only very few species were examined (Burkill 1917, Keng 1962, 1972, Burger 1972), they appear to be vastly different among these three taxa. For example in *Camellia sinensis* O.K., the two large hemispheric cotyledons essentially retain within the seedcoat serving as food reservoirs, and remain underground; after the epicotyl emerges from the soil, 3–5 cataphylls are produced, followed by larger, petiolate foliage leaves (Keng 1962) (Fig. 2, C). In *Pyrenaria acuminata* Planch., the two huge, laminate cotyledons which were folded and twisted within the seedcoat, emerge and expand to full size (ca. 2.5 x 3.5 cm) and function instantly as photosynthetic organs (Keng 1972) (Fig. 2, F). Whereas in *Gordonia singaporeana* Wall. ex Ridl., the two tiny, oblong cotyledons, after emerging from the soil, expand to full size (ca. 0.2 x 1 cm) and function as photosynthetic organs until the foliage leaves are established. (Burkill 1917) (Fig. 2, I)

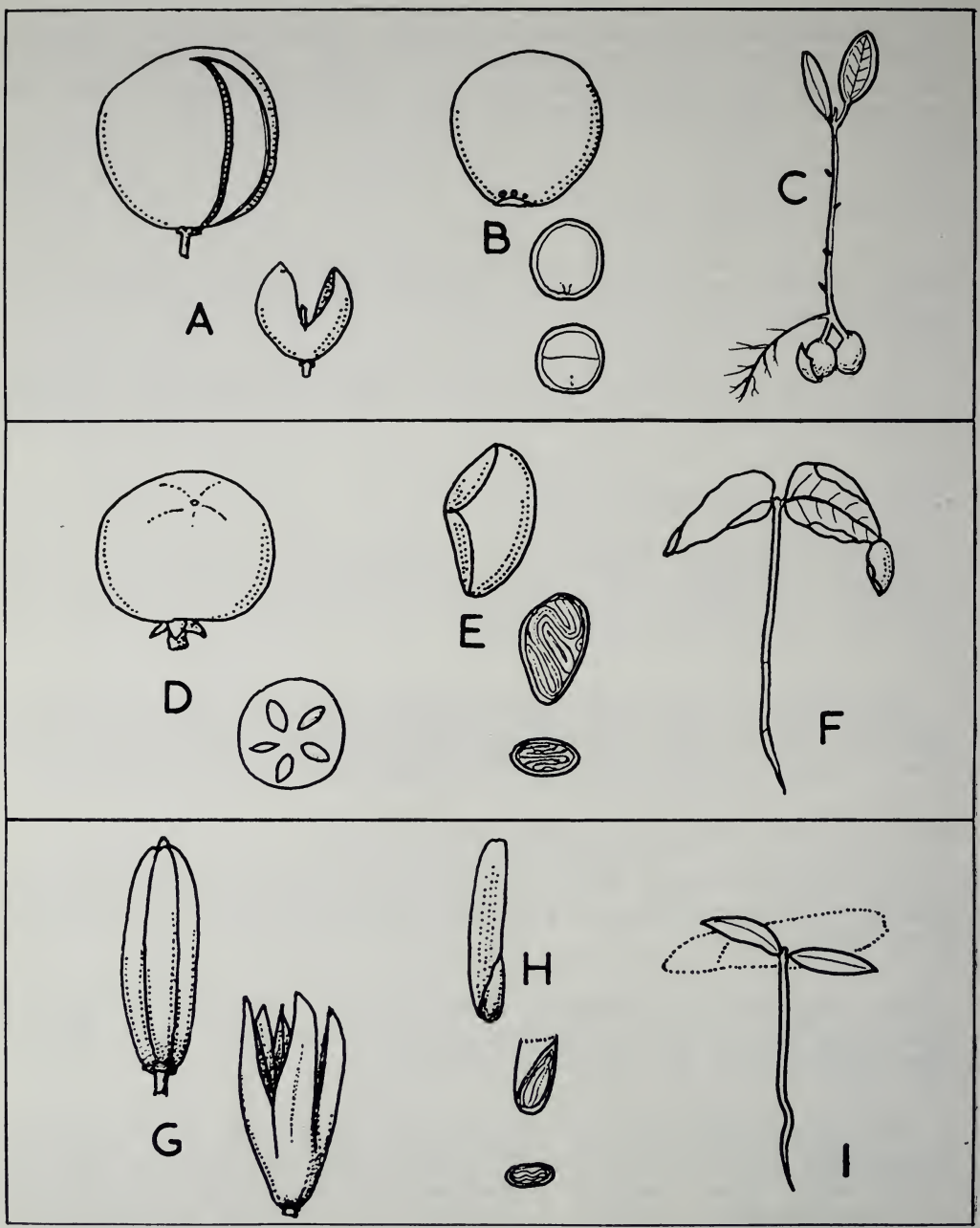

Fig. 2. Fruits, seeds, and seedlings of *Camellia sinensis* O.K. (A, B, C), *Pyrenaria acuminata* Planch. (D, E, F), and *Gordonia singaporeana* Wall. ex Ridl. (G, H, I).
A. Spheric, dehiscent capsule, with a large seed inside; B. Exalbuminous seed, the embryo with a pair of hemispherical cotyledons; C. Seedling; the thick cotyledons serving as food reservoir for early stage of seedling development.
D. Subglobose, indehiscent, soft-woody, drupaceous capsule, with 1, 2 or several seeds in each of the 5 chambers; E. Exalbuminous seed, the embryo with a pair of extremely large thin cotyledons clasped and irregularly plaited within the seed coat; F. The cotyledons unfolded and spread from the seed coat, photosynthesizing during the early stages of seedling development.
G. Cylindrical capsule, dehiscing by 5 valves; H. Winged, scantily endospermous seed, the embryo with a pair of thin, narrow and slightly undulating cotyledons; I. The cotyledons emerging from the seed coat, photosynthetic. (A, B, C from Keng 1962; D, E, F based on Keng 1972; G, H, I based on Burkill 1917).

Since the floral characters of the *Gordonia-Laplacea* complex, as in *Camellia* and *Pyrenaria* of the same subfamily are so variable whilst their fruit and seed characters are uniform, it seems more logical and appropriate to treat this complex as a single genus rather than to split it into two, three or more genera with largely overlapping characters. In this sense, the geographical range of *Gordonia* (*sensu lato*) will cover both subtropical and tropical regions of S.E. Asia, N. America, and C. & S. America,, and be closely comparable to that of *Cleyera* and *Ternstroemia* (Keng 1962, pp. 351-3) of Theaceae, and to that of numerous amphi-transpacific genera of various families as enumerated by Steenis (1962).

For the reasons given above, the present writer therefore formally proposes to merge *Laplacea* HBK with *Gordonia* Ellis, and to reduce the known species of *Laplacea* to *Gordonia.*

Gordonia Ellis in Phil. Transact. 60 (1770) 518, *t. 11. nom cons.*

Laplacea Humboldt, Bonpland and Kunth, Nov. Gen. Pl. 5 (1822) 160 (ed. folio, 207), *t. 461;* DC. Prodr. 1 (1824) 527; Benth. & Hook. f. Gen. Pl. 1 (1862) 186; Melchior in E. & P. Nat. Pflanzenfam. ed. 2, 21 (1925) 135; Kobuski in J. Arnold Arb. 28 (1947) 435, 30 (1949) 167, 31 (1950) 406. *syn. nov.*

The ten Malesian species which were formerly described under *Laplacea* (or *Haemocharis*) as enumerated by Burkill (1919) and Melchior (1925) will be treated and incorporated into the following account: "Flora Malesianae Precursores LVIII, part 2, The genus *Gordonia* in Malesia."

The following West Indian species were formerly included in Kobuski's (1949) revision of *Laplacea.*

Gordonia alpestris (Krug & Urban) H. Keng, comb. nov.

Haemocharis alpestris Krug & Urban in Bot. Jahrb. 21 (1896) 547.

Haiti.

Gordonia angustifolia (Brit. & Wils.) H. Keng, comb. nov.

Haemocharis angustifolia Britton & Wilson in Bull. Torrey Bot. Cl. 50 (1923) 43.

Cuba.

Gordonia benitoensis (Brit. & Wils.) H. Keng, comb. nov.

Haemocharis benitoensis Britton & Wilson in Mem. Torrey Bot. Cl. 16 (1920) 82.

Cuba.

Gordonia curtyana (A. Rich.) H. Keng, comb. nov.

Laplacea curtyana A. Richard, Ess. Fl. Cuba 1 (1845) 225.

Cuba.

Gordonia ekmanii (Schmidt) H. Keng, comb. nov.

Laplacea ekmani O.C. Schmidt in Fedde, Rep. Sp. Nov. Reg. Veg. 22 (1925) 94.

Cuba.

Gordonia haemotoxylon Swartz, Fl. nd. Occ. 2 (1800) 1199.

Jamaica.

Gordonia moaensis (Marie-Vict.) H. Keng, comb. nov.

Laplacea moaensis Marie-Victorin in Contr. Inst. Bot. Univ. Montreal 49 (1944) 72.

Cuba.

Gordonia portoricensis (Krug & Urban) H. Keng, comb. nov.

Haemocharis portoricensis Krug & Urban in Bot. Jahrb. 21 (1896) 548.

Porto Rico.

Gordonia urbanii (O.C. Schmidt) H. Keng, comb. nov.

Laplacea urbanii O.C. Schmidt in Fedde, Rep. Sp. Nov. Reg. Veg. 22 (1925) 93.

Cuba.

Gordonia villosa Macfadyen, Fl. Jamaica 1 (1837) 117.

Jamaica.

Gordonia samuelssonii (O.C. Schmidt) H. Keng, comb. nov.

Laplacea samuelssonii O.C. Schmidt in Fedde, Rep. Sp. Nov. Reg. Veg. 29 (1931) 16.

Haiti.

Gordonia wrightii (Griseb.) H. Keng, comb. nov.

Laplacea wrightii Grisebach in Mem. Amer. Acad. n.s. 8 (1860) 166.

Cuba.

The following Central and South American species were included in Kobuski's (1950) revision of *Laplacea*.

Gordonia acutifolia (Wawra) H. Keng, comb. nov.

Haemocharis semiserrata (Nees) Cambessedes var. *acutifolia* Wawra in Martius, Fl. Bras. 12 (1886) 290.

Brazil.

Gordonia brandegeei H. Keng, nom. nov.

Laplacea grandis T.S. Brandegee in Univ. Calif. Publ. Bot. 6 (1915) 186. (non *Gordonia grandis* Andre 1880).

Mexico, Costa Rica, Guatemala, Panama, Honduras (?).

Gordonia fruticosa (Schrad.) H. Keng

Wikstroemia fruticosa Schrader in Gotting. Gel. Anzeig. 1821 (71) (May 5, 1821) 711..

Laplacea fruticosa (Schrad.) Kobuski in J. Arnold Arb. 28 (1947) 437.

Brazil, Peru, Venezuela, Guiana, Panama, Costa Rica.

Gordonia humboldtii H. Keng, nom. nov.

Laplacea speciosa HBK. Nov. Gen. & Sp. 5 (1822) 209, *t. 461* (non *Gordonia speciosa* Choisy 1855).

Ecuador, Venezuela.

Gordonia obovata (Wawra) H. Keng, comb. nov.

Laplacea semiserrata (Nees) Camberssedes var. *obovata* Wawra in Marius, Fl. Braz. 12 (1886) 290.

Brazil.

Gordonia planchonii H. Keng, nom. nov.

Laplacea pubescens Planchon & Linden ex Triana & Planchon in Ann. Sci. Nat. ser. 4, 18 (1862) 269. (non *Gordonia pubescens* Cavanilles 1787).

Colombia, Bolivia, Peru.

Gordonia robusta (Kobuski) H. Keng, comb. nov.

Laplacea robusta Kobuski in J. Arnold Arb. 31 (1950) 415.

Colombia.

Gordonia spathulata (Kobuski) H. Keng, comb. nov.

Laplacea spathulata Kobuski in J. Arnold Arb. 31 (1950) 424..

Peru, Brazil.

Gordonia tomentosa (Mart. & Zucc.) Spreg. Syst. Veg. Cur. Post 4 (1827) 260.

Haemocharis tomentosa Martius & Zuccarini, Nov. Gen. & Sp. 1 (1826) 108, *t. 67.*

Brazil.

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TAXONOMIC NOTES ON THE TRIBE DISSOCHAETEAE (NAUD.) TRIANA (MELASTOMATACEAE)

J. F. Maxwell

Botanic Gardens, Singapore

In a recent revision the tribe Dissochaeteae (Naud.) Triana has been found to include 54 species and 32 varieties which are in the following genera: *Diplectria* (Bl.) Reichb., *Dissochaeta* Bl., *Macrolenes* Naud., *Creochiton* Bl., and *Pseudodissochaeta* Nayar.* The first four genera are woody climbers, while the last genus has species which are mostly shrubs or trees up to 5 m tall. The entire tribe ranges from Assam, throughout SE Asia, Hainan, throughout the Malay Archipelago and the Philippines, to New Britain.

The Dissochaeteae has been divided into two subtribes based on the positions of the stamens and staminodes:

1. Subtribe Diplectrinae Maxw., *subtrib. nov.*

Stamina petalibus opposita maiora, semper fertilia; stamina petalibus alternatia staminodia reducta.

Stamens opposite the petals larger and fertile, those alternating with them reduced to staminodes.

2. Subtribe Dissochaetinae Naudin

Stamens opposite the petals smaller, sometimes reduced to staminodes, or absent; those alternating with the petals larger and always fertile.

Subtribe Diplectrinae Maxw. includes one genus, *Diplectria* (Bl.) Reichb., with 8 species and 4 varieties. The following changes have been made from the most recent revision of this genus by Veldkamp et al. in Blumea 24 (1978) 405:

1. *Diplectria anomala* (King) Veldk. l.c. 426 and fig. 5C has been reduced to a synonym of *Diplectria viminalis* (Jack) O. Ktz.

2. *Diplectria beccariana* (Cogn.) O. Ktz. was considered by most authors as *Dalenia beccariana* (Cogn.) Ridl. *ex* Nayar. *Dalenia beccariana* (Cogn.) Ridl. *ex* Nayar var. *matangensis* Nayar and *Dalenia furfuracea* Ridl. have been reduced to *syn. nov.* of *Diplectria beccariana* (Cogn.) O. Ktz.

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* Ph. D. thesis, University of Singapore, June 1980.

3. *Diplectria glabra* (Merr.) Nayar var. *glabra, stat. nov. Diplectria glabra* (Merr.) Nayar ssp. *glabra,* Veldk. l.c. 421 and fig. 4B.

4. *Diplectria glabra* (Merr.) Nayar var. *kinabaluensis* (Veldk.) Maxw., *stat. nov. Diplectria glabra* (Merr.) Nayar ssp. *kinabaluensis* Veldk. l.c. 422 and figs. 1A, 4C.

5. *Diplectria glabra* (Merr.) Nayar var. *micrantha* (Veldk.) Maxw., *stat. nov. Diplectria micrantha* Veldk. l.c. 422 and fig. 5B.

6. *Diplectria glabra* (Merr.) Nayar var. *papuana* (Mansf.) Maxw., *stat. nov. Diplectria papuana* (Mansf.) Bakh. f., "Thesis" (1943) 202, Med. Mus. Bot. Utrecht 91 (1943) 202, Rec. Trav. Bot. Neerl. 40 (1943-45) 202.

Subtribe Dissochaetinae Naudin

7. *Dissochaeta* Bl. includes 21 species, 20 varieties, and has been divided into three sections: sect. Dissochaeta, sect. Anoplodissochaeta Baill., and sect. Omphalopus (Naud.) Baill.

8. *Neodissochaeta* Bakh. f., l.c. 24, 134; is reduced to a synonym of *Dissochaeta* Bl.

9. *Dissochaeta annulata* Hk. f. *ex* Triana var. *griffithii* (Nayar) Maxw., *comb. et stat. nov. Macrolenes griffithii* Nayar, J. Jap. Bot. 55:2 (1980) 47 (15).

10. *Dissochaeta annulata* Hk. f. *ex* Triana var. *johannis-winkleri* (Schwartz) Maxw., *stat nov. Dissochaeta johannis-winkleri* Schwartz, Mitt. Inst. Bot. Hamburg 7 (1931) 251. Plate 1, holotype.

11. *Dissochaeta fallax* (Jack) Bl., more commonly known as *Omphalopus fallax* (Jack) Naud., is the only representative of *Dissochaeta* sect. *Omphalopus* (Naud.) Baill. *Omphalopus fallax* (Jack) Naud. var. *novoguineensis* Mansf. is a *syn. nov.* of *Dissochaeta fallax* (Jack) Bl.

12. *Dissochaeta glandiformis* Maxw., *sp. nov.*

Ramuli obtuse quadrangulares et quadrosulcati, stellato-furfuracei; cristae interpetiolares annulares, c. 2–3 mm latae. Inflorescentia terminalis, thyrsoidea multiflora, minime 15 cm longa. Calyx campanulatus, c. 5 mm longus, c. 2 mm latus, furfuraceo-stellatus, glabrescens; lobis in alabastro distincte connatis ad structuram tenuiem glandiformen vel tholiformen conspicue venatam, sine suturis, apice munita apertura termi 4 loba, difisa in patribus 4, saepe irregularibus, in maturitate c. 2 mm longis, apicem versus late rotundatis atque densique caducis vel maturis marcescentibus. Stamina 4, alternipetala, in alabastro c. 7 mm longa, apicem verus angustata, crista subtriangularis, c. 0.5 mm longa, appendicibus posterioribus applanatis tenuibus c. 3 mm longis.

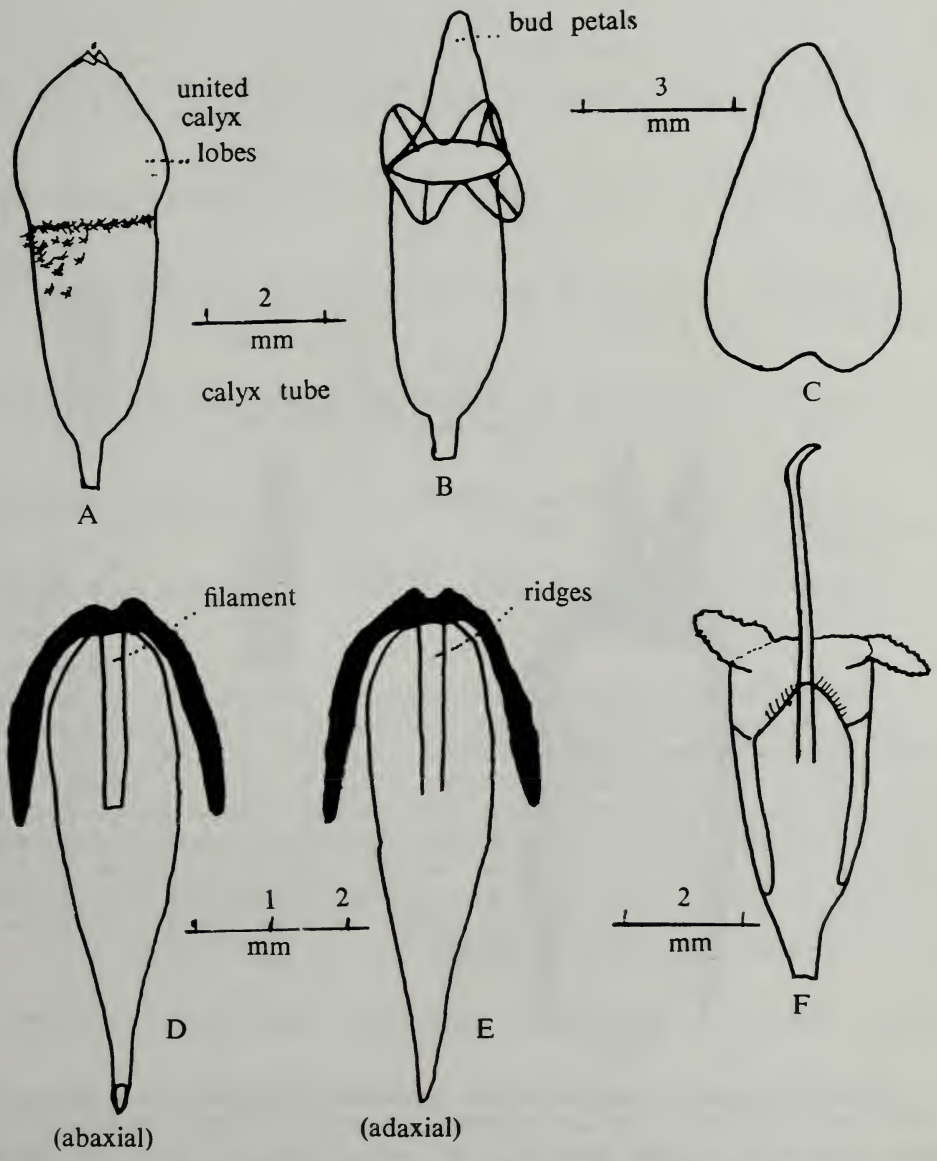

Fig. 1. *Dissochaeta glandiformis* Maxw. A: calyx with united calyx lobes; B: calyx split into four lobes; C: bud petals; D, E: alternipetalous stamens in bud; F: ovary. A-E Meijer 7282 (holotype).

Typus: Meijer 7282 (*holotypus* L). Tab. 1, A-E.

Branchlets bluntly 4-angled and 4-grooved, stellate furfuraceus; interpetiolar crests annular, 2–3 mm wide; inflorescence terminal, in a multiflowered panicle of cymes (thyrse) which is at least 15 cm long; calyx campanulate, c. 5 mm long, 2 mm wide, stellate furfuraceus and glabrescent, lobes in bud distinctly united

in a thin glandiform (lingum) or tholiform structure with distinct venation and no visible sutures and with a tiny, 4-lobed opening at the top which splits into 4, often irregular, lobes c. 2 mm long at maturity which are broadly rounded at the tip and finally either fall off or wither in mature flowers; stamens 4, alternipetalous, c. 7 mm long in bud, narrowed to the tip, crest somewhat triangular, c. 0.5 mm long, posterior appendages flattened and thin, c. 3 mm long.

The lingum-shaped "cap" with a hole in the tip is unique in the Dissochaeteae.

Distribution: Sumatra, Korintji Region, Gunong Tudjuh: Meijer 7282 (holotype, L). Fig. 1, A-E.

13. *Dissochaeta intermedia* Bl. var. *leprosa* (Bl.) Maxw., *stat. nov.* *Dissochaeta leprosa* (Bl.) Bl., Flora 14 (1831) 494 and Bijdr. Nat. Wet. 6 (1831) 237.

14. *Dissochaeta intermedia* Bl. var. *sagittata* (Bl.) Maxw., *stat. nov.* *Dissochaeta sagittata* Bl., l.c. 500 and l.c. 214.

15. *Dissochaeta laeve* Ohwi *ex* Maxw., *sp. nov.* *Anplectrum laeve* Ohwi, *in scheda* (L).

Ramuli cylindrici, minute stellato-furfuracei, glabrescentes; cristae interpetiolares applanatae, c. 2.5 mm longae, setis marginabilus furfuraceis c. 0.75 mm longis munitae. Foliorum lamina subtus domatis binis basalibus. Inflorescentia cymis racemiformibus angustis pauciflorus, c. 4–6 cm longis composita. Calyx campanulatus, c. 3 mm longus, 2.5 mm latus, margine truncato, punctis 4 minutus munito. Stamina, 8, antheris poro terminali minuto, poro angustior quam antherarum apiculi. Antherae alternipetalae crista erosa bifida ad biloba (i.e. valde irregulari), c. 1.5 mm longa, atque appendicubus posteriorubus binis applanatis 2 mm longis. Antherae oppositipetalae minores, appendice lineari c. 1 mm longo, apice erosi atque irregulariter marginato.

Typus: Endert 3127 (*holotypus* L, *isotypus* K). Tab. 2, A-D.

Branchlets cylindric, minutely stellate furfuraceus and glabrescent; interpetiolar crests flat, c. 2.5 mm long with furfuraceus marginal bristles c. 0.75 mm long; blades with a pair of basal domatia on the undersurface near the petiole; inflorescence in narrow racemes of cymes, few-flowered, 4–6 cm long; calyx campanulate, c. 3 mm long, 2.5 mm wide, margin truncate with 4 minute points; stamens 8, anthers with a minute terminal pore which is smaller than the tip of the anther; alternipetalous anthers with an erose, bifid, to 2-lobed (i.e. very irregular) crest c. 1.5 mm long and a pair of flattened posterior appendages c. 2 mm long; oppositipetalous anthers smaller with a linear appendage which has an erose tip and irregular margins, c. 1 mm long.

Distribution: Borneo, central east part, W. Koetai near L. Petah: Endert 3127 (holotype L, isotype K). Fig. 2, A-D.

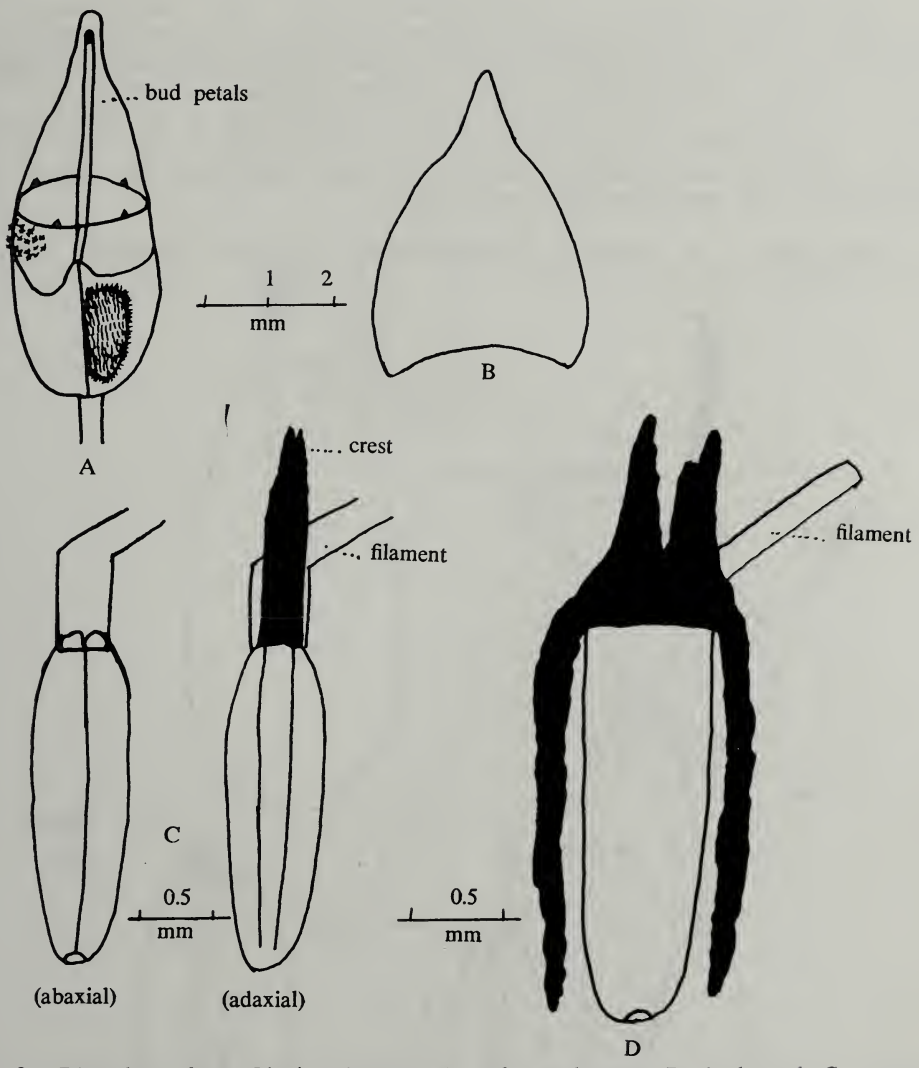

Fig. 2. *Dissochaeta laeve* Ohwi *ex* Maxw. A: calyx and ovary; B: bud petal; C: oppositipetalous stamen in bud; D: alternipetalous stamen in bud. A-D Endert 3127 (holotype).

16. *Dissochaeta microplectrosa* Maxw., *sp. nov.*

Inflorescentia axillaris, 5–7 cm longa, pauciflora. Calyx campanulatus, c. 4 mm longus, stellato-puberulus glabrescens, margine late ac non-profunde undulato. Stamina 8, antheris apicem versus angustatis, poro terminalis atque obliquo; stamina minora oppositipetala, appendice minuta ad basin facis adaxialis (connectivum) ad basin utraeque loculi calcari minuto. Antherae majores alternipetalae ad basin lobulo minuto munitae, ceterum inappendiculatae. Fructus subglobosi, 9–10 mm longi, apice mammiformi atque ex areolo protruso instructi.

Typus: Lörzing 13673 (*holotypus* L). Tab. 3, A-D.

Inflorescence axillary, 5–7 cm long, few-flowered; calyx campanulate, c. 4 mm long, stellate puberulous and glabrescent; margin with 4 broad and shallow undulations; stamens 8, anthers narrowed to the tip, pore terminal and oblique; smaller anthers oppositipetalous with a minute appendage at the base of the adaxial (connective) surface, abaxially with a minute spur at the base of each locule; larger anthers alternipetalous with a minute lobe at the base of the anther, otherwise inappendiculate; fruit subglobose, 9–10 mm long, top of fruit mammiform and protruding from the areolus.

Distribution: N. Sumatra, Karoboclebende, N. Fusz Sinabung: Lörzing 13673 (holotype L). Fig. 3, A-D.

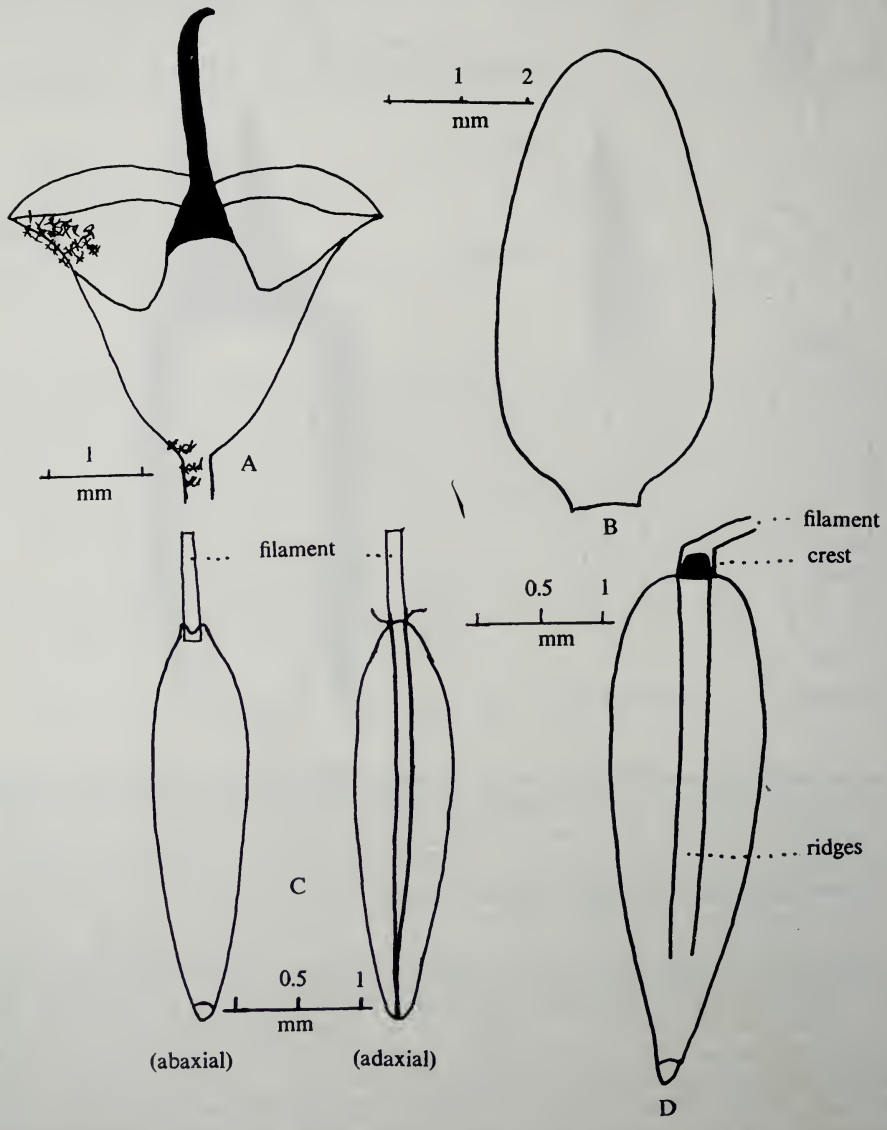

Fig. 3. *Dissochaeta microplectrosa* Maxw. A: calyx and ovary; B: mature petal; C: oppositipetalous stamen in bud; D: alternipetalous stamen in bud. A-D Lörzing 13673 (holotype).

17. *Dissochaeta pulchra* (Korth.) Maxw., *comb. nov.* *Dalenia pulchra* Korth. in Temm., Verh. Nat. Gesch. (1842) Bot. tab. 58.

18. *Dissochaeta rostrata* Korth. var. *alstonii* (Nayar) Maxw., *stat. nov.* *Dissochaeta alstonii* Nayar, Bull. Bot. Surv. India 11 (1969) 188.

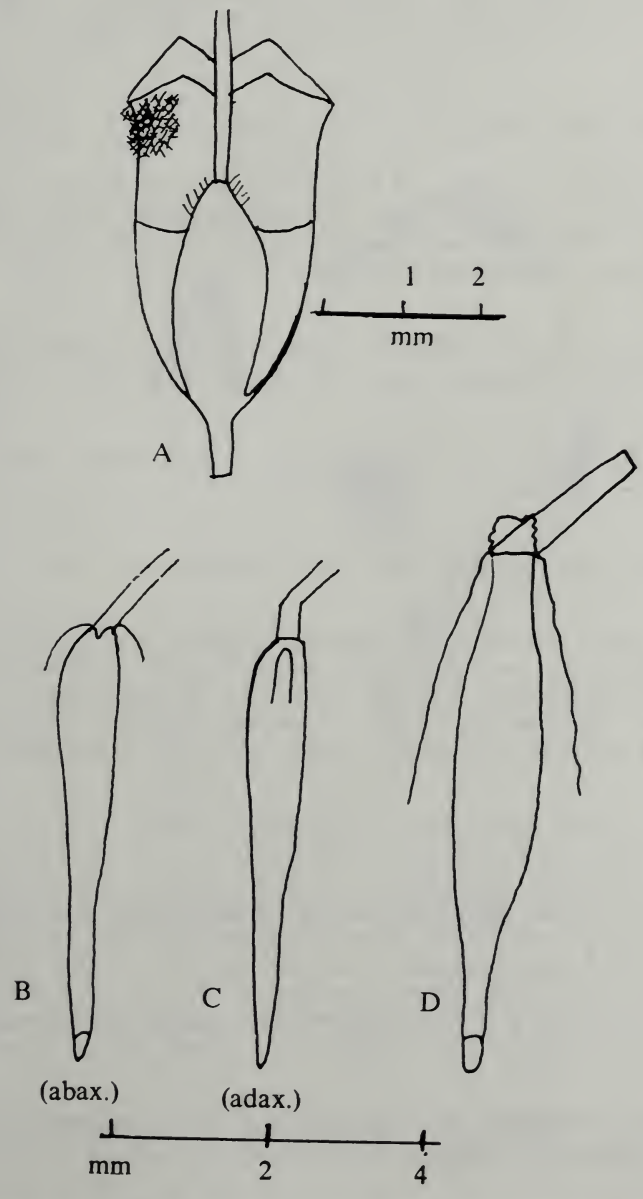

Fig. 4. *Dissochaeta rostrata* Korth. var. *esetosa* Maxw. A: calyx; B, C: oppositipetalous stamens in bud; D: alternipetalous stamen in bud. A-D Endert 2304 (holotype).

19. *Dissochaeta rostrata* Korth. var. *densiflora* (Ridl.) Maxw., *stat. nov. Dissochaeta densiflora* Ridl., Kew Bull. 1946, 32.

20. *Dissochaeta rostrata* Korth. var. *esetosa* Maxw., *var. nov.*

Differt a variesatibus ceteris Dissochaeta rostrata Korth. omibus partibus sine setis, petiolis pancis escal. Calycis lobi triangulares c. 1 mm longi. Calyx atque stamina eorum Dissochaeta rostratae Korth. var. malayanae (Furt.) Maxw. valde similes.

Typus: Endert 2304 (*holotypus* L, *isotypus* K). Tab. 4, A-D.

Differs from all other varieties of *Dissochaeta rostrata* Korth. in being without bristles on all parts, except for a few on some petioles. Calyx lobes triangular, c. 1 mm long. The calyx and stamens closely resemble those of *Dissochaeta rostrata* Korth. var. *malayana* (Furt.) Maxw.

Distribution: Borneo, Sabah — Mostyn District, Kalumpang For. Res.: Nordin & Ali 54413, Tingkayu Camp: Sinanggul 57228; East — Liang Gagang:

Hallier 2665; W. Koetai, near Hikam Batoe Beng: Endert 2304 (holotype L, isotype K). Fig. 4, A-D.

21. *Dissochaeta rostrata* Korth. var. *floccosa* Maxw., *var. nov.*

Ramuli, petioli, inflorescentiae, infructescentiarum axes, calyces atque fructus floccosi, i.e. dense et crasse obtecti pilis stellatis et setis capitatis 1–2 mm longis a pilis stellatis absconditis. Calyx tubulosus, c. 9 mm longus, 3–4 mm latus, lobis linearibus 7–8 mm longis, apice rotundatis. Fructus urceolati, c. 10 mm longi, 5 mm lati, lobis persistentibus, vulgo fructubus aequilongis.

Typus: Maradja 350 (*holotypus* L; *isotypus* L, SING). Tab. 5, A-F.

Branchlets, petioles, inflorescence and infructescence axes, calyx, and fruit floccose, i.e. densely and thickly covered with stellate hairs and capitate bristles 1–2 mm long which are concealed by the stellate hairs. Calyx tubular, c. 9 mm long, 3–4 mm wide, lobes linear, rounded at the tip, 7–8 mm long. Fruit urceolate, c. 10 mm long, 5 mm wide, lobes persisting and generally as long as or longer than the fruit.

Distribution: Sumatra, West Coast, east of Pajakumbuh: Maradja 350 (holotype L; isotypes L, SING). Fig. 5, A-F.

22. *Dissochaeta rostrata* Korth. var. *hirsuta* (Hk. f. *ex* Triana) Maxw., *stat nov. Dissochaeta hirsuta* Hk. f. *ex* Triana, Trans. Linn. Soc. 28 (1871) 83.

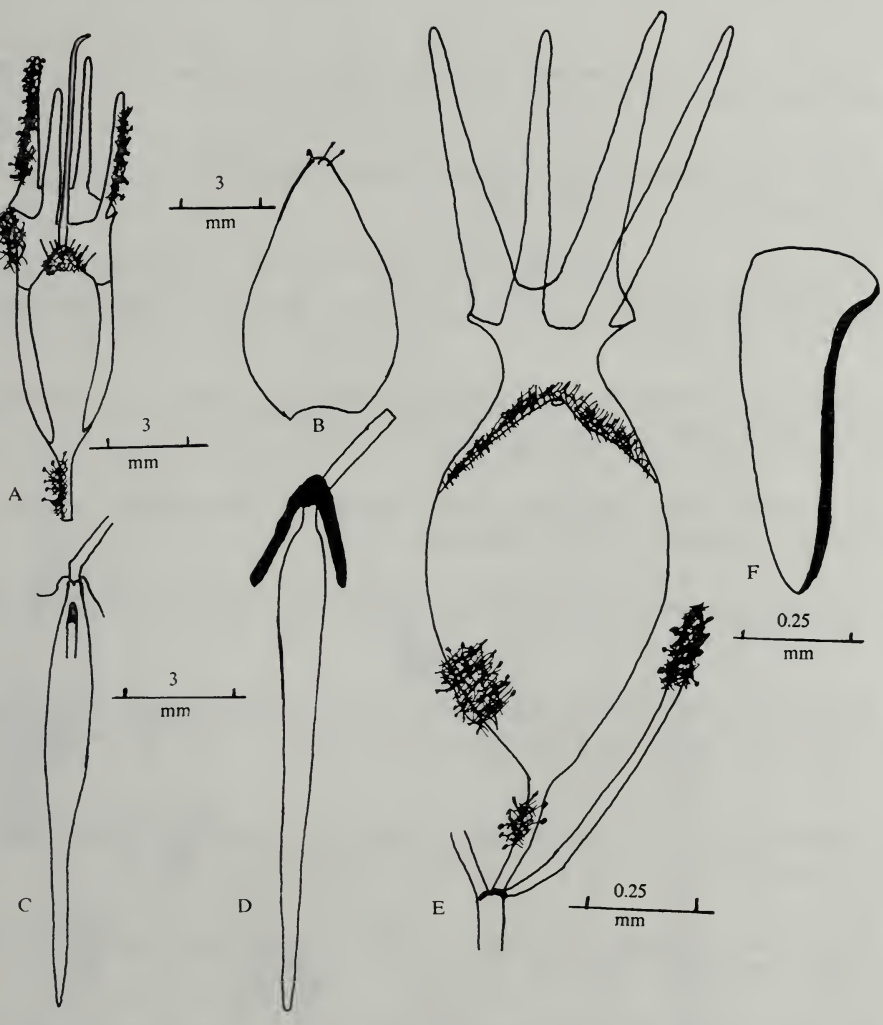

Fig. 5. *Dissochaeta rostrata* Korth var. *floccosa* Maxw. A: calyx and ovary; B: petal bud; C: oppositipetalous stamen in bud; D: alternipetalous stamen in bud; E: fruit; F: seed. A-D Maradja 350 (holotype), E, F Maradja 350 (isotype).

23. *Dissochaeta rostrata* Korth. var. *horrida* (Bakh. f.) Maxw., *comb. et stat. nov.* *Macrolenes horrida* Bakh. f., l.c. 208.

24. *Dissochaeta rostrata* Korth. var. *macrosepala* (Stapf) Maxw., *stat. nov.* *Dissochaeta macrosepala* Stapf, J. Linn. Soc. Bot. 42 (1914) 80.

25. *Dissochaeta rostrata* Korth. var. *malayan* (Furtado) Maxw., *stat. nov.* *Dissochaeta malayana* Furtado, Gard. Bull. Sing. 20 (1963) 110.

26. *Dissochaeta rostrata* Korth. var. *porphyrocarpa* (Ridl.) Maxw., *stat. nov. Dissochaeta porphyrocarpa* Ridl., Kew Bull. 1946, 32.

27. *Dissochaeta rostrata* Korth. var. *setosa* (Schwartz) Maxw., *stat. nov. Dissochaeta setosa* Schwartz, l.c. 250. Plate 2, holotype.

28. *Dissochaeta sarawakensis* (Nayar) Maxw., *comb. now. Neodissochaeta sarawakensis* Nayar, l.c. (1969) 195.

29. *Dissochaeta spectabilis* Maxw., *nom. nov.* This is a new name for *Dissochaeta marumioides* Furtado, l.c. 111 and fig. 1, which is a later homonym of *Dissochaeta marumioides* Cogn.

30. *Dissochaeta velutina* Bl. var. *reticulata* (Bl.) Maxw., *stat. nov. Dissochaeta reticulata* Bl., l.c. 499 and l.c. 241.

Macrolenes Naud. has been retained instead of *Marumia* Bl. and has 11 species and 6 varieties with the following notes:

31. *Macrolenes dimorpha* (Craib) Maxw., *comb. nov. Marumia dimorpha* Craib, Kew Bull. 1930, 320.

32. *Macrolenes echinulata* (Naud.) Bakh. f. var. *esetosa* (Craib) Maxw., *comb. nov. Marumia rhodocarpa* Cogn. var. *esetosa* Craib, Fl. Siam. Enum. I:4 (1931) 697.

33. *Macrolenes hirsuta* (Cogn.) Maxw., *comb nov. Marumia hirsuta* Cogn. in DC., Monogr. Phan. 7 (1891) 553. Plate 3, hololectotype.

34. *Macrolenes rufolanata* (Ridl.) Maxw., *comb. nov. Marumia rufolanata* Ridl., Fl. Malay Pen. 5 (1925) 310.

35. *Macrolenes stellulata* (Jack) Bakh. f. var. *ciliatiloba* (Baker f.) Maxw., *stat. nov. Macrolenes ciliatiloba* (Baker f.) Bakh. f., l.c. 215.

36. *Macrolenes subulata* Maxw., *sp. nov.*

Pedicilli et tubus calyxis stellato-tomentosi, setis simplicubus, stritus, subulatis, aureo-brunneis ad fulvis, 1–2.5 (3) mm longis, basi glabris, apicem versus pilis stellatis dense obtectis, basi incrassata, apice acri dense obtecti. Tubus calycis tubularis, 10–12 mm longus, lobis triangularibus e basi ovata, apice rotundato, ambobus stellato-tomentosis, extra setis sparsis vel nullis, 9–11 mm longis. Ramuli, petioli, axes primarii secondariique inflorescentiae stellato-furfuracei, atque pilis dispersis, tenuibus, 0.5–1 mm longis, apice capitato stellatiformeve stellato-furfuracie.

Typus: Jacobs 8028 (*holotypus* L; *isotypus* SING, KEP, etc.) Tab. 6, A-G.

Pedicels and calyx tube stellate tomentose, densely covered with simple, straight, subulate bristles which are golden-brown to tan, 1–2.5 (3) mm long, glabrous in the lower part, densely covered with stellate hairs near the tip, thickened near the base, sharp pointed. Calyx tube tubular, 10–12 mm long; lobes triangular, rounded at the tip, ovate near the base, stellate tomentose on both surfaces, with few or without bristles on the dorsal surface, 9–11 mm long. Branches, petioles, and primary and secondary axes of inflorescence stellate furfuraceus and with scattered, thin, capillary hairs 0.5–1 mm long which are capitate or barbed (i.e. stalked stellate hair) at the tip.

This species is closely related to *Macrolenes dimorpha* (Craib) Maxw. which differs in the nature of the calyx bristles.

Distribution: Sumatra, Lampung Province, Mt. Tanggamus (1100–1200 m):

Jacobs 8028 (spirit collection at L no. 6561) (holotype L; isotypes SING, KEP, etc.). Fig. 6,, A-G.

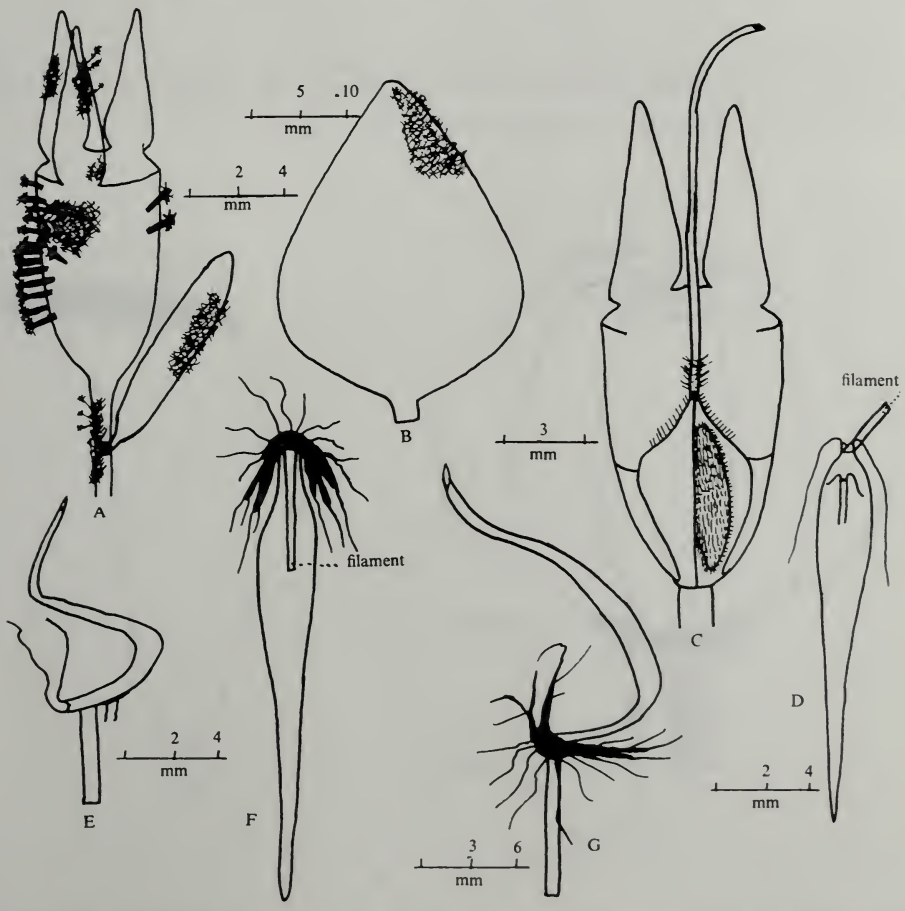

Fig. 6. *Macrolenes subulata* Maxw. A: calyx and bracteole; B: mature petal; C: ovary; D: oppositipetalous stamen in bud; E: mature oppositipetalous stamen; F: alternipetalous stamen in bud;; G: mature alternipetalous stamen. A-G Jacobs 8028 (holotype).

Croechiton Bl. includes 9 species and 2 varieties. *Enchosanthera* Guill. (Bull. Soc. Bot. France 60 (1913) 314), *Eisocreochiton* Quis. & Merr. Phil. J. Sci. 37 (1928) 177), and *Anplectrella* Furtado (l.c. 106) are all based on *Creochiton anomala* (King & Stapf *ex* King) Veldk. and are *syn. nov.* of *Creochiton* Bl.

37. *Creochiton ledermannii* Mansf. var. *turbinata* Maxw., *var. nov.*

Differt a var. ledermannii indumento minus denso ramules, petiolos atque axes inflorescentiarum obtegenti, bracteolis glabris, calyxis patribus connatis turbinatus, fructubus extus lines verticalibus 8 munitis, atque collo brevi.
Typus: Schram 12260 (*holotypus* L). Tab. 7, A *et* B.

Differs from var. *ledermannii* in having less dense indumentum on the branchlets, petioles, and inflorescence axes; glabrous bracteoles; depressed globose, i.e. turbinate, fruit which has 8 vertical lines on the outside; and with a short neck-like areolus.

Distribution: New Guinea, Asbakin, Warsamson Valley: Schram 12260 (holotype L); Sepik District, Yapa (Hunstein River): Hoogland & Craven 10735; Kouffaer River: Docters van Leeuween 10382. Fig. 7, A & B.

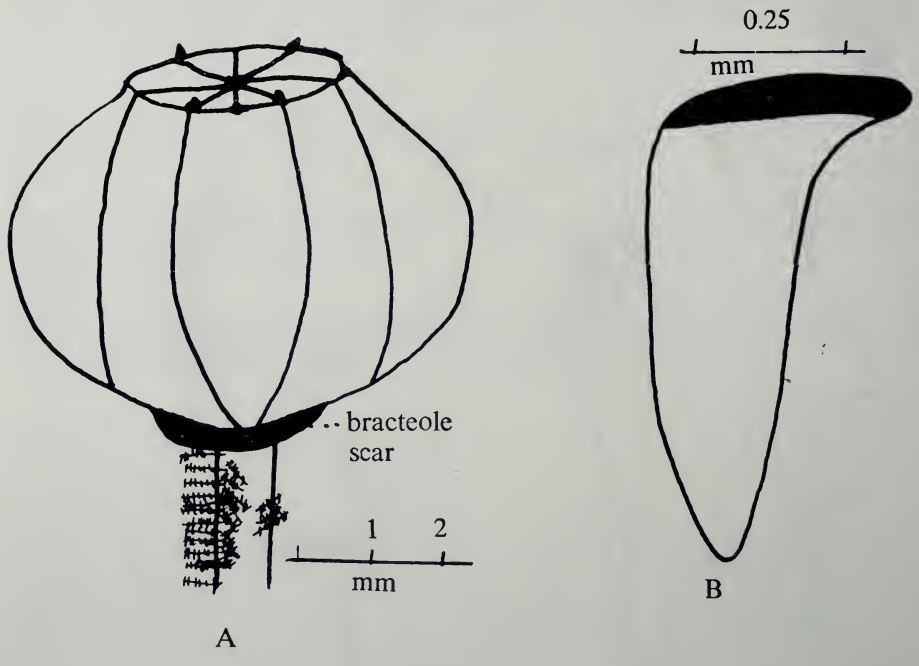

Fig. 7. *Creochiton ledermannii* Mansf. var. *turbinata* Maxw. A: mature fruit; B: seed. A and B Schram 12260 (holotype).

Pseudodissochaeta Nayar has five species, more of which may eventually be found in *Medinilla* Gaud. and other genera in the Melastomataceae which require revision.

38. *Pseudodissochaeta spirei* (Guill.) Veldk. & Maxw., *comb. nov.* *Medinilla spirei* Guill., Fl. Gen. Indo-Ch. 2 (1921) 921. Lectotype: Chevalier 32408 (P) from Co-ba, North Vietnam.

Acknowledgements

I would like to thank my former supervisor, Prof. Hsuan Keng, at the University of Singapore for his valuable assistance. My appreciation is also extended to Dr. R. C. Bakhuizen van den Brink Jr., at Leiden, who provided the Latin descriptions of the new taxa described in this paper. My research could not have been completed without the assistance of Prof. Dr. C. G. G. J. van Steenis, Prof. Dr. C. Kalkman, Drs. R. Geesink, and Dr. J. F. Veldkamp — all at Leiden — who arranged for and sponsored my trip to Leiden from January to March 1979. Finally, I would like to thank Dr. Chang Kiaw Lan, curator of the Singapore herbarium, for many useful suggestions.

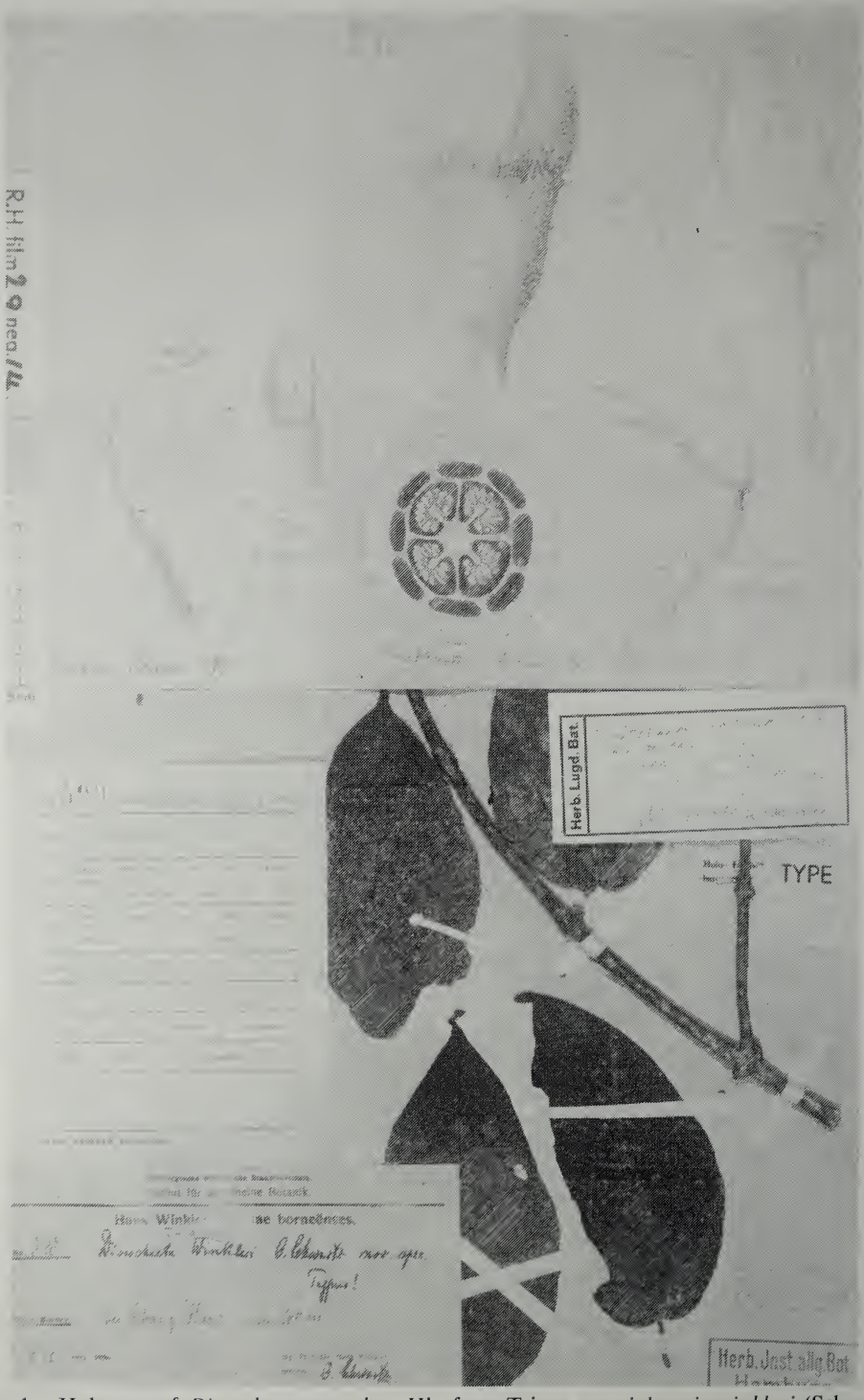

Plate 1. Holotype of *Dissochaeta annulata* Hk. f. *ex* Triana var. *johannis-winkleri* (Schwartz) Maxw. at Hamburg. The specimen was collected in Hara, western Borneo by Hans Winkler (590) on 5 December 1924. Photo: Rijksherbarium, Leiden..

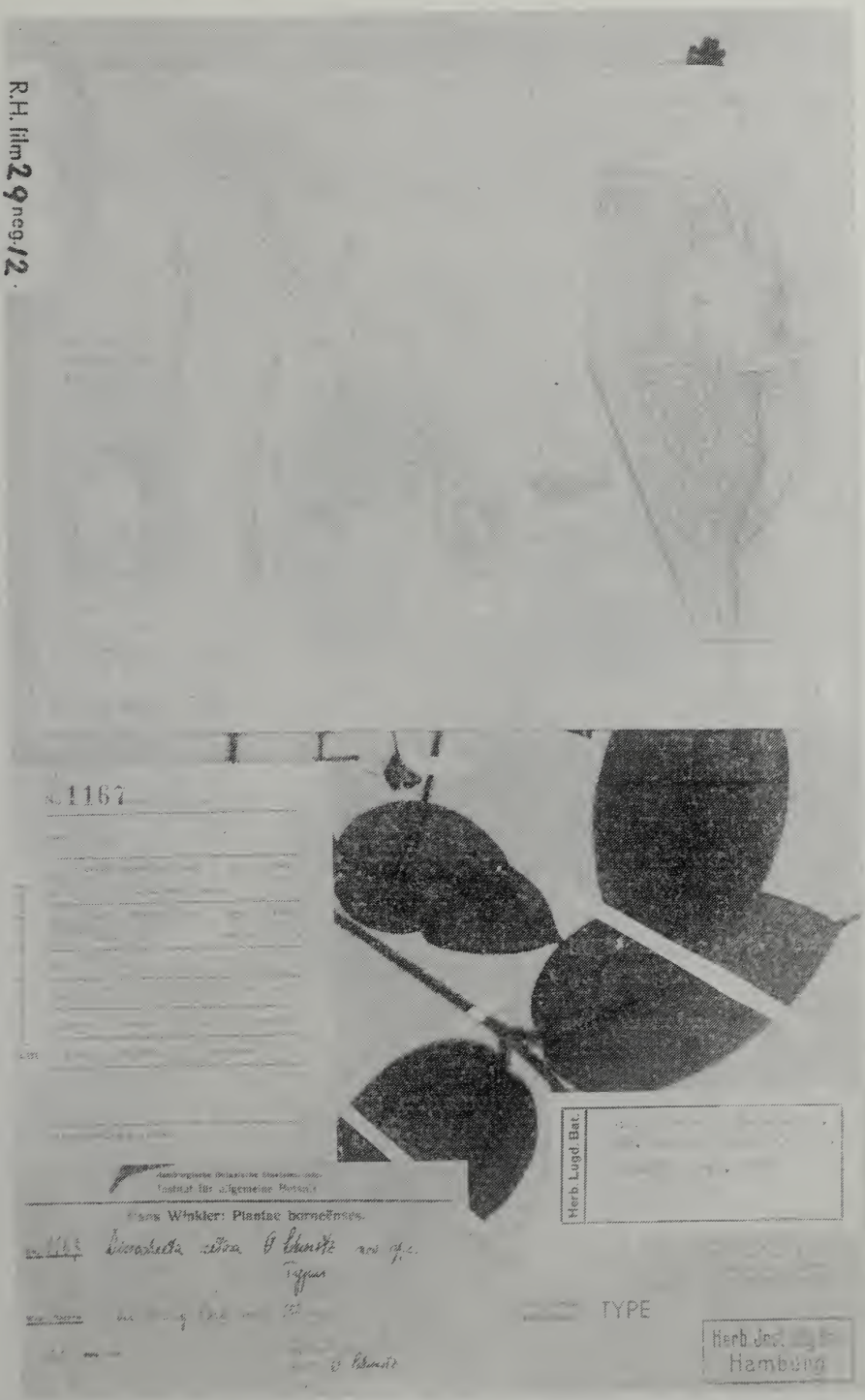

Plate 2. Holotype of *Dissochaeta rostrata* Korth. var. *setosa* (Schwartz) Maxw. at Hamburg. This species was collected in Hara, western Borneo by Hans Winkler on 1 January 1925 and was originally described as *Dissochaeta setosa* Schwartz in 1931. The drawings are attached to the sheet. Photo: Rijksherbarium, Leiden.

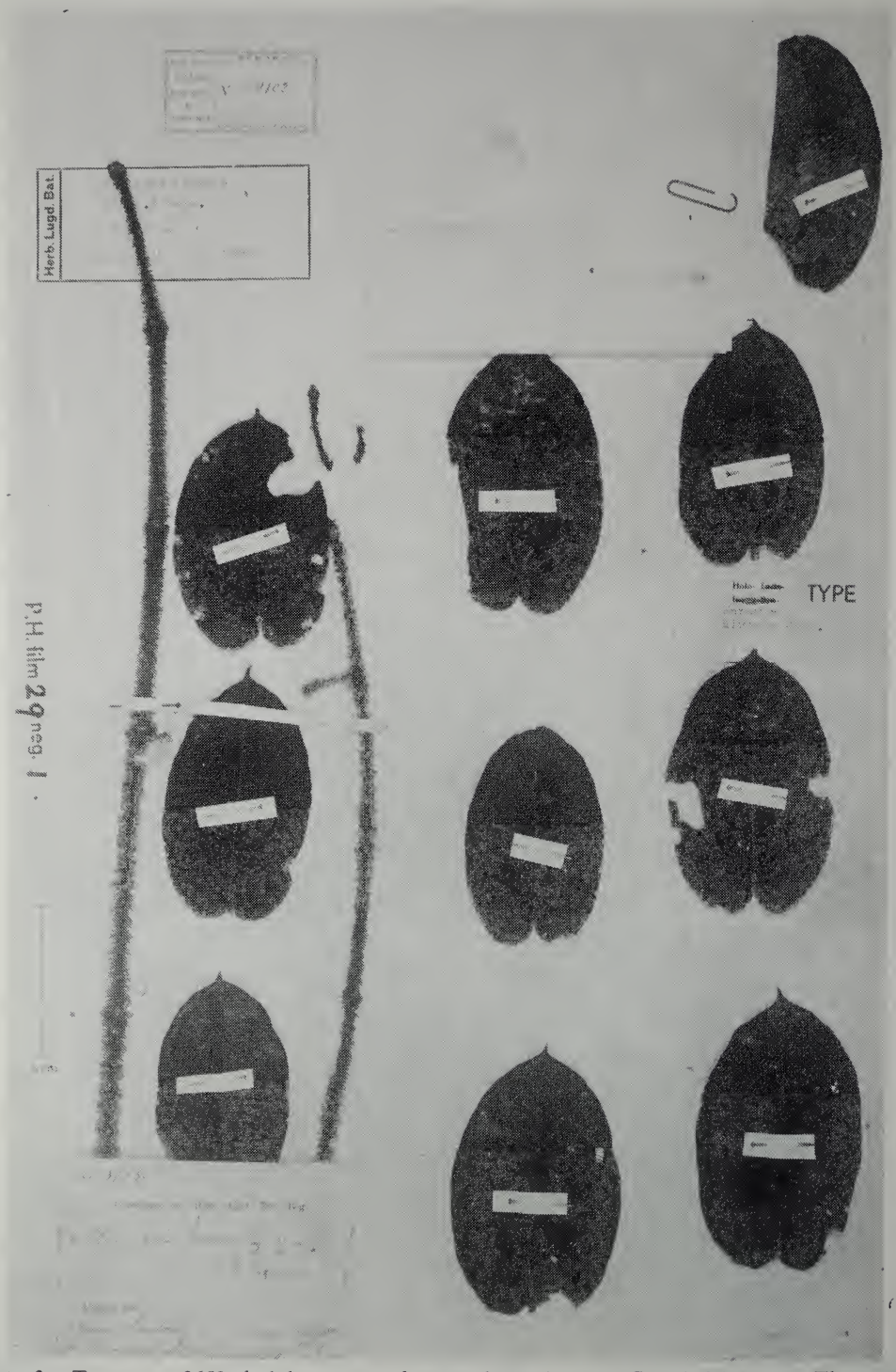

Plate 3. Teysmann 8658, hololectotype of *Macrolenes hirsuta* (Cogn.) Maxw. at Florence. This specimen was collected in SE Borneo at Sintang in 1874. Photo: Rijksherbarium, Leiden.

BOOK REVIEW

by

J. F. Maxwell

Botanic Gardens, Singapore

John Dransfield, *A Manual of the Rattans of the Malay Peninsula*, Malayan Forest Records no. 29; Forest Department, West Malaysia, 1979; 270 pp. Price: Malaysian $25.00

Rattans, those spiny climbing palms which are found throughout the forests of the Malay Peninsula, have been used by man for ages for the construction of furniture, binding materials, and many other purposes. Rattans also provide vital ecological niches for many forest animals, e.g. ants and other insects, as well as birds and small mammals. The sweet, juicy fruit is also relished by many forest inhabitants.

These unusual climbers, however, have not been studied by many botanists since they are difficult to collect, bulky, taxonomically complex, and generally incompletely represented in most herbaria. John Dransfield's revision of the eight genera and 104 species of Malayan rattans is a product of his own extensive field studies combined with a thorough review of relevant literature and the examination of numerous herbarium collections. I was pleased to have met him in the Singapore herbarium several years ago when he was studying our rattan collection, however time did not permit the answering of all the questions I had concerning this group.

The study of Malaysian rattans dates back to the mid-1800's with accounts by Griffith and Blume. Beccari, Ridley, and most recently the late C. X. Furtado also worked on this complex group. Dransfield's manual includes chapters on rattan morphology, natural history, utilization, and taxonomy. The taxonomic part, forming the bulk of the book, includes keys to genera and species based mostly on vegetative features, literature citations, complete descriptions with lucid line drawings, distribution, uses, and short comments for each taxon.

This book is a scholary revision of a very difficult group of plants which is presented in a format and style that naturalists and taxonomists can easily understand. Dransfield has made a significant contribution to the knowledge of the Malayan flora which ranks with other masterpieces on the wayside trees (Corner), orchids and ferns (Holttum)), grasses (Gilliland), palms (Whitmore), and other groups from the region. This rattan book is a necessary companion to the *Tree Flora of Malaya* volumes and is an invaluable addition to the Malayan Forest Record series.

ANNOTATED LIST OF SEED PLANTS OF SINGAPORE (VI)*

by

HSUAN KENG

Department of Botany, University of Singapore

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* Continued from Gdns' Bull. Sing. 31: 113. 1978.

II. ANGIOSPERMAE-DICOTYLEDONS (continued)

80. TILIACEAE

KEY TO THE GENERA

A. Herbs or undershrubs; fruit capsular,

B. Fruit spiny or bristly ..... *Triumfetta*

B. Fruit smooth or rough, but not bristly ..... *Corchorus*

A. Shrubs or trees; fruit various,

C. Fruit fleshy or pulpy,

D. Fruit a berry, with many seeds inside ..... *Muntingia*

D. Fruit a drupe,

E. Leaves 3-nerved at base; fruit with 1–4 stones inside .... *Grewia*

E. Leaves with 1 main vein at base; fruit with one large stone (with 3–5 seeds embedded inside) ..... *Elaeocarpus*

C. Fruit dry,

F. Fruit indehiscent (a 3-winged samara) ..... *Pentace*

F. Fruit dehiscent,

G. Fruit of 1–5 free-carpelled follicles, smooth ..... *Brownlowia*

G. Fruit of a 4-valved capsule, spiny ..... *Sloanea*

Brownlowia argentata Kurz

Shrub or small tree. Leaves cordate, spiral, silvery scaly beneath. On brackish tidal sandy soil, rare. Kranji (*Ridley 6364*), Bukit Timah.

Brow. tersa (L.) Kosterm.

Formerly called *Brow. lanceolata* Benth. Leaves lanceolate, alternate, golden scaly beneath, in mangroves, rare. Kranji (*Sinclair 40685*).

Corchorus acutangulus Lam.

Herb or shrubby. Flowers small, yellow, in axillary pairs. Weed, in open ground by sea. Choa Chu Kang. 野黄麻

Elaeocarpus ferrugineus Steud.

Formerly called *Elaeo. jackianus* Wall. Branches and petioles covered with thick, brown, velvet hair; leaves elliptic. Tanglin, Seletar (*M. Shah & Shukor 2373*), Bukit Mandai.

The *Elaeocarpus* species are large or small trees; buds often coated with resin; young and falling leaves pinkish red or purplish; flowers in racemes; flower parts mostly in 5s (but some species in 4s), the petals usually fringed or laciniate at tip; drupe green or greyish, with a large stone containing 1–5 seeds inside. Malay name is called 'Mendong'.

Elaeo. floribundus Bl.

Leaves ovate-elliptic, entire; petiole pinkish. Fruit oblong. Rare, Bukit Timah (*Corner s.n.* in 1937).

Elaeo. griffithii Mast.

Leaves lanceolate to ovate-lanceolate. In lowland woods, Choa Chu Kang, Tanglin, Seletar. Botanic Gardens (*Burkill 5978*).

Elaeo. hullettii King

Leaves lanceolate. Not common, Bukit Timah, Bukit Mandai, Reservoir woods (*Corner 32537*).

Elaeo. macrocerus Merr.

Called *Elaeo. littoralis* Kurz by Corner. Leaves obovate-spathulate. Tree with stilt roots and knee-shaped pneumatophores, in swamps and mixed forests. Jurong (*Ridley 5588*).

Elaeo. mastersii King

Leaves oblong-lanceolate, relatively small (5–10 x 2–4 cm). Flower parts in 4s. Fruit ellipsoid, greyish blue. Common, Tanglin, Bukit Timah, Kranji, Changi. Reservoir woods (*Burkill 1228*).

Elaeo. nitidus Jack

Formerly called *Elaeo. parvifolius* Wall. Leaves oblong-lanceolate. serrulate. Like *E. mastersii*, but with flower parts in 5s and larger fruits dull green in colour. Bukit Timah (*Corner 34665*).

Elaeo. obtusus Bl.

Formerly called *E. rugosus* var. *singaporensis* Ridl. Leaves obtuse. Bukit Timah Road (*Ridley 5727*).

Elaeo. paniculatus Wall.

Leaves oblong-lanceolate. Inflorescences very long (20–25 cm). Common, Bukit Mandai (*Corner 32522*), Seletar.

Elaeo. pedunculatus Wall.

Leaves oblanceolate, often crowded near the tip. Fruit oblong, greyish blue. Near seashores, Loyang, Tuas, Jurong, Pulau Tekong, Pulau Bayan (*Ridley 10434*).

Elaeo. petiolatus Wall.

Leaf-buds thickly coated with resin; leaves elliptic, entire. Common in lowland woods, Gardens' Jungle, Bukit Timah, Seletar, Reservoir woods (*M. Shah 3861*), Changi.

Elaeo. polystachyus Wall.

Branches silky; leaves elliptic-lanceolate. Common in woods, Bukit Timah (*S. Ahmad 1353*), Jurong, Changi.

Elaeo. sphaericus K. Schum.

Leaves lanceolate. Large tree, native of the Malay Peninsula, occasionally planted. Formerly called *Elaeo. ganitrus* Roxb.

Elaeo. salicifolius King

A slender tree; leaves narrow lanceolate. Not common; Bukit Timah, Choa Chu Kang. Reservoir Jungle (*Corner 29225 A*).

Elaeo. stipularis Bl.

Tree, pubescent all over with velvet hair. Leaves ovate with a large triangular stipule, often with 2–5 points. Fruit round. In woods, Tanglin, Bukit Timah, Changi. Choa Chu Kang (*Hullett 8*).

Grewia blattaefolia Corner

Formerly called *G. latifolia* Auct. non Muell. Small tree; leaves densely hairy below. Fruit pear-shaped, orange yellow. Bukit Timah (*Ridley 4943*), Choa Chu Kang.

Grew. hirsuta (Korth.) Kochum.

Small tree; formerly called *Grew. omphacarpa* Miq. Rare, Tanglin.

Grew. acuminata Juss.

Stout climber. Flowers white. Tanglin, Geylang. Formerly called *Grew. umbellata* Roxb.

Muntingia calabura L.

Shrub or small tree. Leaves alternate, in one plane, the blades unequal-sided, densely woolly. Flowers white; berry red, edible. Native of Brazil, commonly found in villages, called 'cherry tree' (the true cherry tree of the Orient belongs to the genus *Prunus* of Rosaceae).

Pentace triptera Mast.

A gigantic tree with prominent buttresses. Flowers white, in panicles. Fruit pink, with 3 membraneous wings. In woods, Bukit Timah (*Ridley 6363a*), Ang Mo Kio, Choa Chu Kang. Vern. Melunak Pusat Beludu.

Sloanea javanica Szysz. ex K. Schum.

Large tree. Flowers white, in axillary panicles. Fruit a woody and spiny capsule. Very rare, Kranji (*Mat 6174*).

Triumfetta rhomboidea Jacq.

Shrublet; stem glabrescent. Flowers yellow. Fruit small round, densely hairy. A weed in waste ground, Tanglin (*Hullett 292*), Changi. Plant in vegetative state can be easily confused with *Urena lobata* L. (Malvaceae), the leaves of the latter, however, bear a gland on lower surface near base of midrib. Erroneously called *Trium. bartramia* L.

Trium. pseudocana Spr. & Craib

Shrublet; stem velvetly hairy; fruit tomentose, with straight long hairs. A weed, not common.

81. MALVACEAE

KEY TO THE GENERA

A. Herbs or shrubs,

B. Flowers small (less than 3 cm across); fruit 5-lobed, separating into 5 1-seeded split fruits.

C. Leaves densely hairy; flowers pink ..... *Urena*

C. Leaves glabrous or nearly so; flowers yellow ..... *Sida*

B. Flowers large (usually over 5 cm across); fruit globose, dehiscing by 3–5 or more valved,

D. Calyx splitting on one-side, apathe-like ..... *Abelmoschus*

D. Calyx cup-shaped,

E. Flowers remaining closed; filamental tube twisted ..... *Malvaviscus*

E. Flowers open, bell-shaped, filamental tube erect,

F. Epicalyx absent; capsule 15–20 parted ..... *Abutilon*

F. Epicalyx present; capsule 3–10 parted,

G. Epicalyx of 5– many bracts; capsule 5–10 chambered ..... *Hibiscus* (in part)

G. Epicalyx of 3 large bracts; capsule 3-chambered ..... *Gossypium*

A. Trees; fruit globose, dehiscing by 5– many valves,

H. Style undivided; bracts of epicalyx deciduous early ..... *Thespesia*

H. Style divided into 5-branches; bracts of epicalyx persistent ..... *Hibiscus* (in part)

Abutilon indicum (L.) Sweet

Erect herb. Weed, sometimes found in waste ground. Geylang (*Teruya 1280*).

Abelmoschus esculentus Moench (= *Hibiscus esculentus* L.)

Annual herb, erect, stout. Leaves 5–7-lobed or -divided. Epicalyx 10–16-lobed, lineate. Flowers yellow with a red centre. Probably native to Africa, cultivated for its long ribbed edible fruits known as 'Lady's finger' or okra. 黄秋葵

Abelm. moschatus Medic. (= *Hibiscus abelmoschus* L.)

Annual hairy herb, the musk mallow, native of India, formerly cultivated.

Gossypium barbadense L.

The sea-island cotton, a native of Peru, together with one or two other species, occasionally cultivated as an ornamental.

Hibiscus mutabilis L.

Shrub or small tree with large pink, multipetalous flowers (called 'cotton rose'). Native of China, propagated by cuttings. 木芙蓉

Hibis. rosa-sinensis L.

Shrub or tree-like. Flowers mostly rose-red, sometimes double or varying into other shades. Never produce any fruit or seed under tropical climate, native of continental Asia, prob. China. Vern. Bunga-raja. 扶桑花，朱槿

Hibis. schizopetalus (Mst.) Hook. f.

Shrub. Flowers drooping; petals red, rarely orange, multisect, recurved. Native of tropical E. Africa, commonly cultivated.

Hibis. surattensis L.

Herb or scrambling shrub, pickly. Leaves lobed. Flowers yellow with a maroon eye. Tanglin, Changi, Pulau Ubin, Alor Gajah (*Sinclair 8930*).

Hibis. syriacus L.

Shrub. Flowers purple ('rose of sharon'). Native of continental Asia, occasionally cultivated. 木槿

Hibis. tiliaceus L.

A common sea-coast tree. Leaves heart-shaped, whitish beneath. Flowers yellow with a maroon eye, turning pink soon after opening. Changi (*M. Shah 762*). 黄槿

Malvaviscus arboreus Cav.

A shrub of tropical American origin, cultivated for its red, hardly opened flowers.

Sida acuta Brum. f. (= *Sida carpinifolia* L.)
Herb or subshrub. Leaves linear lanceolate. A weed, with yellow flowers. Geylang. (*Teruya 1263*).

Sida cordifolia L.

Leaves ovate, thick, tomentose, with dordate base. Geylang. (*Teruya 1979*).

Sida rhombifolia L.

Leaves rhomboid.

Thespesia populnea (L.) Soland. ex Correa

Tree of the sea-coast, very similar to the sea *Hibiscus* (*H. tiliaceus* L.) but can be easily distinguished from the latter by its truncate, cup-shaped calyx and the round, non-splitting fruits. Changi (*Hullett 92*).

82. BOMBACACEAE

KEY TO THE GENERA

A. Leaves palmately compound; leaflets 5–9 ..... *Ceiba*

A. Leaves simple,

B. Leaf-tips round or notched; fruit wall hairy inside, splitting completely before falling ..... *Neesia*

B. Leaf-tips pointed; fruit wall glabrous inside,

C. Midrib raised above; fruit with short stout spines ..... *Coelostegia*

C. Midrib sunken above; fruit with long sharp spines ..... *Durio*

Ceiba pentandra (L.) Gaertn.

Large tree, trunk and twigs thorny. Leaves palmately compound, native to tropical America, probably carried by current to Africa in remote times. The tree yields kapok which is the floss derived from the inner fruit wall, in which the seeds lie loose when ripen. Vern. *Kapok.* 吉貝

Coelostegia griffithii Benth.

Large tree. Flowers small, on old wood. Fruit large, round; woody fruit wall covered with thorn and black on the outside, orange on the inside. Gardens' Jungle, Bukit Timah (*Ridley 4738*).

Durio griffithii (Mst.) Bakh.

Medium-sized tree. Flowers small, white. Fruit small, scarlet. Gardens' Jungle, Bukit Timah (*Ridley s.n.* in 1894)

Durio singaporensis Ridl. (= *D. oblongus* Auct. Corner, non Mast.)

Flowers white, large. Fruit green, not edible. In woods, rare; Bukit Timah (*Ridley 3704*, type), Bukit Mandai. Reservoir woods.

Durio zibethinus L.

Large tree. Fruit large, thorny; the pulp (aril) surrounding the seeds edible. Possibly wild in Malaya, Sumatra and Borneo, often cultivated. Vern. *Durian*. 榴槤

Neesia altissima Bl.

Large tree. Leaves hairy beneath. Fruit woody, large, partly open, the walls inside covered with yellow stinging hair. Seeds black, with a yellow waxy aril. Rare, Bukit Timah, Seletar (*Corner s.n.* in 1941)

Nees. malayana Bakh.

Leaves glabrous beneath, in fresh water swamp forest, Mandai (*Corner 37138*). Kranji, Choa Chu Kang.

83. STERCULIACEAE

KEY TO THE GENERA

A. Woody climbers ..... *Byttneria*

A. Erect shrubs or tree,

B. Shrubby, shrubs or small trees,

C. Shrubby ..... *Melochia*

C. Shrubs or small trees,

D. Fruit a capsule,

E. Capsule bristly with long woolly hairs ..... *Commersonia*

E. Capsule membranaceous, inflated ..... *Kleinhovia*

D. Fruit a leathery follicle ..... *Sterculia* (in part)

B. Tall trees,

F. Fruit woody; seeds winged,

G. Fruit a capsule; leaves yellow-brown beneath ... *Pterospermum*

G. Fruit a follicle, leaves usually whitish beneath ..... *Heritiera*

F. Follicles not woody; seeds not winged,

H. Follicle leathery ..... *Sterculia*

H. Follicle large, membranaceous, green ..... *Scaphium*

Byttneria maingayi Mast.

Big woody climber; flowers white or pink, small; fruit a prickly capsule, opening by 5 valves, with 1 seed in each locule. Gardens' Jungle (*Ridley 6016*), Changi, Bukit Mandai. Vern. Akar Kachubong.

Commersonia bartramia Merr.

Small tree, spreading; flowers white, in large branched cymes; capsule globose, with long sofe grey hairs. In open jungle, Tanglin, Jurong.

Heritiera borneensis (Merr.) Hosterm.

Tree. Bukit Timah (*Ngadiman 34617*).

Heritiera elata Ridl.

Gigantic inland tree; petiole over 2.5 cm long. Gardens' Jungle.

Herit. littoralis Dryand. ex W. Ait

Tree, in mangrove swamps; lower surface of leaves silvery grey to brown; petiole to 2.5 cm long; follicles 2–5, winged on one side. Bajau, Kranji, Pulau Jahat (*Ridley 2049*). Pulau Tekong. Vern. Dungun, 銀葉樹

Heritiera simplicifolia (Mast.) Kosterm. (= *Tarrietia simplicifolia* Mast.)

Large tree; leaves elliptic, usually with a broad apical notch. Bukit Timah. Gardens, Jungle (*Md. Nur 1026*).

Kleinhovia hospita L.

Shrub or small tree, with a dense crown; flowers pink in terminal panicles, fruit a bladder-like, 5-shouldered capsule. Formerly recorded as wild, now only occasionally found in cultivation.

Melochia corchorifolia L.

Shrubby weed; flowers small, pink, in waste places.

Pterospermum diversifolium Bl.

Learge sea-shore tree, with short buttresses; leaves oblong, with a heart-shaped base or peltate and palmately lobed; fruit a woody capsule, oblong. Pulau Ubin (*Ridley 387*).

Pterosp. javanicum Jungh.

Slender inland tree, with much smaller leaves than the above species. Bukit Timah, Sungei Bulah (*Ridley 61101*).

Scaphium linearicarpum Pierre

Large tree; leaf-base heart-shaped; flowers small, in scurfy panicles; fruit a large papery follicle, dehiscing early becoming boat-shaped and exposing the single seed. Jurong (*Mat 6761*).

Scaph. macropodum (Miq.) Beuinee ex Heyne (= *Scaph. affine* Pierre)

Like the above, but leaf-base rounded. Gardens' Jungle, Bukit Mandai, Bukit Timah (*M. Shah & Samsuri 3910*).

Sterculia bicolor Mast.

Tree; flowers apetalous, in hanging racemes; fruit follicles 1–5, leathery, pink or scarlet, radiating from a common stalk, splitting open along the inner suture; seeds hanging from the split edges. Bukit Timah, Seletar (*Sinclair S.F. 40637*).

Sterculia coccinea Jack (= *Sterc. laevis* Wall.)

Shrub; flowers green; follicles 3–5, scarlet; seeds blue black. Common in woods, Tanglin, Bukit Timah (*Ridley s.n.* in 1903), Pulau Ubin.

Sterc. cordata Bl. (= *Sterc. javanica* R. Br.)

Large tree. Bukit Timah.

Sterc. elongate Ridl.

Shrub. Bukit Timah (*Goodenough s.n.* in 1890).

Sterculia foetida L.

Tree, the only Malayan species of *Sterculia* with palmately compound leaves (the others being all simple-leaves). Native of E. Africa and India, occasionally planted.

Sterc. macrophylla Vent

Big tree; follicles 3–5, red, large. Choa Chu Kang, Nee Soon (*Samsuri 1455*), Reservoir woods.

Sterc. nobilis Smith

Small tree. Native of S. China, occasionally planted for its edible seeds. 蘋婆樹

Sterc. parviflora Roxb.

Big tree; flowers pink, follicles orange red. Gardens' Jungle, Grange Road (*Corner 31479*).

Sterc. rubiginosa Vent

Small tree; flowers pink. Tanglin, Bukit Timah, Choa Chu Kang (*Ridley 6082*), Bukit Mandai.

84. LINACEAE

KEY TO THE GENERA

A. Woody climber, spiny; fruit drupaceous ..... *Indorouchera*

A. Erect trees, not spiny; fruit capsular ..... *Ixonanthes*

Indorouchera griffithiana (Planch.) Hallier

Formerly called *Roucheria griffithiana* Planch. Woody climber, with stiff woody tendrils; flowers small, yellow; drupe red. In thickets and woods. Tanglin, Bukit Timah (*Ridley 4629*), Bukit Mandai.

Ixonanthes icosandra Jack

Tree; leaf-margin wavy or toothed; stamens 14–18; fruit a thinly woody capsule, opening by 5 valves. In woods. Water Catchment Areas, Changi (*Ridley 130*).

Ixon. reticulata Jack

Leaf-margin entire; stamens 8–12. In woods, Gardens' Jungle, Bukit Timah, Jurong, Pulau Bukom (*Md. Nur s.n.* in 1947).

85. ERYTHOXYLACEAE

Erythroxylum cuneatum Kurz

Shrub or small tree; flowers white or yellow; fruit drupe-like, bright red. In woods near the sea; Changi (*Sinclair 37935*).

Eryth. nova-granatense Heiron.

The cocaine bush of Colombia, formerly grown as a hedge plant, now prohibited. 古柯

86. OXALIDACEAE

KEY TO THE GENERA

A. Herbs; leaves 3-foliolate ..... *Oxalis*

A. Woody climbers or trees,

B. Climbers; leaves simple, leathery ..... *Dapania*

B. Trees,

C. Leaves simple ..... *Sarcotheca*

C. Leaves pinnate ..... *Averrhoa*

Averrhoa bilimbi L.

Small tree; leaves pinnate; flowers in tufts on stem and large branches; fruit green, warty, more or less rounded in cross section, very acidic, edible. Cultivated in villages; origin unknown, probably of S. India. Vern. Bilimbi.

Averrh. carambola L.

Fruit with 5 prominent ribs, star-shaped in cross section (hence 'star fruit'), light green or yellow, edible. Probably of S. Indian origin; cultivated. Vern. Kembola, 陽桃，五敛子

Dapania racemosa Korth.

Climber; leaves leathery, simple. Bukit Timah (*Sinclair 39648*), Jurong.

Oxalis barrelieri L.

Small herb, erect, 10–30 cm high; leaflets ovate; flowers pale blue. A weed of S. American origin.

Oxalis corniculata L.

Small herb, creeping; leaflets 3, rounded, notched; flowers yellow. A weed in gardens and waste places. 黄花酢浆草

Oxalis corymbosa DC

Creeping herb; leaves and flowers both larger than those of *C. coniculata;* flowers pink. Native of Brazil, occasionally cultivated or running wild.

Sarcotheca griffithii Hall. f. (= *Connaropsis griffithii* Planch.)

Tree, leaves 3-foliolate; flowers black. Gardens' Jungle, Bukit Timah Mandai Road (*Sinclair 39536*).

87. RUTACEAE

KEY TO THE GENERA

A. Herbs; leaves divided into 2–3 times pinnate ..... *Ruta*

A. Woody climbers, shrubs or trees,

B. Woody climbers, prickly or spiny,

C. Leaves simple ..... *Paramignya*

C. Leaves pinnate, with 5–9 leaflets ..... *Zanthoxylum*

B. Shrubs or trees,

D. Leaves always simple or 1-foliolate,

E. Leaves opposite ..... *Acronychis*

E. Leaves alternate,

F. Shrubs or trees with round or ovoid fruits, mostly cultivated ..... *Citrus*

F. Shrubs with 3-angled fruit, in mangroves ..... *Merope*

D. Leaves often 3-foliolate (sometimes also 1-foliolate),

G. Fruit with a thick, hard shell, cultivated ..... *Aegle*

G. Fruit small, with soft rind,

H. Flowers in large inflorescence; wild ... *Glycosmis* (in part)

H. Flowers solitary, axillary; hedge plant ..... *Triphasia*

D. Leaves pinnate, usually with 5–9 or more leaflets,

I. Fruit of dry follicles ..... *Euodia*

I. Fruit of small berries,

J. Style less than 1 mm long,

K. Ovary sessile, on a cushion-like disk ..... *Glycosmis*

K. Ovary on a stalk-like disk ..... *Clausena*

J. Style 4–9 mm long ..... *Murraya*

Acronychia porteri Hook. f.

Tree; leaves simple, opposite; flowers 4-merous, on an expanded inflorescence; stamens 8; fruit a small drupe. In woods, Gardens' Jungle, Bukit Timah, Changi, Jurong (*Ridley 7285*).

Aegle marmelos Correa

Deciduous tree; flowers with many stamens; ovary 8–12 chambered; fruit subglobose, with hard woody shell. Native of India, cultivated for medicine, called Bel-fruit tree.

Citrus aurantifolia Swingle

Small tree or shrub; leaves smaller than lemon (*C. limon* Burm. f. 檸檬) the fruit is also smaller, nearly rounded and with thinner rind, very sour ('limau asam' or lime, 酸橘). Bukit Timah Road (*Furtado 10567*). Besides some imported citrus fruits such as sweet orange (*C. sinensis* Osb., 'limau potong' 甜橙), mandarin orange (*C. reticulata Blanco, 'limau kupas'* 柑) grapefruit (*C. paradisi* Macf. 葡萄柚), the following species are sometimes cultivated in private gardens: *C. grandis* Osb. (pomelo, 'limau besar 柚 , 文旦), *C. hystrix* DC. (Mauritius papeda, 'limau purut'), *C. medica* L. (citron, 'limau sus' 枸橼), *C. microcarpa* Bunge (musk lime, 'limau kesturi'), and others.

Clausena excavata Burm. f.

Shrub, with foetid odour; leaves odd-pinnate with numerous leaflets; flowers white; fruit pink. In open woods, Tanglin (*Goodenough 223*), Pulau Ubin.

Claus. lansium Skeels

Shrub or small tree. Fruit (wampi 黃皮) edible. Native to S. China, occasionally planted.

Euodia glabra Bl.

Small tree; leaflets 3, obovate; flowers with 4–5 stamens, in large panicles; fruit folliculate. Bukit Timah (*Liew 37255*), Tanglin, Choa Chu Kang, Seletar.

Euodia robusta Hook. f.

Tall tree; leaflets 3, broadly elliptic. Reservoir woods, Tuas, Bukit Mandai, Bukit Timah (*Hullett 455*).

Euodia roxburgiana Benth. ex Hook. f.

Tree; leaflets 3, oblong elliptic; flowers white. Tanglin, Jurong, Bukit Timah, Kranji, Botanic Gardens (*Ridley 11264*).

Glycosmis chlorosperma Spr. (= *G. malayana* Ridl.)

Tree or large shrub; leaves with 5–7 leaflets; flowers and fruit white. Gardens' Jungle, Bukit Timah, Seletar, Changi, Choa Chu Kang (*Ridley 3912*).

Glyc. lanceolata Spr. (= *G. citrifolia* Auct. Ridl.)

Small tree; leaves 1- or 3-foliolate, lanceolate-elliptic. Tanglin (*Ridley 10835*).

Merope angulata Swingle (= *Paramignya longispina* Hook. f.)

Shrub or small tree with stout single or paired spines; flowers axillary, solitary, 5-merous; fruit yellow, like a small pear, 3-angulate, aromatic, used in native medicine. In mangrove swamps, Jurong Kranji. Vern. Limau lelang.

Murraya koenigii Spr.

Small tree or shrub; leaflets 9–23, stinging when bruised ('curry bush'). Native of India, cultivated.

Murraya paniculata Jack (= *M. exotica* L.)

Shrub or small tree; leaflets 3–7; flowers white, strong-scented. Native of continental Asia, cultivated as an ornamental. Vern. Kumuning, mock orange, 九里香

Paramignya scandens Craib var. ridleyi Swingle (= *P. griffithii* Hook. f.)

Prickly climber; fruit globose, not lobed. Rare, Changi.

Ruta graveolens L.

Perennial herb, rue, from S. Europe; leaves 2–2 times subdivided. Occasionally planted for medicine and flavouring. 芸香

Triphasia trifolia P. Wils.

Spiny shrub; leaves of 1–3 leaflets; flowers white; fruit ovoid, red. Prob. a native of S. China, planted for hedges. Vern. Limau keah.

Zanthoxylum nitidum DC (= *Z. hirtellum* Ridl.)

Climbing shrub; leaflets usually 5–9. Yio Chu Kang (*Ridley 11291*), 山椒

88. SIMAROUBACEAE

KEY TO THE GENERA

A. Leaves simple,

B. Gigantic tree, in inland forest ..... *Irvingia*

B. Shrub or small tree, in tidal swamps ..... *Quassia*

A. Leaves pinnately compound, shrubs or small trees,

C. Leaflets sessile or nearly so, attached to the rachis with a conspicuous joint ..... *Eurycoma*

C. Leaflets stalked, joint indistinct ..... *Brucea*

Brucea javanica Merr. (= *B. sumatrana* Roxb.)

Shrub or small tree; leaves with 3–15 coarsely-toothed leaflets, aromatic; flowers small, purple; drupe black, bitter, used in native medicine for many purposes. Changi (*Kiah 2603*). Vern. lada pahi. 鴉胆子

Eurycoma longifolia Jack

Shrub or small tree; bark bitter, used in native medicine against fever; leaves with many opposite leaflets plus a terminal one. In primary and secondary forests, Tanglin, Changi (*Hullett 51*), Bukit Timah. Vern. Bidara pahit.

Irvingia malayana Oliv. ex Benn.

Large tree with steep plank buttresses; flowers small, green; fruit like a small mango. In Reservoir woods, Bukit Timah (*Ridley 6356*). Vern. Pauh kijang.

Quassia indica (Gaertn.) Nooteb. (= *Samadera indica* Gaertn.)

Shrub or small tree; leaves with few to many scattered, pitted glands on the lower surface; fruit laterally compressed, sharp-edged. Formerly reported from tidal swamps, extinct.

89. BURSERACEAE

KEY TO THE GENERA

A. Fruit a winged capsule ..... *Triomma*

A. Fruit a drupe, not winged,

B. Fruit with an apical stigma, wrinkled when dry,

C. Calyx enlarged in fruit; stone wall thickly woody ..... *Canarium*

C. Calyx not enlarged in fruit; stone wall thinly woody ..... *Dacryodes*

B. Fruit with a lateral stigma, smooth when dry ..... *Santiria*

Canarium grandifolium (Ridl.) Lam (= Trigonochlamys grandifolia Ridl.)

Large tree, buttressed; leaves pinnate, with 5–7 leaflets; inflorescence terminal or axillary; flowers unisexual, 3-merous; drupe seated on an enlarged calyx; stone woody, 3-angulate in section. Changi.

Canar. littorale Bl.

A common but variable species formerly considered as several separate species (*C. purpurascens* Benn., *C. rufum* Benn., *C. secundum* Benn.). Medium-sized tree; flowers creamy yellow; fruit large, greyish green; stone 3-angled. Tanglin, Bukit Timah, Changi, Seletar, MacRitchie (*Corner 33553*). Vern. Kedondong.

Canar. patentinervium Miq. (= *C. nitidum* Benn.)

In open woods, Reservoir woods, Bukit Timah, Changi (*Ridley 5001*).

Canar. pilosum Benn. (= *C. grandiflorum* Benn.)

Flowers orange. Changi, Bukit Mandai, Bukit Timah (*Corner 34995*).

Canar. vulgare Leenh. (= *C. commune* L.)

Native of Celebes and Molucca, the kenai nut tree is valued for its oily kerneel of fruits. One time planted as a roadside tree.

Dacryodes laxa (Benn.) Lam (= *Santiria laxa* Benn.)

Large tree with spreading crown; leaves with 7–9 leaflets; flowers deep red, in a lax hanging hairy panicle; drupe rosy, plume-like. Bukit Timah (*Ngadiman 37037*), Gardens' Jungle.

Dacryodes rostrata (Bl.) Lam (= *Canarium kadondon* Benn.)

Big tree, fruit pink. Gardens' Jungle; Bukit Timah (*Ridley 6359*), Changi.

Santiria apiculata Benn.

Small tree; leaves with 3–9 leaflets; flowers whitish green; fruit rosy, obliquely ellipsoid. Bajau (*Ridley 6361*), Bukit Timah.

Santiria griffithii (Hook. f.) Engl. (= *Trigonochlamys griffithii* Hook. f.)

Tree; leaflets 9–15; flowers whitish yellow; fruit blue. Kranji, Seletar, Tanjong Gul, Mandai (*Corner 34904*).

Santiria laevigata Bl.

Large tree; flowers green. Seletar, Gardens' Jungle; Bukit Timah (*Ngadiman 34772*).

Triomma malaccensis Hook. f.

Large tree, exuding aromatic resin; leaflets 9; fruit a 3-winged capsule, green, opening by 3 woody valves; seed 1 in each locule, flatly winged. Gardens' Jungle, Bukit Timah (*Corner 34956*), rare.

80. MELIACEAE

KEY TO THE GENERA

A. Leaves simple, small shrubs ..... *Turraea*

A. Leaves compound,

B. Leaves imperfectly 2–3 times pinnate ..... *Melia*

B. Leaves 3-foliolate or once pinnate,

C. Flowers with a prominent glandular disc, cup or tube shaped, surrounded but free from the ovary,

D. Leaves 3-foliolate ..... *Sandoricum*

D. Leaves once pinnate ..... *Dysoxylum*

C. Flower disc inconspicuous or absent, or if prominent, then fused with the ovary,

E. Petals globosely connivent,

F. Flower parts in 3s, trees ..... *Amoora, Aphanamixis*

F. Flower parts in 5s, trees or shrubs,

G. Inflorescence spike-like, ovary 3–5 loculed ... *Lansium*

G. Inflorescence panicled, ovary 1–3 loculed ..... *Aglaia*

E. Petals not globosely connivent,

H. Flower parts in 4s,

I. Calyx deeply 4-lobed; capsule not dehiscent, many seeded; trees of mangrove swamps ..... *Xylocarpus*

I. Calyx subentire; capsule dehiscent, 1–4-seeded; disc absent ..... *Chisochetum*

H. Flower parts in 5s,

J. Leaflets serrate; drupe globose, 1.5–2 cm long .... *Azadirachta*

J. Leaflets entire; capsule ovoid, 7–17 cm long .... *Swietenia*

Aglaia cordata Hiern.

Small tree; leaflets 7–9; flowers minute, in axillary panicles; berry globose or ovoid, 1–2 seeded; seeds with a yellow pulpy coat. Seletar (*Ridley 333*).

Aglaia glabriflora Hiern.

Shrub; leaflets 9 or more. Edge of woods; Tanglin, Changi, Bukit Timah (*Sinclair 40189*).

Aglaia odorata Lour.

Shrub with very small yellow fragrant flowers (exclusively male ones). Native of S. China, often cultivated; propagated by marcots. 樹蘭，米仔蘭

Aglaia odoratissima Bl.

Shrub or small tree; leaflets 5–7; fruit yellow; fruit ovoid. Bukit Mandai, Bukit Timah, Reservoir woods, Choa Chu Kang (*Ridley 3919*).

Aglaia oligophylla Miq.

Small tree; leaflets 3–5; fruit globose. Singapore, formerly recorded by *Wallich 4887*.

Aglaia palembanica Miz,

Shrub or small tree; leaflets 5–9; fruit ellipsoid. Stagmount.

Aglaia trichostemon DC

Small tree; leaflets 9–13; fruit ovoid. Gardens' Jungle (*Corner 33582*), Jurong.

Amoora cucullata Roxb.

Tree, leaves pinnate; leaflets 5–11; racemes supra-axillary; petals yellow; capsule pear-shaped, 6–6.5 cm across, 3-valved, with 1 seed in each locule; aril orange. Seletar, Mandai, Pandan.

Amoora rubescens Hiern.

Tree; leaflets 13–15. Singapore (Maingay ?), Seletar.

Amoora rubiginosa Hiern.

Large tree; leaflets 17–21, of copper colour beneath; fruit subglobose, apiculate, 5–7 cm across. Choa Chu Kang, Bukit Timah (*Corner 37277*).

Aphanamixis rohituka Pierre (= *Amoora aphanamixis* Schultes)

Tree; leaflets 9–15; male flowers in panicles; female flowers in racemes; capsule globose, 3-valved; seeds arillate, scarlet. Tuas, Seletar, Bukit Timah, Jurong (*Corner 36036*).

Azadirachta indica Juss. (= *Melia indica* L.)

Trees; leaves pinnate; leaflets 8–16; flowers yellowish white; fruit greenish yellow. Wild in India, known as nim tree, a valuable medicinal plant.

Chisocheton patens Bl. (= *Chis. divergens* Bl.)

Laticiferous tree; leaflets 20–30; flowers in supra-axillary panicles; petals yellowish white; capsule pear-shaped, red, 2–4 valved; seed 1 in each chamber. black with orange aril as base. Tanglin, Mandai (*Corner 36292*), Changi.

Chisocheton erythrocarpus Hiern.

Big tree; leaflets 8–12. Pulau Ubin, Tampines River (*Ridley 5963*).

Chis. macrophyllum King

Tree; leaflets many. Pulau Ubin (*Ridley 4767*, type 1).

Chis. pauciflorus King

Shrub or small tree; leaflets 4–6; fruit fusiform. Reservoir woods.

Chis. pentandrus Merr. Subsp. paucijugus Mabberley (= *Chis spicatus* Hiern.)

Tree; leaflets 4–6; fruit spear-head shaped; seeds 2. Bukit Timah (*Ridley 8448*).

Dysoxylum acutangulum Miq.

Tree, glabrous; leaflets 6–8, entire; flowers axillary or on old woods, in panicles or racemes; capsule globose, pear shaped, 3-loculate; seeds black with an orange aril. Changi, MacRitchie (*Corner 34950*).

Dysox. cauliflorum Hiern.

Tree, leaflets 9–13; flowers and fruits clustered on the trunk; fruit ovoid, split by 4 valves; seeds black with a red aril. Tanglin, Bukit Timah, Changi, Choa Chu Kang, Pulau Ubin (*Hullett 392*).

Dysox. costulatum Miq.

Tree; leaflets 8–9; fruit depressed globose, tapering below, 4-valved. Seletar, Changi, Bukit Timah (*Ngadiman 36424*).

Dysox. flavescens Hiern.

Tree; leaflets 9–13; fruit ovoid, on large branches. Bukit Timah, Changi, Seletar (*Ridley 6127*).

Dysox. macrothyrsum Miq.

Tree; leaflets 6–8; fruit turbinate, with 4 shallow grooves and 4 round angles. Choa Chu Kang.

Dysox. thyrsoideum Griff.

Large tree; leaflets 6–8; fruit globose, shortly narrowed at based. Bukit Timah (*Ngadiman 35586*).

Dysoxylum tubinatum King

Small tree; leaflets 4–6; fruit depressed glabrous. Bukit Timah, Choa Chu Kang (*Goodenough 3468*).

Lansium domesticum Carr.

Tree; leaflets 3–8, flowers in axillary racemes; simple, branched or in fascicles; flowers pale yellow; berry globose, 5-loculate, but usually only 1 or 2-seeded; seeds with a fleshy gelatinous edible aril. Vern. Langsat. duku.

Melia azedarach L.

Tree; leaves imperfectly 2–3 times pinnate; leaflets crenate or incised; petals lilac (hence the common name "Persian lilac"); fruit a yellow-brown berry, as if with a porcelain-like coating (hence "China berry tree"). Native of N. India, sometimes cultivated. 楝，苦楝

Sandoricum koetjape (Burm. f.) Merr. (= *S. indicum* Cav.)

Laticiferous tree ;leaflets 3, entire or shallowly serrate; petals reddish yellow; drupe yellow, depressed globose, 5–7.5 cm across, with 2 to 5 pyrenes. Vern. Sentol.

Swietenia macrophylla King

Tree; leaves even-pinnate; leaflets 9–15; capsule ovoid, woody, greyish brown, 15–17 cm long, 5-loculate, dehiscing by 5 valves from the base. The broad-leaved mahogany tree is a native of Honduras, often cultivated as a roadside tree.

Swietenia mahogani Jacq.

This is the mahogany tree which differs from the above species in smaller leaflets with distinctly recurved margins at base, and in smaller capsule (7.5–10 cm long). Native of tropical America, only occasionally planted. 桃花心木

Turraea breviflora Ridl.

Small shrub; leaves simple; flowers in axillary cymes. In woods, Serangoon.

Xylocarpus granatum Koen. (= *Carapa obovata* Bl.)

Tree with smooth, peeling reddish bark, in mangrove swamps; leaflets 2–4(–6), obovate oblong, thick leathery; fruit globose, 10–20 cm across, brown; seeds several, cocky. Kranji, Serangoon, Pulau Seletar (*Samsuri 1204*). Vern. Nireh.

Xyloc. moluccensis (Lamk.) Roem. (= *Carapa moluccensis* Lamk.)

Tree with dark brown bark; leaflets 1–7, ovate-oblong, thin leathery; fruit broadly ellipsoid, 8–15 cm across. Pulau Pawai (*Sinclair 38898*). Ulu Pandan.

91. POLYGALACEAE

KEY TO THE GENERA

A. Herbs; petals 3, fused at base and adnate to the staminal tube,

B. Stamens 8 ..... *Polygala*

B. Stamens 4–5 ..... *Salomonia*

A. Trees; petals 5, free,

C. Stamens 5 ;fruit of 3 samaras ..... *Trigoniastrum*

C. Stamens 8; fruit a drupe ..... *Xanthophyllum*

Polygala brachystachya Bl.

Small trailing herb; leaves small narrow; flowers yellow, in racemes. St. Michael's Road (*Sinclair 38867*).

Polygala paniculata L.

Flowers white or pale violet, in terminal simple or branched racemes. Native of Brazil, common in road borders in certain areas.

Salomonia cantoniensis Lour.

A very thin herb: flowers very small, pink, found in open grassland. Choa Chu Kang (*Goodenough 3838*).

Trigoniastrum hypolecum Miq.

Small tree; leaf underneath white from a layer of twisted hairs; flowers irregular, in panicles; fruit winged. Bukit Timah (*Ridley 10379*).

Xanthophyllum affine Korth.

Tree, flowers white or yellow, in branched racemes; fruit soft woody, round, 2–2.5 cm across, seed 1.

Xanth. discolor Chodat

Fruit round, 1.2 cm across.

Xanth. ellipticum Korth. (= *X. kingii* Chodat)

Fruit round, 1.4–2 cm across.

Xanth. griffithii var. curtissi (King) Ng

Fruit round, 1–1.2 cm across.

Xanth. maingayi Benn. (= *X. palembanicum* Auct.)

Small tree; fruit round, 1.2–1.5 cm across. Common understorey tree. Bukit Timah (*Md. Shah & Samsuri 3956*).

Xanth. obscurum Benn.

Fruit round or obovoid, 8–12 cm across.

92. EUPHORBIACEAE

SYNOPTIC KEY TO THE NATIVE GENERA*

A. Each ovary-locule with 2 ovules; flowers mostly in dense clusters (at least in staminate ones); inflorescences always axillary; sepals overlapping or not; stamens usually equal to or double sepal number, outer ones opposite sepalous; fruit usually a capsule, sometimes fleshy to leathery, slowly splitting. (Subfamily Phyllanthoideae).

B. Flowers with petals,

C. Calyx lobes not overlapping in bud; stamens joined in a column ..... (*Bredelia, Cleistanthus*)

C. Calyx lobes overlapping in bud; stamens free ..... (*Actephila*)

B. Flowers apetalous,

D. Leaves opposite ..... (*Austrobuxus*)

D. Leaves alternate (spiral or in 2 ranks),

E. Staminate flowers in axillary clusters or solitary,

F. Staminate flowers with ring-like disc, or of separate glands, or absent; styles slender, divided or not .... (*Breynia, Glochidion, Phyllanthus, Sauropus, Securinega, Synostemon*)

F. Staminate flowers with a broad, plate-like disc; style and stigma flattened, fan-shaped ..... (*Drypetes*)

E. Staminate flowers in axillary racemes, spikes or panicles .... (*Antidesma, Aporusa, Baccaurea*)

A. Each ovary-locule with only 1 ovule; inflorescence a spike, raceme or panicle, sometimes terminal; sepals in male seldom overlapping; stamens often numerous; fruit usually a capsule. (Subfamily Euphorbioideae).

G. Flowers naked, without petals or sepals, crowded and surrounded by a calyx-like involucre, the whole resembling a single flower ... (*Euphorbia*)

G. Flowers with sepals, and sometimes petals, not clustered within in involucre,

H. Inflorescence of terminal cymes, with a central female surrounded by male flowers ..... (*Aleurites*)

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* Based on T. C. Whitmore in Tr. Fl. Mal. 2 (1973): 40-43, modified.

H. Inflorescence axillary or if terminal, not cymose,

I. Staminate flowers with petals,

J. Outer (or all) stamens opposite sepals; fruit a strongly sculptured or flattened stone; stipules arising from different levels ..... (*Galearia, Microdesmis*)

J. Outer (or all) stamens alternate with sepals; fruit without a stone; stipules arising on same level,

K. Stamens numerous, strongly inflexed in bud; flowers in terminal, bisexual spikes; commonly stellate hairy; leaves with 2 large glands at base of blade ... (*Croton*)

K. Stamens erect in bud; flowers and leaves not as above ..... (*Agrostistachys, Trigonostemon, Fahrenheitia*)

I. Flowers without petals,

L. Slender twiners; styles joined in a usually massive column ..... (*Pterococcus, Megistostigma*)

L. Shrubs, trees, or rarely herbs; styles not as above,

M. Sepals of staminate flowers not overlapping in bud, or calyx bursting irregularly ..... (*Acalypha, Alchornea, Blumeodendron, Claoxylon, Endospermum, Koilodepas, Macaranga, Mallotus, Ptychopyxis*)

M. Sepals of staminate flowers overlapping in bud,

N. Disc or glands present; flowers in small dense clusters ..... (*Suregada*)

N. Disc or glands absent; flowers mostly in spikes or racemes ..... (*Excoecaria, Pimelodendron, Sebastiania, Sapium*)

Acalypha godseffiana Mast.

Shrub; leaves heart-shaped, coarse-toothed, green with creamy edge; sometimes planted; native of New Guinea.

Acal. hispida Burm. f.

Shrub; spikes long, cylindrical, hairy, bright red; sometimes cultivated; prob. native of Indonesia.

Acal. indica L.

A hairy herb; females flowers few, enclosed in a large bract. Widely distributed in the Old tropics; Bajau, Geylang (*Ridley in 1896*), Pulau Ubin, etc.

Acal. siamensis Oliv. ex Gage

Shrub, glabrous; leaves rhomboid, coriaceous; racemes slender, 3 cm long. Native of Thailand and N. Malaya, often as a hedge plant. Vern. *Tumput.*

Acal. wilkesiana M.A.

Shrub; leaves ovate, red or in several colour forms or markings. Native of Fiji, commonly planted as a roadside ornament.

Actephila excelsa M.A. var. javanica (Miq.) P. & H.

Shrub or small tree; leaves elliptic, spiral; fruit a woody capsule, seated on the persistent calyx with a long stalk. Gardens Jungle, Bukit Timah (*Samsuri 820*), Bukit Mandai.

Agrostistachys longifolia Benth. (= *A. sessilifolia* P. & H.)

Shrub or small tree; leaves always clustered at twig tips, blades leathery, very narrowly obovate, 30–60 cm long, the base decurrent to twig. Common in understorey of forests; Tanglin, Sungei Buluh, Gardens Jungle (*Burkill 129*), Choa Chu Kang, etc.

Alchornia rugosa M.A. (= *A. javensis* M.A.)

Shrub or small tree; leaves obovate; fruit the size of a pea. Changi (*Ridley 3605*), Serangoon.

Alch. villosa M.A.

Shrub, coated with long soft golden hairs; leaves ovate, toothed. In thickets; Bukit Timah, Reservoir Woods, Bukit Mandai, Choa Chu Kang (*Ridley 3452*), etc.

Aleurites moluccana Willd.

Tree, occasionally planted. Fruit with a thick rind and 1–2 seeds; seeds with a stony coat, though poisonous, used to a small extent for food; oil from the kernel was formerly used for making candle (hence 'candle nut tree'). Vern. *buah keras,* 石果

Antidesma coriaceum Tul.

Small tree, glabrous; leaves spirally arranged; flowers tiny, on slender spikes or panicles; drupe small red, roundish but compressed. Bukit Timah, Tanglin, Gardens Jungle, Nee Soon (*Samsuri 1452*).

Ant. cuspidatum M.A.

Tree, pubescent. Changi, Bukit Timah, Gardens Jungle, Choa Chu Kang (*Ridley 3908*).

Ant. neurocarpum Miq. (= *A. alatum* Hook.)

Small tree, glabrous. Changi (*Ridley 1840*), Jurong, Bukit Timah.

Ant. velutinosum Bl.

Shrub or small tree, tomentose. Pulau Ubin (*Hullet 629*), Changi.

Aporusa benthamiana Hook. f.

Small tree; leaves oblong, with very big, crescentic stipules; dioecious, male flowers in short catkins; females in clusters or short spikes; fruit red. Bukit Timah (*Ridley 6259*), Tanglin, Choa Chu Kang. A genus of shrub, small to medium tree, the generic name *Aporusa* means 'difficult', formerly misspelt as *Aporosa*.

Apor. bracteosa P. & H.

Small to medium tree; leaves elliptic. Bajau (*Ridley 6484*).

Apor. confusa Gage

Small tree. Bukit Mandai (*Ridley 6490*).

Apor. falcifera Hook. f.

Medium tree. Bukit Timah, Gardens Jungle (*Sinclair 40697*), Kranji.

Apor. frutescens Bl.

Bushy tree; male catkins yellow, 1–2 cm long. Bukit Timah (*Ridley 4443*).

Apor. lunata (Miq.) Kurz

Shrub. Jurong (*Ridley 6098*).

Apor. microstachya M.A. (= *A. maingayi* Hook. f.)

Shrub. Gardens Jungle (*Cantley 8*), Seletar, Kranji, Jurong.

Apor. nervosa Hook. f.

Medium tree. Tuas (*Ridley 6488*).

Apor. nigricans Hook. f.

Small tree. Tanglin, Bukit Timah (*Md. Shah & Samsuri 3903*), Choa Chu Kang.

Apor. prainiana King ex Gage

Small tree. Bukit Mandai, Seletar (*Sinclair 40217*), Kranji.

Apor. symplocoides (Hook. f.) Gage

Small tree. Seletar (*Ridley 6173*).

Austrobuxus nitidus Miq. (= *Longetia malayana* P. & H.)

Shrub or small tree; leaves opposite, elliptic; flowers small in short panicles; fruit elliptic, splitting into 3 parts. Sungei Bupuh, Serimbun.

Baccaurea bracteata M.A.

Small tree. Bukit Mandai, Nee Soon (*Samsuri 1450*), Holland Road, Kranji. *Baccaurea* is a genus of small trees, with flowers in long racemes which are in tufts on the knotted stem. Male racemes are usually borne above and females at the base of the tree. Fruit a globose capsule, orange or brown, usually splitting and exposing the pulpy seeds. The pulp is edible, though often acidic. The Malay name for this group is *tempoi* or *rambai*.

Baccaurea griffithii Hook. f.

Seletar (*Ridley 6125*).

Bacc. hookeri Gage

Small tree. Seletar (*Sinclair 40305*).

Bacc. kunstleri King ex Gage

Medium tree. Gardens Jungle, Seletar, Tanjong Bul.

Bacc. lanceolata M.A.

Bacc. macrophylla M.A.

Small to medium tree. Gardens Jungle, Seletar (*Corner s.n.*).

Bacc. maingayi Hook. f.

Bukit Timah (*Tamby H9*).

Bacc. minor Hook. f.

Gardens Jungle, Bukit Timah, MacRitchie (*Md. Shah & Samsuri 3944*).

Bacc. motleyana King

This is a well-known fruit tree, 'rambai', common in cultivation.

Bacc. parviflora M.A.

Tanglin, Bajau, Changi (*Ridley 1896*).

Bacc. pyrifomis Gage

Kranji (*Ridley 6491*, type).

Bacc. racemosa M.A. (= *B. wallichii* Hook. f.)

Seletar (*Ridley 6258*).

Bacc. reticulata Hook. f.

Kranji (*Ridley 6146*), Seletar.

Bacc. summatrana M.A. (= *B. kingii* Gage)

Blumeodendron tokbrai J.J. Sm.

Large tree; leaves often with a pale whitish margin; fruit round, orange, 3-shouldered. In lowland and swampy forest. Bukit Timah (*Henderson 37296*).

Breynia coronata Hook. f.

Shrub; leaves alternate, in 2 ranks; flowers small in axillary clusters; fruit small, rose-pink, with enlarged calyx.

Brey. discigera M.A.

Shrub. Bukit Timah, Mandai (*Burkill 6101*).

Brey. reclinata Hook. f.

Shrub; berry red. Common near the sea; Bukit Timah (*Samsuri 1421*), Tanglin, Reservoir Woods, Changi. Vern. *hujan panas*.

Brey. vitis-idaea C.E.C. Fisch. (= *B. rhamnoides* M.A.)

Large shrub.

Bridelia pustulata Hook. f.

Shrub; leaves ovate; flowers small, in clusters; fruit a small drupe. Jurong (*Ridley 3874*), Changi.

Brid. stipularis Bl.

Bush or small tree; leaves soft velvety below. Pasir Panjang (*Sinclair 40195*).

Brid. tomentosa Bl.

Shrub or small tree; leaves glabrous below. In open places, Garden Jungle, Tanglin (*Hullett 692*). 土蜜樹

Claoxylon indicum Hassk.

Large shrub or small tree; leaves softly velvety below; spikes to 40 cm long. In thickets, Grange Road, Dalvey Road (*Sinclair 10922*).

Claoxylon longifolium Endl. ex Hassk.

Tree; leaves glabrous; spikes less than 10 cm long. In Woods, Bukit Timah, Pulau Ubin, Bukit Mandai (*Ridley 5911*), Choa Chu Kang.

Cleistanthus hirsutulus Hook f.

Shrub or small tree; leaves papery, often glaucous below; flowers like *Bridelia* except ovary 3-loculed; fruit a 3-lobed capsule, hairy. Bukit Timah (*Ridley 6514*).

Cleist. macrophyllus Hook. f.

Leaves large, ovate-elliptic, 14–20 x 69 cm. Bukit Timah (*Ridley 6478*).

Cleist. malaccensis Hook. f.

Leaves glabrous. Choa Chu Kang (*Ridley 4586*).

Cleist. myrianthus Kurz

Bushy tree; leaves coppery. Kranji (*Ridley 6375*), Jurong, Choa Chu Kang.

Cleist. sumatranus (Miq.) M.A. (= *C. heterophyllus* Hook. f.)

Codiaeum variegatum (L.) Bl.

Shrub or small tree; leaves bright-coloured, having unlimited variations in form and colour pattern (colours, including red, orange, yellow, green and purple). Horticulturally known as 'Croton' (not to be confused with *Croton* which is a different genus). Native of Fiji. 變葉木

Croton argyratus Bl.

Small tree; leaves silvery or bronze beneath. Changi (*Ridley 3638a*). Vern. *Tuku Takal.*

Croton caudatus Geisel.

Scandent or erect shrub; flowers white, in erect racemes; capsule globose, yellow. Tanglin, Bukit Timah, Bajau, Choa Chu Kang (*Ridley 3884*), Changi. Vern. *Tuku Takal.*

Croton heterocarpus M.A. (= *C. heteropetalum* Ridl.)

Leaves small, strongly wavy. In mangrove swamps. Choa Chu Kang (*Sinclair 38591*).

Croton laevifolius Bl. (= *C. griffithii* Hook. f.)

Shrub or small tree. Gardens Jungle, Bukit Timah (*Md. Shah & Samsuri 3890*), Sungei Puluh, Choa Chu Kang.

Drypetes pendula Ridl.

Small tree; leaves oblong, leathery, base heart-shaped; young leaves in drooping purplish tassels. Bukit Timah, Reservoir Forests (*Ridley 6124*).

Euphorbia antiquorum L.

Cactus-like shrub, to 8 m tall, with milky sap; branches 3–4 angled; leaves oval-shaped, often reduced; spines brown, on ridge-elevations. Native of India and Malaya.

Euph. atoto Forst. f.

Small herb, to 1 m tall, glabrous, with white sap; leaves opposite. On seashores, Changi, Katong (*Ridley 10804*).

Euph. hirta L.

Hairy herb, to 30 cm tall; leaves opposite, oblong, toothed. Common weed.

Euph. milii des Moulin (= *E. splendens* Bojer)

Shrub; stem succulent, bearing long spines mixed with few obovate leaves; involucre bright red (or ivory yellow). Native of Madagascar, vern. Crown of Thorns, 麒麟花

Euph. neriifolia L.

Like *E. antiquorum*, but branches 5-angled; leaves obovate. Native of India, known as Indian Spurge tree.

Euph. pulcherrima Willd.

The poinsettia is a symbol of the Christmas Season, when in N. temperate countries, it can be found in full bloom; leaves usually green, but the floral leaves at stem-tips are bright red in a rosette. Native of tropical America. 聖誕紅

Euph. thymifolia L.

Small herb, prostrate on ground, tinged reddish or purplish. Common weed, on open ground.

Euph. tirucalli L.

A large succulent shrub, to 5 m tall; branches slender, green, cylindrical; leaves small or absent. Native of Africa, the milk is used in native medicine. 珊瑚木

Excoecaria agallocha L.

Small tree, sap milky, poisonous; leaves ovate-elliptic; flowers small in axillary spikes. Common in mangrove swamps; Kranji (*Ridley 6921*), Changi, Tuas.

Excoecaria bilolor Hassk.

Glabrous shrub; leaves ovate-elliptic, dark green above and reddish purple beneath. Native of southern Indo China. 青紫木

Fahrenheitia pendula (Hassk.) Airy-Shaw (= *Ostodes macrophyllus* Benth.)

Small tree; leaves large, narrowly obovate; inflorescence a terminal panicle. In open woods; Choa Chu Kang, Bukit Panjang (*Burkill 7619*).

Galearia fulva (Tul.) Miq.

Shrub or small straggling tree; leaves elliptic, rusty below; flowers small, in slender tail-like pendulous spikes; fruit white pulpy. Very variable, formerly described under a host of binomials. Bukit Timah (*Corner 33588*).

Glochidion brunneum Hook. f.

Small tree; leaves elliptic ovate, in 2 ranks; flowers small, in dense axillary clusters; fruit a stalked, 4–6-lobed capsule. Gardens Jungle, Bukit Timah, Balestier Road (*Ridley 10388*). Vern. Ubah merak (ubah is the Malay name for *Glochidion*).

Glochidion glomerulatum Boerl.

Shrub or small tree; fruit 6-lobed.

Glochidion hypoleucum Boerl. (= *G. laevigatum* Hook. f.)

Shrub or small tree; leaves usually glaucous below. Bukit Timah, Bukit Mandai,, Tuas (*Ridley 6519*).

Gloch. littorale Bl.

Banks of tidal rivers. Choa Chu Kang, Bukit Mandai (*Ridley 8436*).

Gloch. microbotrys Hook. f.

Tall tree with flaking bark; flowers small, scented. Gardens Jungle, Reservoir Jungle (*Corner 32270*), Choa Chu Kang, Changi, Pulau Ubin.

Gloch. rubrum Bl. (= *G. leiostylum* Kurz)

Shrub or small tree; leaves elliptic to ovate, variable. Gardens Jungle, Seletar, Nee Soon (*Samsuri 1394*).

Gloch. sericeum Hook. f.

Leaf undersurface and capsule covered with short velvety hairs. Bukit Mandai (*Ridley 179*).

Gloch. singaporense Gage

Shrub, to 3 m tall; leaves rough, with raised dots below; fruit stalk thread-like; capsule shallowly 3-lobed. Reservoir Jungle (*Ridley 5044*, type).

Gloch. superbum Baill.

Small tree; leaves large (12–23 x 5–12 cm). In open places, Mandai (*Samsuri 1385*).

Gloch. wallichianum M.A. (= *G. desmocarpum* Hook. f.)

Leaves scurfy on the main nerves below. Tanglin, Bajau.

Gloch. zeylanicum Juss. (= *Gloch. perakense* Hook. f.)

Leaves lanceolate. In coastal swamp places, Cluny Road (*Corner 32520*).

Hevea brasiliensis (HBK) M.A.

The latex of the para Rubber tree is the source of most of the world's supply of natural rubber. A native of the Amazon region, Brazil, first successfully planted in Singapore Botanic Gardens in 1877, the seedlings were from the Kew Gardens, England. 橡膠樹，巴西橡皮樹

Jatropha curcas L.

Soft-wooded shrub or small tree with milky sap; leaves heart-shaped, sometimes lobed; flowers with 5 pale-green petals. Native of trop. America.

Jatr. hastata Jacq. (= *J. pandurifolia* Andr.)

Slender shrub, 1–1.5 m tall; leaves ovate to fiddle-shaped. Native of Cuba.

Jatr. multifida L.

Leaves palmatedly lobed into many long, pointed parts. Called coral plant; native of Trop. America.

Jatr. podagrica Hook.

Shrubby; to 1.5 m tall; stem much swollen especially near the base; leaves 5-lobed. Native of central America. 佛肚樹

Koilodepas longifolium Hook. f. (= *Coeladepas glanduliferum* P. & H.)

Small tree with stellate hairs on various parts; spikes slender, yellow, often galled; capsule orange, woolly. Gardens Jungle, Kranji (*Ridley 6555*), Bukit Timah.

Macaranga conifera M.A. (= *M. populifolia* M.A.)

Small to medium tree; leaves glabrous, ovate. In secondary forest; Bukit Timah, Nee Soon, Choa Chu Kang (*Ridley 3915*).

Macaranga gigantea M.A.

Tree with spreading crown, dome-shaped; leaves 3-lobed, over 30 cm across. Seletar, Mandai (*Sinclair 39255*). Vern. Mahang gajah.

Macar. griffithiana M.A.

Small bushy tree; leaves leathery, glabrous below. In swampy area, Tanglin (*Ridley 14722*).

Macar. heynei I.M. Johnston (= *M. javanica* Hook. f.)

Small tree; inflorescence reddish, with deeply toothed bracteoles; capsule bilobed, smooth, waxy-coated. Singapore (*Hullett 538*). Vern. Mahang.

Macar. hosei King ex Hook. f.

Tree; leaves 3-lobed. In secondary forest.

Macar. hullettii King ex Hook. f. (= *M. cornuta* Corner)

Small tree; leaves glabrous; fruit horned. In primary forest. Reservoir Jungle (*Corner 32235*).

Macar. hypoleuca M.A.

Small tree; leaves 3-lobed, intensely white beneath. Common in secondary forest, MacRitchie (*Md. Shah 3914*). Vern. Mahang putih.

Macar. pruinosa M.A. (= *M. maingayi* Hook. f.)

Tree; leaves 3-lobed; fruit 2-shouldered. In swamps.

Macar. punticulata Gage

Leaves leathery, broadly triangular, peltate. In swamp forest, Jurong (*Corner 26033*).

Macar. recurvata Gage

Tree; leaves thick leathery, oblong-triangular, often longer than 20 cm. Mandai Road (*Corner 34528*).

Macar. triloba M.A.

Small tree; leaves thin, entire or 3-lobed; stipules persistent, broader than long, thick, recurved. A well-known ant-plant, common in secondary forest; Tanglin, Changi, Choa Chu Kang (*Ridley 6165*), etc. Vern. Pahang merah.

Macar. trichocarpa M.A.

Semi-scandent shrub; branches scrambling; leaves ovate, with a long tip; capsules prickly, irritation. In dry wood; Seletar (*Ridley 3654*), Tanglin, Bukit Timah, Changi.

Mallotus albus (Roxb.) M.A. (= *Mall. macrostachyus* M.A.)

Small tree; leaves heart-shaped, thinly brown scurfy below, to 20 cm across; fruits woolly, on long spikes. In thickets, Bukit Timah (*Ridley 3448*).

Mall. paniculatus M.A.

Bushy tree; leaves smaller than above species, whitish to pale brown and thinly scurfy below; fruit spiny, on large panicles. Tanglin, Kranji (*Goodenough 5040*).

Manihot esculenta Crantz (= *M. utilissima* Pohl)

Shrubby; leaves peltate, 3–9 partite. From tropical America, cultivated for edible, starchy roots ('tapioca'). 木薯

Manihot glaziorii M.A.

Small tree, laticiferous, native of Brazil; formerly cultivated for rubber production.

Magistostigma malaccense Hook. f. (= *Sphaerostylis malaccense* P. & H.)

Slender twiner, with stinging hairs; leaves elliptic; flowers small, in axillary racemes. In woods, climbing on trees; Nassim Road, Gardens Jungle.

Micrcocca mercurialis Benth.

Herb; leaves ovate; racemes slender; capsules 3-lobed. In open places near the sea.

Microdesmis caseariifolia Planch.

Shrub or small tree; leaves oblong-lanceolate; flowers in axillary clusters. In woods; Gardens Jungle, Changi MacRitchie (*Md. Shah 3950*).

Pedilanthus tithymaloides Poit.

Shrubby, green succulent; stems straight or zigzag; inflorescence bright red, with a 2-lipped bracts enclosing unisexual flowers inside. Native of tropical America, often grown as ornament.

Phyllanthus acidus (L.) Skeels (= *Cicca acida* Merr.)

Shrub or small tree. Native of tropical America, cultivated for the pulpy acidic edible fruits. Vern. Chermai

Phyl. arnarus Schum. (= *Phyl. niruri* L.)

Tiny diffuse herb; ovary and fruit smooth. On open ground, weed; Tanglin Geylang (*Teruya 2018*), Changi.

Phyl. emblica L. (= *Emblica officinalis* Gaertn.)

Medium tree; leaves small, linear, crowded on slender twigs like a feather; fruits round, fleshy, ripening greenish yellow, sour, used for preserves. Both wild (Bukit Timah (*Goodenough 411*), Choa Chu Kang, Nee Soon) and cultivated, the Malay name is Pukok melakka. The town of Malacca is said to take its name from the tree. 餘甘子。菴摩勒。

Phyl. pulcher Wall. ex M.A.

Herb or small shrub; leaves oblong, asymmetric. Sometimes cultivated as a medicinal plant. Tanglin, Geylang (*Teruya 1312*).

Phyl. urinaria L.

Tiny diffuse herb; ovary and fruit covered with scales. On open ground. Geylang (*Beker in 1893*). 葉下珠·

Pimeleodendron griffithianum Benth.

Tree; leaves elliptic-ovate; racemes short, fascicled below the leaves.

Pteroccoccus corniculatus P. & H. (= *P. glaberrimus* Hassk.)

Slender woody twiner; flowers in axillary spikes. On open ground.

Ptychopyxis caput-medusae Ridl.

Small tree; leaves ovate-oblong; flowers in racemes, velvety; fruit spinescent (like a thick, soft, spiny chestnut). Bukit Timah (*Ngadiman 34800*).

Ptych. costata Miq. var. oblanceolata Airy-Shaw

Leaves oblanceolate, ferruginous. In woods; Gardens Jungle, Choa Chu Kang (*Ridley 4828*), Bukit Mandai.

Ricinus communis L.

Perennial herb to small tree; leaves round ovate, 6–11-lobed; flowers in terminal panicles; fruit soft prickly. Native of tropical Africa; oil from the seeds ('castor bean oil') used or a lubricant, for lighting and in medicine and industry. 蓖麻

Sapium discolor M.A.

Tree; leaves elliptic, withering bright red; petiole slender, with 2 glands near tip; flowers in solitary spikes. In woods and secondary jungles; Gardens Jungle, Reservoir Woods (*Ridley 5031*), Jurong, Tanglin.

Sauropus androgynus Merr. (= *S. ablicans* Bl.)

Shrubby; leaves oblong, 2 ranked. Young branches used as vegetable. Serangoon (*Ridley 9111*). Vern. Chekup manis.

Sebastiania chamaelea M.A.

Herb, branched; leaves narrowly oblong; capsule spiny. Open sandy places near the sea; Changi (*Md. Nur 29744*), Blakang Mati.

Suregada multiflora Baill. (= *Gelonium glomerulatum* Hassk.)

Small tree; leaves oblong, fleshy. Near the sea; Changi (*Ridley 1824*), Pulau Uubin.

Synostemon acciformis G.L. Webster (= *Agyneia bacciformis* L.)

Herb, in grassland near the sea. Teluk Karau.

Trigonostemon longifolius Baill.

Shrub; branches golden hairy; leaves oblanceolate, sessile; spikes to 40 cm long; fruit golden scurfy. In woods; Choa Chu Kang, Reservoir woods, Kranji, Bukit Timah (*Ngadiman 35902*).

93. DAPHNIPHYLLACEAE

Daphniphyllum laurinum (Benth.) Baill.

Small tree; leaves elliptic, clustered; fruit ellipsoid, 1 cm long, warty. In open places or near the sea; formerly found in Changi (*Ridley 3437*), Siglap, Kranji, probably extinct.

(to be continued)

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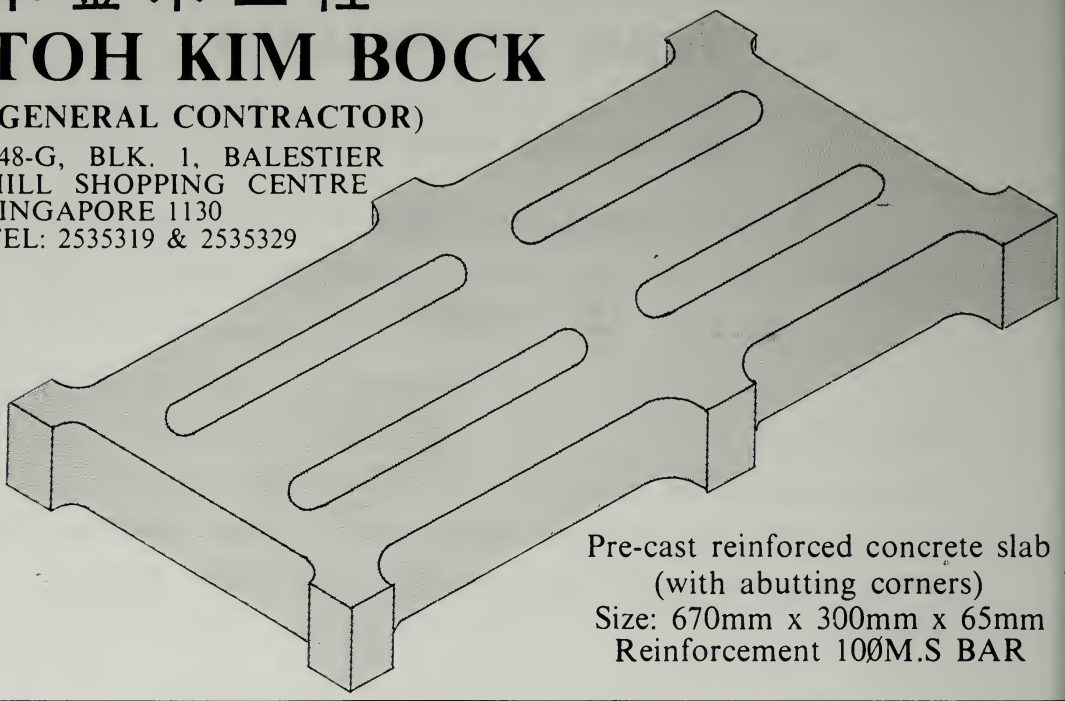

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