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A TAXONOMIC REVIEW OF THE GENUS ACTINIDIA

Hui-Lin Li

The genus *Actinidia* was revised by S. T. Dunn in 1911.* He then recognized 24 species for the genus, and these were arranged in four sections. The genus is limited to eastern and southern Asia, with the main center of development in China. Intensive botanical exploration in eastern Asia during the last forty years has added 26 supposedly new species to the genus, in addition to a few new combinations and other nomenclatural changes. A very much larger series of specimens is now available than at the time of Dunn's study. It is the purpose of this paper to coordinate these later additions with Dunn's treatment and to evaluate his system of classification in the light of our fuller knowledge of the genus.

Among the 24 species enumerated by Dunn, he had not seen material of five, namely *A. giraldii* Diels, *A. holotricha* Finet & Gagnep., *A. davidii* Franch., *A. eriantha* Benth., and *A. fortunatii* Finet & Gagnep. For most of the other species, the number of specimens examined by him were few. With our present more abundant material, the nature of many of the species, including their variation, distribution, and taxonomic delimitation, can be more fully understood and more adequately interpreted.

An account of the early history of the genus is given in Dunn's paper and need not be repeated here. He also presented a discussion of the affinities of the genus, which together with other related genera, was then generally included in the Ternstroemiaceae or Dilleniaceae, and he reached the following conclusion concerning *Actinidia* and closely related genera: "*Saurauja* is inseparable from Ternstroemiaceae, while the remaining two, *Actinidia* and *Clematoclethra*, can be properly excluded from Dilleniaceae." A search into this problem is not herein attempted. It may be mentioned that the prevalent view at present is to establish the family Actinidiaceae for these three genera. In Gilg & Werdermann's treatment (in Engler & Prantl, Nat. Pflanzenf. ed. 2.

* Dunn, S. T. A revision of the genus *Actinidia* Lindl. Jour. Linn. Soc. Bot. **39**: 394–410, map. 1911.

21: 36–47. 1925), the three genera are considered as constituting the family Actinidiaceae, but each represents a distinct subgenus, to which is added a fourth represented by *Sladenia*. The last-named genus, however, is very different from *Actinidia* and *Clematoclethra* and should not be associated with these two. Kobuski (Jour. Arnold Arb. **32:** 403. 1951) has retained *Sladenia* in the Theaceae (Ternstroemiaceae), as originally proposed.

In Dunn's paper, full bibliographic citations for each species are given, and these will not be repeated in the present treatment. Aside from the original citation for each species, only literature subsequent to Dunn's paper is here listed. A few misapplied names of taxonomic significance are given, but no attempt is made to list all such records. Nakai (in Bot. Mag. Tokyo **47:** 251–259. 1933) has enumerated many such names in synonymy, particularly with regard to Japanese plants; I think that, at least in some cases, this contributes little to the proper understanding of the species concerned.

Dunn's key to the species is constructed on a very sketchy basis, with only one character to each item, and in general it is unsatisfactory. The different species are enumerated but not described, which renders attempts to use his account for identification purposes rather difficult. He divides the genus into four sections, giving particular emphasis to the degree of pubescence, shape of ovary, and presence or absence of lenticels on the fruit. After reviewing all the species, I find it desirable to modify his system somewhat. A very important and fundamental character of the genus, namely, the structure of hairs on the leaves, was neglected by Dunn. This is far more significant in the differentiation of the species-groups than such relative characters as the degrees of pubescence and the shape of the ovary. Both stellate-haired and simple-haired species were included in his section Vestitae. This section is here divided into two, Stellatae for species with stellate hairs and Strigosae for those with simple hairs. For the glabrous or nearly glabrous species, the section Maculatae of Dunn for species with spotted fruit is retained. For species with unspotted fruit, Dunn originally proposed two section, Ampulliferae for those with bottle-shaped ovary, and Leiocarpae for *A. kolomikta* Maxim., a species with cylindric ovary. However, this is also not a fundamental character, as such a species as *A. tetramera* Maxim. has the ovary intermediate in shape. Thus these two sections are now combined into one, Leiocarpae. As a result there still remain four sections in the genus, but they are modified in circumscription as compared with Dunn's classification.

The present study accounts for 36 species and a number of varieties. Three species, six varieties, and one form are described as new, and several new combinations are proposed. Many synonyms are listed for the first time, and the species and varieties are described.

The species of *Actinidia*, being all climbing or straggling plants, are, like most other woody vines, very variable in vegetative structures. They are dioecious plants, and often there is a slight vegetative difference between staminate and pistillate individuals, though rarely of a sharp or striking nature. Such differences, if pronounced, will be mentioned in the descriptions. It appears that *Actinidia* is in general more variable in the individual plant than most other ligneous vines; shoots from the same plant borne at different seasons often bear very different leaves, variable in pubescence as well as in shape. The large number of synonyms indicates the lack of appreciation of this fact on the part of some of the describing taxonomists.

Dunn happily had the opportunity of collecting and studying *Actinidia* in the field, and so his judgments are mostly sound and reliable. He calls special attention to the variable nature of this genus, remarking: "The long arching shoots which appear during the spring and summer months give rise in the following year to secondary branches bearing leaves which are often strikingly different in shape and character from those on the primary stems — a point which will explain some anomalies in the series of specimens in herbaria." As a matter of fact, a number of supposedly new species of later years are based on single anomalous specimens.

The distribution pattern is instructive in revealing the nature of the species in *Actinidia.* Most of the species appear to be polymorphic and to occur in very wide areas, comprising several varieties, morphologically slightly different and geographically often of contiguous but distinct areas. The type species of the genus, *A. callosa* Lindl., is the most variable and also the widest in distribution. It is one of the two that extend from temperate Asia to the tropical regions of Malaysia, the other being *A. latifolia* (Gardn. & Champ.) Merr., which is less variable in nature. All other species of the genus are primarily of the hills or mountains of temperate regions. Those of wider ranges, extending from Japan through northeastern Asia to western China, are *A. polygama* (Sieb. & Zucc.) Maxim., *A. arguta* (Sieb. & Zucc.) Planchon, and *A. chinensis* Planchon. Geographical varieties of slight morphological differences are recognizable in all these species. The majority of the species are of less wide range and less variable nature, occurring in Japan, Taiwan, Tonkin, northeastern India, and in all temperate and subtropical provinces of mainland China. Most of them occur in southwestern China, which is the present center of development of the genus. The species are generally common plants in the thickets of the region and occupy fairly broad ranges. Only a few, as records stand at present, are of very limited ranges, such as *A. rudis* Dunn and *A. rubricaulis* Dunn of southern Yunnan and the three new species herein proposed, but future explorations may prove that they are also of wider distribution.

In citing specimens, the general order of north to south is followed. An attempt has been made to standardize the geographical place names of China, which are very confusing on field labels as well as in botanical literature. With the exception of a few which cannot be deciphered, which will appear in parentheses, all names follow those given in "Gazetteer of Chinese Place Names based on the Index to V. K. Ting Atlas," June 1944, published by the Army Map Service, Washington, D. C.

Actinidia is of economic importance because of the fruits. *Actinidia chinensis* and *A. arguta*, well known as *Yang-tao* in China, have long been used for their edible fruits, which have a greenish pulp of pleasant acid taste. The fruits are collected from wild plants. *Actinidia arguta* is common in northern China while *A. chinensis* is especially common along the Yangtze valley. Many other species have similarly edible fruits. Recent efforts in introducing these species into cultivation and in improving their products are highly desirable and commendable. *Actinidia chinensis*, with its densely hairy leaves and large yellowish flowers, is also highly ornamental. *Actinidia polygama* and *A. kolomikta* have very decorative leaves variegated with white or pinkish blotches and have become desirable ornamental plants.

The material used in this study has been assembled from the following herbaria, to whose curators the writer is indebted for their generosity in permitting the use of specimens. Corresponding abbreviations are used in the citation of specimens. Arnold Arboretum (A); Gray Herbarium, (GH); New York Botanical Garden, (NY); U.S. National Herbarium, (US).

This study was carried on in the Department of Botany of the U. S. National Museum, Smithsonian Institution, to whose officials grateful acknowledgment is made for their kindness in placing the library and herbarium facilities at my disposal. The writer wishes to express especially his thanks to Dr. A. C. Smith, Curator of Phanerogams, for his kindness in reading the manuscript.

ACTINIDIA

Actinidia Lindley, Nat. Syst. ed. 2. 439. 1836; Benth. & Hook., Gen. Pl. **1**: 177. 1862.

TYPE SPECIES: *A. callosa* Lindl.

Climbing shrubs, glabrous, strigose, or tomentose, the indumentum of stellate or simple hairs; pith solid or lamellate; bark often with linear lengthwise lenticels; winter buds very small, enclosed in the swollen base of the petiole. Leaves simple, alternate, usually long-petiolate, serrate or dentate, rarely entire, penninerved, the costa usually sulcate, the veinlets reticulate, usually in cross bars; stipules minute, obsolete or absent. Flowers white, yellow, or reddish, polygamous or dioecious, usually 5- or 4-merous, in axillary often pseudo-umbellate cymes of few or many flowers, sometimes solitary; bracts generally present, minute, 1 or 2 at the apex of the peduncles. Sepals 5, rarely 2–4, imbricate, rarely valvate, free or slightly connate at the base, persistent. Petals 5, rarely 4 or more than 5, convolute, thin. Stamens numerous, in pistillate flowers usually with shorter filaments and smaller sterile anthers; filaments slender; anthers versatile, attached at the middle, reflexed in bud, usually divaricate at base, dehiscing lengthwise, yellow, brown, or purple. Disc absent. Ovary free, superior, tomentose or glabrous, ovoid, cylindrical, or bottle-shaped, many-celled; ovules attached on the central axis; styles many (15–30), free, persistent, radiating, elongating after flowering, the tip stigmatic, excurrent; rudimentary ovary in staminate flowers very small, with minute styles. Fruit a berry, glabrous or sometimes hairy, globose or oblong, spotted with lenticels or not, containing raphides. Seeds numerous, small, biconvex, oblong, immersed in pulp; testa cartilaginous, reticulate-pitted, dark when dry; albumen copious; embryo comparatively large, cylindrical, straight, the cotyledons short.

About 36 species from Sakhalin and eastern Siberia, Japan, and China to the Himalayas and Malaysia; the majority of the species are found in western to eastern and southern China.

Synopsis of the Sections.

Sectio I. **Strigosae** sect. nov. (Vestitae Dunn, p. p.)

Caulis et petioli longe strigosi, foliis plus minusve setosis, baccis maculatis.

Sectio II. **Maculatae** Dunn.

Caulis et petioli plerumque glabri, foliis glabris, baccis maculatis.

Sectio III. **Leiocarpae** Dunn (*Ampulliferae* Dunn).

Caulis et petioli glabri, foliis glabris, baccis emaculatis.

Sectio IV. **Stellatae** sect. nov.

Planta plus minusve tomentosa; indumento sub folio stellato, baccis glabris vel hirsutis, maculatis.

Key to the Species.

A. Plants glabrous or hairy, the pubescence on the under surface of the leaves when present simple, not stellate.
  B. Stems, especially young shoots, and sometimes petioles covered with yellowish or brownish strigose hairs; leaves more or less setose on one or both surfaces (Sect. Strigosae).
    C. Mature leaves more or less densely setose or strigose above, the bases rounded to cordate.
      D. Leaves cordate; petioles long, 3–7.5 cm. in length.
        E. Leaves ovate; sepals puberulous without . . . . 1. *A. rudis.*
        EE. Leaves obovate; sepals glabrous without . . . . . . 2. *A. rubus.*
      DD. Leaves oblong-lanceolate, not cordate; petioles short, about 1–1.5 cm. long. . . . . 3. *A. melliana.*
    CC. Mature leaves glabrous or very sparsely hairy above.
      D. Leaves ovate to broadly ovate, generally less than 1–1/2 times as long as broad, the base rounded to cordate, the lower surface usually strigose, not glaucous, the veins or main veinlets ending distinctly in the marginal teeth.
        E. Petioles long, slender, 5–8 cm. long; veinlets subconspicuous. . . . . 4. *A. holotricha.*

EE. Petioles short, 1.5–3 cm. long; veinlets conspicuous, strongly raised below .... 5. *A. petelotii.*

DD. Leaves narrowly ovate to oblong-lanceolate, generally two or more times as long as broad, the base cuneate, rounded to cordate, the upper surface glabrous, not strigose, the lower surface glabrous or not, the veins or veinlets strongly anastomosing.

E. Leaves ovate, slightly coriaceous, the base rounded to distinctly cordate; petioles short, 2–3 cm. long.

F. Leaves dark above, pale beneath, the base distinctly cordate; petioles very short, to 2.5 cm. long .... 6. *A. henryi.*

FF. Leaves concolored, the base rounded, not cordate; petioles 2.5–3 cm. long .... 7. *A. strigosa.*

EE. Leaves oblong-lanceolate, rarely ovate, chartaceous, the base cuneate to rounded, rarely cordate; petioles usually long, over 2 cm. in length.

F. Leaves dark above, pale and glaucous beneath, the base cuneate to narrowly rounded, never cordate (S. W. China). .... 8. *A. hemsleyana.*

FF. Leaves concolored, the lower surface green, not glaucous, the base broadly rounded to cordate (Taiwan). .... 9. *A. arisanensis.*

BB. Stems and petioles nearly always glabrous; leaves generally glabrous, or sometimes sparsely setose along the veins or pubescent in the vein-axils on the lower surface, rarely thinly tomentose beneath along the veins.

C. Fruit not spotted with pale lenticels; ovary cylindric to bottle-shaped, strictly glabrous (Section Leiocarpae).

D. Ovary cylindric; pith brown, lamellate .... 10. *A. kolomikta.*

DD. Ovary bottle-shaped, rarely cylindric; pith white or brown, solid or lamellate.

E. Pith solid, white, rarely slightly lamellate in the center.

F. Calyx of 5 distinct sepals, imbricate; pith large, solid, white. .... 11. *A. polygama.*

FF. Calyx of 2 or 3 sepals, valvate; pith small, solid, white, or rarely slightly lamellate. .... 12. *A. valvata.*

EE. Pith lamellate, brown or sometimes white.

F. Leaves small, rarely large, elliptic to oblong-ovate, to 10 cm. long and 5.5 cm. broad; petals not brownish at base; anthers yellow.

G. Flowers 4-merous, rarely 5-merous, white, sometimes tinged with pink. .... 13. *A. tetramera.*

GG. Flowers 5-merous, white tinged with red especially toward the margins. .... 14. *A. maloides.*

FF. Leaves small or large, elliptic to ovate; petals usually brownish at base; anthers purple.

G. Leaves small, narrower, to 9.5 cm. long and 4.5 cm. broad.

H. Leaves not glaucous beneath. ...... 15. *A. kwangsiensis.*

HH. Leaves glaucous beneath.

I. Leaves thicker, shorter, and broader, ovate, to 7 cm. long and 4.5 cm. broad; pith brown, lamellate to nearly solid; petals usually brownish at base; fruit larger, about 2.5 cm. across (W. China). . . . . 16. *A. melanandra.*

II. Leaves thinner, longer, and narrower, ovate to oblong-lanceolate, to 9.5 cm. long and 4.3 cm. broad; petals not brownish at base; fruit smaller, about 1.5 cm. across (Japan) . . . . 17. *A. hypoleuca.*

GG. Leaves larger, broader, over 8 cm. long and 4.5 cm. broad.

H. Leaves elliptic to elliptic-oblong, the serrations appressed; fruit obovoid or oblong, purple; pith white (S. W. China) . . . . 18. *A. purpurea.*

HH. Leaves broadly ovate, the serrations sharp, spreading; fruit subglobose, greenish; pith white or brownish (Japan, Korea, N. China, Liukiu). . . . . 19. *A. arguta.*

CC. Fruit spotted with pale lenticells; ovary slightly to densely pubescent at first, becoming glabrate or pubescent when mature.

D. Leaves very narrow, 3 or more times as long as broad; ovary soon glabrate.

E. Leaves cuneate to subrounded at base; flowers whitish. . . . . 20. *A. rubricaulis.*

EE. Leaves distinctly cordatulate at base; flowers red. . . . . 21. *A. fortunatii.*

DD. Leaves broader, twice or less as long as broad; ovary pubescent.

E. Flowers red; leaves 1–1/2 times or more as long as broad.

F. Leaves coriaceous, the veins indistinct, the base acute to acuminate (Szechuan, Kweichow, Yunnan) . . . . 22. *A. coriacea.*

FF. Leaves membranaceous to chartaceous, the veins distinct, the base auriculate-cordate (Kwangsi). . . . 23. *A. asymmetrica.*

EE. Flowers white or yellow; leaves 1–1/2 times or less as long as broad.

F. Flowers yellow; pith large, white, lamellate; leaf-bases broadened.

G. Leaves white-pubescent above, membranaceous. . . . . 24. *A. pilosula.*

GG. Leaves thinly chartaceous, glabrous or sparsely setose above, not pubescent.

H. Leaves with numerous distinct parallel cross bars in the veinlets, these strongly raised below, the lower surface not glaucous. . . . . 25. *A. venosa.*

HH. Leaves with less conspicuous veinlets, the lower surface strongly glaucous. . . . . 26. *A. trichogyna.*

FF. Flowers white; pith small, brown, lamellate or solid and orange-colored; leaf-base narrowed.

G. Pith small, brown, lamellate; flowers small, about 1 cm. across; leaf-margins subentire to inconspicuously mucronulate.

H. Leaves subcoriaceous, larger, over 6 cm. long and 3 cm. broad, not glaucous (Kwangsi) . . . . 27. *A. glabra.*

HH. Leaves chartaceous, smaller, scarcely to 6 cm. long and 3 cm. broad. . . . . 28. *A. sabiaefolia.*

GG. Pith light orange-colored, solid or rarely slightly and irregularly lamellate; flowers larger, about 2 cm. across; leaf-margins serrulate, rarely subentire. .... 29. *A. callosa.*

AA. Plants glabrous or hairy; leaves more or less densely tomentose with stellate hairs on the lower surface (Section Stellatae).

B. Inflorescence large, 10-flowered or more, the peduncles 2–3 times branched; fruit glabrate. .... 30. *A. latifolia.*

BB. Inflorescence smaller, 1–5 (rarely to 10–)-flowered, the peduncles once-branched or not branched; fruit glabrous to hairy.

C. Leaves large, oblong to broadly ovate or orbicular, over 7 cm. long and 4 cm. broad, rounded or cordate at base; stellate tomentum on under surface of the leaves not appressed; fruit large, more than 2.7 cm. long or across, hairy or glabrate.

D. Leaves broadly ovate to orbicular, to 1–1/2 times as long as broad; indumentum whitish; fruit large, about 3 cm. across, densely hirsute or villose.

E. Young shoots villose; leaves coriaceous, acute to acuminate, about 1–1/2 times as long as broad; flowers purplish. .... 31. *A. eriantha.*

EE. Young shoots setose; leaves chartaceous, truncate to emarginate, rarely acute to short-acuminate, usually as long as broad; flowers white to yellowish. .... 32. *A. chinensis.*

DD. Leaves ovate to ovate-oblong, about 2 times as long as broad; indumentum brownish; fruit small, about 2 cm. across, glabrate; flowers white. .... 33. *A. fulvicoma.*

CC. Leaves small, ovate-lanceolate, to 7 cm. long and 3 cm. across, strongly cuneate at base; stellate tomentum on under surface of leaves appressed; fruit very small, scarcely 1 cm. long, glabrous; flowers greenish. .... 34. *A. lanceolata.*

Imperfectly known species. .... 35. *A. kiusiana.*
.... 36. *A. longicauda.*

1. **Actinidia rudis** Dunn in Jour. Linn. Soc. Bot. **39:** 408. 1911.

Large climbing shrubs; stems and petioles densely rigid-strigose, the hairs brown to light brown or yellow; pith white, lamellate. Leaves chartaceous, ovate, 12–15 cm. long, 7.5–9.5 cm. broad, acute to acuminate at apex, auriculate-cordatulate at base, the margins minutely denticulate, sparsely to densely strigose above, densely strigose along the costa, veins and veinlets beneath, the upper surface dark, the lower paler, the costa and veins slender, inconspicuous above, raised and subconspicuous beneath, the veinlets reticulate, inconspicuous, the secondary veins about 9–11 per side, straight ascending, anastomosing; petioles variable in length, 1.5–7 cm. long, densely strigose. Inflorescence densely fasciculate, 3–5-flowered, densely ferrugineous-tomentose; pedicels about 5 mm. long. Flowers white; sepals 5, ovate, about 3 mm. long and 2 mm. broad, acute at apex, slightly puberulous without; petals 5, oblong-ovate, 5–6 mm. long, 3–4 mm. broad, rounded at apex; stamens numerous, the filaments about 2 mm. long, the anthers yellow, linear, about 1 mm. long, rounded at apex, slightly sagittate at base; ovary oblong densely villose, the styles about 2 mm. long. Fruit cylindric to oblong, to 1.7 cm. long and 1 cm. across, slightly tomentose to glabrescent, lenticellate.

Southwestern China, in southern Yunnan only, in mountain forests and in ravines, at altitudes of about 1200–1650 meters. Flowers white, May–June.

CHINA: Yunnan: Meng-tzu, *A. Henry 11307* (A, NY, US, ISOTYPES); P'ing-pien Hsien, *H. T. Tsai 55137, 55205, 55429, 60073A, 60765, 61052, 61944* (A).

Henry originally cited 2 collections, *Henry 11307* and *11335*, both fruiting specimens. These were first included in *A. henryi* by Dunn. Subsequently he established the species *A. rudis*, basing it on these two collections. Flowering materials are now available in *Tsai 55205* and others. The species is distinct in its yellow to light brown strigose hairs on the leaves and stems and in the auriculate-cordatulate leaf-bases.

2. **Actinidia rubus** Lév. in Rep. Sp. Nov. **12:** 282. 1913, Cat. Pl. Yün-Nan 270. 1917; Rehder in Jour. Arnold Arb. **15:** 97. 1934.

Climbing shrubs; branches grayish, sulcate, densely brownish-strigose, with pale lenticels; pith white, small, lamellate. Leaves chartaceous, obovate to obovate-oblong, shortly but distinctly acuminate at apex, broad and cordatulate at base, the margins irregularly setose-serrulate, the teeth long or short, spreading, the upper surface dark, sparsely scattered-strigose, the lower surface paler, strigose along the costa and veins, the costa and veins subconspicuous above, distinct and elevated beneath; the secondary veins about 7–9 per side, straight-ascending, the veins or their main branches ending in the longer marginal teeth, the veinlets reticulate, subconspicuous above, with more distinct cross bars beneath; petioles slender, 5–6 cm. long, densely strigose. Flowers solitary or few-fascicled, yellow; pedicels 1–1.3 cm. long, strigose; sepals 5, ovate, unequal, to 6 mm. long and 3.5 mm. broad, acute to acuminate at apex, glabrous without; petals 5, obovate, more or less unequal, 10–11 mm. long, 5–7 mm. broad, rounded at apex; stamens numerous, the filaments slender, about 4 mm. long, the stamens yellow, about 1.2 mm. long, acute at apex, sagittate at base; ovary ovoid, about 2.5 mm. long, densely pubescent, the styles about 3 mm. long. Fruit unknown.

In southwestern China, in northern Yunnan only. Flowers yellow, June.

CHINA: Yunnan: Chao-t'ung, *E. E. Maire s. n.* (A, fragments of TYPE).

The material on hand is more or less fragmentary, but no additional material is available. The species appears to differ from the closely related *A. holotricha* Finet & Gagnep. mainly in the obovate leaves with spreading teeth and in the glabrous sepals.

3. **Actinidia melliana** Hand.-Mazz. in Anz. Akad. Wiss. Wien, Math.-Nat. **59:** 57. 1922, in Beih. Bot. Centralbl. **48**(2): 306. 1931; Merr

in Lingn. Sci. Jour. **7:** 315. 1929; Merr. & Chun in Sunyatsenia **2:** 283. 1935; Chun in Sunyatsenia **4:** 190. 1940.

Climbing shrubs to 10 m.; branches, inflorescences, and petioles densely covered with long rigid brown hispid hairs to 8 mm. in length; pith white, lamellate. Leaves membranaceous to chartaceous, persistent, oblong to ovate or obovate-oblong, 8–18 cm. long, 2.5–8 cm. broad, shortly acuminate at apex, broadly rounded and distinctly cordatulate at base, with brown-hirsute hairs on both surfaces when young, becoming scattered hispid-hirsute above, glabrous throughout or with hirsute hairs along the costa and veins beneath, often glaucous, the margins entire, with numerous sharp rigid pointed hairs, the costa and veins slender, slightly conspicuous above, distinct and raised beneath, the secondary veins about 6 or 7 per side, arcuately ascending, anastomosing near the margins, the veinlets reticulate, subconspicuous on both surfaces; petioles short, 10–15 mm. long, more or less terete, densely hirsute. Inflorescences in axillary cymes, about 10-flowered, subsessile, shortly dichotomously branched, densely brown-hirsute; pedicels slender, to 12 mm. long; bracts subulate, 4–5 mm. long, elongating to 6 mm. in fruit. Flowers white; sepals oblong-ovate, obtuse to acute at apex, 4–5 mm. long, hirsute without; petals white, ovate to obovate, rounded to acute at apex, 8–9 mm. long, 6–7 mm. wide; stamens numerous, the filaments 2 mm. long, the anthers 1 mm. long, sagittate-ovate; ovary subglobose, densely hirsute. Fruit strigose-hirsute to glabrescent when mature, oblong, 16–22 mm. long, 11–15 mm. across, strongly verrucose, with small white rounded lenticels; styles persistent, to 3 mm. long.

Southern China (Kwangsi, Kwangtung, southern Kiangsi, and Hainan), in forests from 800 to 1350 meters. Flowers white, June.

CHINA: Kiangsi: Lung-nan Hsien, *S. K. Lau 4429* (A, US). Kwangtung: Lung-tau Mountain, *R. Mell 22* (A, ISOTYPE), *Canton Christ. Coll. 12085* (US), *12175* (NY, US). Hainan: "Fan Yah," *N. K. Chun & C. L. Tso 44219* (A, NY, US).

This species is a distinct one, strongly characterized by its long indumentum and the oblong distinctly cordatulate leaves, green or glaucous beneath. The leaf-margins are entire in general appearance, the very fine teeth appearing as pointed rigid hairs along the straight edge of the leaves. The stems as well as the leaves and inflorescences are covered by very long brown hispid hairs. The hairs on the leaves, however, vary greatly in density. Sometimes these hairs are present on both surfaces, distributed all over on the costa, veins, and veinlets. At other times, they may be present all over the upper surface but only very sparsely so on the costa and a few veins on the lower surface. As the leaves advance in age, they apparently become more glabrous and more glaucous on the under surface.

The species is evidently more closely related to *A. hemsleyana* Dunn than to any other. It is, however, readily distinguished by its denser, longer hairs and its distinctly cordate leaf-base. It also has a more southerly range.

4. **Actinidia holotricha** Finet & Gagnep. in Bull. Soc. Bot. France **52:** Mém. **4:** 18, *t. 3.* 1905 (Contr. Fl. As. Or.); Dunn in Jour. Linn. Soc. Bot. **39:** 407. 1911.

Climbing shrubs; branches and petioles covered with sparse brown hispid hairs; pith white, lamellate. Leaves membranaceous to thinly chartaceous, broadly oblong-ovate, 9–13.5 cm. long, 6–7.5 cm. broad, short- to long-acuminate at apex, rounded to truncate at base, the margins sharply and finely denticulate, the teeth ascending, sparsely to densely setose along the costa and veins on both surfaces when young to nearly glabrous when mature, the lower surfaces slightly paler, the costa and veins slender, sub-conspicuous above, distinct and raised beneath, the secondary veins about 7 or 8 per side, straight-ascending, the veins or main branches ending in the marginal teeth, the veinlets reticulate, inconspicuous above, subconspicuous beneath; petioles long, slender, terete, 5–8 cm. long, sparsely strigose. Inflorescences glabrate or very sparsely strigose, shortly branched; pedicels 3–10 mm. long, slender. Flowers yellow (?); sepals ovate, obtuse, 5–6 mm. long, more or less puberulous without; petals oblong-obovate, 10–11 mm. long, 7–8 mm. broad, rounded at apex; stamens numerous, the filaments to 4 mm. long, the anothers yellow, sagittate-ovate; ovary subglobose, densely hirsute. Fruit unknown.

Southwestern China (Yunnan and southwestern Szechuan), at altitudes of about 1400–2000 meters. Flowers yellow (?), May–June.

CHINA: Szechuan: Ma-pien Hsien, *F. T. Wang 23086* (A). Yunnan: Ping-pien Hsien, *H. T Tsai 60483* (A), *62642* (A).

This species was based originally on a Delavay collection from "Outchay," which was not examined by Dunn. I suspect this type locality is Hui-tse (Tong-ch'üan), in northeastern Yunnan. The specimens here referred to this species are from nearby localities in Szechuan and Yunnan. They are more or less fragmentary or sterile specimens.

5. **Actinidia petelotii** Diels in Notizbl. Bot. Gart. Berlin **11:** 213. 1931.

Tall climbing shrubs; stems slender, the branches grayish, more or less striated, the young branchlets long and densely ferrugineous-strigose; pith large, white, lamellate. Leaves chartaceous, ovate, about 9–14 cm. long, 6–9 cm. broad, long-acuminate at apex, cordate to subcordate at base, the margins callose-serrulate, the upper surface green, glabrous or very sparsely setose along the veins, the lower surface paler, densely to sparsely setose along the costa and main veins, otherwise glabrous, the costa and nerves slender, subconspicuous above, distinct and raised beneath, the secondary nerves about 6–8 per side, arcuate-ascending, anastomosing, the branchlets ending in the marginal teeth, the veinlets reticulate, with more or less parallel cross-bars, distinct beneath; petioles 1.5–2.5 cm. long, densely long-ferrugineous-strigose. Inflorescence fasciculate, axillary, or on short branches, densely ferrugineous-strigose; peduncles about 1.5 cm. long. Flowers not seen; ovary pilose. Immature fruit oblong, about 1.5 cm. long and 7 mm. across, slightly pubescent or nearly glabrate, brown, with pale lenticels; styles 2.5–3 mm. long; persistent sepals membranaceous, ovate, about 4 mm. long and 2.5 mm. broad, acute at apex, pubescent without.

Indo-China, known from Chapa, Tonkin, only, at an altitude of 1800 meters.

INDO-CHINA: Chapa, *A. Pételot 3829* (A, NY, US, ISOTYPES).

Specimens of the type collection are all young fruiting ones. No additional material is available. Based on this somewhat incomplete material, this species can be compared with *A. strigosa* Hook. f. & Thoms., of India, which has smaller, narrower leaves concolored on both surfaces and never cordate at the base, and peduncles which are not strigose.

6. **Actinidia henryi** Dunn in Kew Bull. **1916:** 1. 1916.

Large climbing shrubs; branches slightly striated, more or less hispid, the young branchlets reddish brown-villose; pith small, lamellate, whitish. Leaves chartaceous, oblong-ovate, 8–14 cm. long, 3–6.5 cm. broad, acuminate at apex, subcordate to cordate at base, the margins minutely serrulate, dark above, pale beneath, glabrous on both surfaces except the veins, the costa and veins slender, subconspicuous above, puberulous or setose, the secondary veins about 8–10 per side, arcuately ascending, anastomosing near the margins, the veinlets reticulate, inconspicuous to subconspicuous above, conspicuous beneath; petioles relatively short, 10–25 mm. long, ferrugineous-pubescent. Inflorescences in axillary cymes, 10-flowered or more, densely reddish-villose; pedicels to 10 mm. long. Flowers white; sepals orbicular, acute at apex, about 3 mm. long, pubescent without; petals ovate, the base cuneate, rounded at apex, about 6 mm. long; stamens numerous, the filaments about 2 mm. long, the anthers yellow, sagittate-ovate; ovary subglobose, densely pubescent.

KEY TO VARIETIES

A. Leaves without rigid pilose hairs .... a. var. *henryi*.
AA. Leaves with scattered rigid pilose hairs on the costa and veins on both surfaces .... b. var. *polyodonta*.

6a. **Actinidia henryi** Dunn var. **henryi.**

Actinidia henryi Dunn in Kew Bull. **1916:** 1(excl. spec. *Henry 11307, 13335*). 1916, in Jour. Linn. Soc. Bot. **39:** 407. 1911.

Leaves chartaceous, oblong-ovate, 10.5–14 cm. long, 3–6.5 cm. broad, acuminate at apex, distinctly cordate at base, the margins very minutely mucronulate-serrulate, glabrous on both surfaces except the veins, the costa and veins reddish-puberulous below; petioles ferrugineous-pubescent when mature, about 15–25 mm. long.

Southwestern China, in southern Yunnan only, in mountain forests at altitudes of about 1650–2650 meters. Flowers white.

CHINA: Yunnan: Meng-tzu, *A. Henry 10381* (US, ISOTYPE), *10381a* (A, NY, US, ISOTYPES); Chien-shui Hsien, *H. T. Tsai 53331* (A).

Dunn's original description was based on, in addition to *Henry 10381* and *10381a* as listed above, also *Henry 11307* and *13335*, which he subsequently segregated as representing a distinct species, *A. rudis.* However, he did not then redescribe the present specis. The above description was prepared by checking the differences between these specimens and his original description, and also the additional collection made by Tsai.

This species is readily distinguished from *A. rudis* by its short petioles, distinctly cordate leaves, and less copiously strigose stems. In Dunn's key, *A. henryi* is separated from *A. hemsleyana* Dunn by its leaves being glaucous beneath, while for *A. hemsleyana* the leaves are mentioned as green beneath. Actually the reverse condition is true.

6b. **Actinidia henryi** Dunn var. **polyodonta** Hand.-Mazz. Symb. Sin. **7:** 391. 1931.

Leaves chartaceous, oblong-ovate, 8–11.5 cm. long, 2.3–4.7 cm. broad, acuminate at apex, subcordate at base, the margins minutely but distinctly serrulate, with scattered rigid setose hairs along the veins on both surfaces; petioles sparsely pilose, about 10–23 mm. long; immature fruits cylindric-oblong, sparsely pubescent.

Southwestern China, in central Yunnan and western Kwangsi, at altitudes of 1650–2450 meters.

CHINA: Kwangsi: N. Lo-ch'eng, *R. C. Ching 5897* (NY).

Handel-Mazzetti's type, from K'un-ming, north of the type locality of the typical form of the species, has not been seen. The Ching specimen cited above, from western Kwangsi, close to the Yunnan border, agrees with Handel-Mazzetti's description. Compared with the typical form of the species, this variety differs in having rigidly pilose petioles, scattered setose hairs on both surfaces of the leaves, and more distinctly serrulate leaf-margins. *Ching 5897* is a young fruiting specimen.

7. **Actinidia strigosa** Hook. f. & Thoms. in Jour. Linn. Soc. Bot. **5:** 55. 1861; Thiselton-Dyer in Hook. f. Fl. Brit. Ind. **1:** 286. 1876; Dunn in Jour. Linn. Soc. Bot. **39:** 407. 1911.

Climbing shrubs; branches reddish brown, with scattered elongate pale lenticels, hispid, the young branchlets more or less densely ferrugineous-setose; pith large, whitish, lamellate. Leaves chartaceous, ovate to oblong-ovate, about 7–13 cm. long and 4–7 cm. broad, acuminate to long-acuminate at apex, obtuse to rounded at base, often obliquely so, the margins callously denticulate, the surfaces concolored, the upper surface glabrous or slightly puberulous along the costa and veins, the lower surface nearly glabrous or sparsely setose along the costa and veins, the costa and veins inconspicuous above, distinct and raised beneath, the secondary nerves about 5–7 per side, arcuate-ascending, anastomosing, the branchlets ending in the marginal teeth, the veinlets reticulate, with many parallel cross-bars, subconspicuous beneath, petioles 2.5–3 cm. long, strigose or puberulous. Inflorescences in short 2–4-flowered axillary cymes, ferrugineous-pubescent, the flowers sometimes solitary; peduncles to 1 cm. long; pedicels to 5–10 mm. long; bracts minute, linear. Flowers white; sepals 5, ovate, about 4–5 mm. long and 3–4 mm. broad, acute to obtuse at apex, glabrate or very sparsely puberulous without; petals 5, obovate, about 8 mm. long and 5 mm. broad, rounded at apex; stamens numerous, the filaments 2.3 mm. long, the anthers yellow, 1–1.5 mm. long, obtuse at apex, sagittate at base; ovary subglobose, about 1.5 mm. across, densely villose, the styles about 1.5 mm. long.

India (Sikkim), at altitudes of 2100–3300 meters. Flowers white.

INDIA: Sikkim: *J. D. Hooker s. n.* (GH, ISOTYPE); eastern Himalaya, *Griffith 57* (GH).

This species seems to be confined to Sikkim Himalaya at fairly high altitudes. It is characterized by its concolored, ovate to oblong leaves, which are sparsely setose along the costa and veins on the lower surface only.

8. **Actinidia hemsleyana** Dunn in Jour. Linn. Soc. Bot. **38:** 355. 1908, **39:** 407. 1911.

Actinidia subglaucifolia Metcalf in Lingn. Sci. Jour. **11:** 15. 1932. *Syn. nov.*
Actinidia kengiana Metcalf in op. cit. 16. *Syn. nov.*

High climbing shrubs to 10 m.; branches dimorphic, some long, arching, densely strigose-tawny especially when young and bearing narrow leaves, others lateral, short, strigulose to hispidulous and bearing both leaves and flowers; buds densely brownish-hispidulous; pith lamellate, brownish. Leaves chartaceous, oblong-ovate to lanceolate-oblong, mostly 8–13 cm. long, 2.5–4.5 cm. broad, some to 18 cm. long and 4 cm. broad or 20 cm. long and 10 cm. broad, acute to obtuse at apex, rounded or acute to cuneate at base, usually slightly obliquely so, the margins serrulate to appressed-serrulate, glabrous on both surfaces or brownish pubescent along the costa or veins beneath, the upper surface dark, the lower pale, usually glaucous, the costa and veins slender, subconspicuous above, distinct and raised beneath, the secondary nerves about 7 or 8 per side, arcuately ascending, anastomosing along the margins, the veinlets reticulate, inconspicuous above, inconspicuous to subconspicuous beneath; petioles 1.5–4.5 cm. long, sparsely hispid to glabrate. Inflorescences in axillary cymes of about 1–3 flowers; pedicels 1–1.5 cm. long, slender, densely brownish tomentose. Flowers greenish; staminate flowers with 5 sepals, these ovate, subacute, about 5 mm. long, densely brownish-tomentose; petals 5, glabrous, ovate, about 10 mm. long, rounded at apex; stamens numerous, about as long as the petals; rudimentary ovary 2 mm. across, tomentose.

Pistillate flowers similar but with sepals connate at base, the lobes ovate, about 8 mm. long, acute at apex, densely brownish-tomentose at apex; stamens rudimentary; ovary depressed-globose, about 6 mm. long, densely brownish-villose. Fruit (immature?) cylindircal oblong-ovoid, about 2.7 cm. long, and 1.5 cm. across, densely brown-villose to glabrate, not lenticellate, rounded at apex, crowned by the persistent short styles of about 4 mm. long.

Eastern China (Fukien and southern Chekiang), in thickets on mountain slopes at altitudes of 500–900 meters. Flowers greenish, June.

CHINA: Chekiang: Between P'ing-yang and T'ai-shun, *R. C. Ching 2120* (A, US); Cheng-ning Hsien, *Y. L. Keng 394* (A, TYPE of *A. kengiana* Metcalf). Fukien: Nan-p'ing Hsien (Yenping), *Hongk. Herb. 2400* (A, ISOTYPE); Shouning Hsien, *Y. L. Keng 339* (A, TYPE of *A. subglaucifolia* Metcalf).

This distinct species has a known range limited to northern Fukien and southern Chekiang. Two specimens of Dunn's type collection, *Hongkong Herb. 2400,* have been seen. Although Dunn's key specifically indicates that the leaves of this species are green beneath instead of glaucous, actually these two specimens have distinctly glaucous leaves. The other collections here cited show that the leaves vary from glaucous to subglaucous, but they are never concolored.

Type specimens of both species of Metcalf, in the Arnold Arboretum herbarium, have been seen. They are leafy specimens with a few detached young fruits, and I cannot separate them from *A. hemsleyana. Actinidia subglaucifolia* Metcalf is based on a specimen with nearly glabrous stems and leaves. Metcalf describes the plants as glabrous and the leaves as glabrous above and somewhat glaucous beneath. He has apparently overlooked the dense brown hairs on the buds and the sparse strigose blackish hairs on the young stems and petioles. In this specimen the leaves are glabrous throughout. *Actinidia kengiana* Metcalf is represented by a stout twig with a few leaves. Among these leaves some are of the size described by Dunn, but a few are exceptionally large. The young shoots are distinctly and densely strigose. The leaves are, as described by Metcalf, "glabrous above, glaucous and sparsely rusty-hairy beneath, especially along the veins." Metcalf compared his *A. subglaucifolia* with *A. sabiaefolia* Dunn, and his *A. kengiana* with *A. melliana* Hand.-Mazz., but he failed to mention *A. hemsleyana* Dunn.

Dunn, who collected this plant in the field calls special attention to the dimorphism in the stems, and flowers, in this and in many other members of the genus as well. He says that the habit of this plant seems to illustrate the usual method of growth in many species of *Actinidia* and explains some of the apparent anomalous specimens in the herbarium. He remarks: "Each new extension of the shrub begins in this case with a long arching, densely strigose tawny shoot bearing abnormal narrow leaves. In the autumn these leaves fall, leaving large thickened leaf-scars and a bud above each, protected by a tuft of stiff yellow hairs. These buds develop in the spring into short flower- and leaf-bearing shoots, the leaves and the indumentum being quite different to those primary shoots."

9. **Actinidia arisanensis** Hayata, Icon. Pl. Formos. **8:** 11. 1911; Sasaki in Trans. Nat. Hist. Soc. Formosa. **19:** 480. 1929; Kanehira, Formos. Trees, rev. ed. 448, *f. 405.* 1936.

Actinidia rankanensis Hayata, op. cit. 13.
Actinidia remoganensis Hayata, op. cit. 13.

Tall climbing shrubs to 5 m. or more; branches dimorphic, the spring shoots glabrous to densely strigose, with narrower glabrous or sparsely setose or more or less densely strigose leaves, the summer shoots flowering, strigose to glabrous, with generally broader nearly glabrous leaves; pith very small, brown, lamellate. Leaves chartaceous, ovate-oblong to ovate, 8–15 cm. long, 3–9 cm. broad, acute to acuminate at apex, cuneate to rounded to subcordate at base, usually unequal, the margins sparsely and finely denticulate, glabrous or strigose on both surfaces or sparsely setose above and tomentose along the costa and sometimes also along the veins beneath, concolored or slightly paler beneath, the costa and veins inconspicuous to subconspicuous above, distinct and raised beneath, the secondary veins 5–7 per side, straight-ascending, the veins or their branches ending in the marginal teeth, the veinlets reticulate, distinct and raised beneath; petioles usually long, slender, 1.5–4.5 cm. long, densely or sparsely strigose or glabrous. Inflorescences in axillary cymes, 3- or 4-flowered, the pedicels nearly glabrous, 5–10 mm. long; bracts minute. Flowers white; sepals 5, oblong, rounded at apex, about 4 mm. long and 2 mm. broad, glabrous without, the margins pubescent; petals 5, oblong-ovate to oblong-lanceolate, about 7 mm. long and 3 mm. broad, rounded at apex, cuneate and contracted at base; stamens numerous, the filaments filiform, the anthers yellow, oblong, about 1.3 mm. long, obtuse at apex, sagittate at base; ovary subglobose, densely tomentose; styles about 4 mm. long. Fruit subglobose, about 2.3–3.5 cm. across, glabrate, lenticellate.

China, in Taiwan only, in thickets and forests at altitudes of 1160–2260 meters. Flowers white, April–May.

CHINA: Taiwan: Suao, *E. H. Wilson 11122* (A, US); Taihai, near Giran, *E. H. Wilson 10255* (A); Arisan, *E. H. Wilson 9671* (A), *10897* (A); Funkiko, Arisan, *E. H. Wilson 9658* (A); Keitou, Arisan, *E. H. Wilson 10862* (A, US); Arisan to Mt. Morrison, *E. H. Wilson 10943* (A, US).

This is a very variable plant, with dimorphic spring vegetative and summer flowering shoots. The young sterile shoots may be strigose bearing densely strigose leaves as in *Wilson 9658*, or with nearly glabrous stems and leaves sparsely strigose above only as in *Wilson 10225*, or with nearly glabrous leaves as in *Wilson 11122*. The flowering shoots bear larger broader leaves, generally strigose all over the upper surface.

In those specimens of nearly glabrous habit, it is difficult to distinguish this species from *A. callosa* var. *formosana* superficially. However, upon closer examination, strigose hairs can generally be revealed from either young or old stems in *A. arisanensis*. The leaves of *A. arisanensis* are also larger and relatively narrower, and they never become obovate as in *A. callosa* var. *formosana*. The fruit of *A. arisanensis* is also much larger. This species inhabits only the northern central mountainous parts of the island, at high altitudes, while *A. callosa* var. *formosana* is of the lower altitudes and is more widespread.

The variable nature of the species can be shown by the fact that Hayata described at the same time three species which now cannot be maintained. He distinguishes his *A. arisanensis* from his *A. rankanensis* "by the leaves which are nearly obtuse or slightly cuneate at the base." *Actinidia remoganensis* Hayata is: "Near *A. rankanensis,* but distinguishable from it in the less serrulate or nearly entire leaves and in the narrower petals." Photographs of type specimens of all three are available. These and the original descriptions prove that Sasaki is justified in reducing the two additional names.

The relationship of *A. arisanensis* is clearly with *A. hemsleyana* Dunn of the nearby coastal provinces Chekiang and Fukien.

10. **Actinidia kolomikta** (Maxim. & Rupr.) Maxim. in Mém. Acad. Sci. St. Pétersb. Sav. Etrang. **9:** 63. 1859 (Prim. Fl. Amur.).

Climbing shrubs to 7 m.; branches usually dark, glabrous or the very young branchlets slightly pubescent; pith brown, lamellate. Leaves membranaceous, sometimes partly discolored or variegated, with a large white to pink blotch at the apex often extending to the middle or beyond, especially in the staminate plant, ovate to oblong-ovate, 6–15 cm. long, 3–12.5 cm. broad, acuminate at apex, distinctly cordate at base, more rarely subcordate to truncate, sometimes unequal, the margins serrulate, concolored or slightly paler beneath, glabrous on both surfaces to sparsely setose or pubescent along the costa and veins, the costa and veins slender, inconspicuous above, distinct and raised beneath, the secondary veins about 6–8 per side, slightly arcuately ascending, anastomosing, the veinlets reticulate, inconspicuous on both surfaces to subconspicuous beneath; petioles slender, 2.5–3.5 cm. long, glabrous to sparsely pubescent. Flowers 1–3-fascicled; pedicels slender, 6–10 mm. long, glabrous to rusty-tomentose; bracts minute, linear; sepals, 5, ovate, 5–6 mm. long, 3–4 mm. wide, glabrous, acute at apex, more or less connate at base; petals 5, oblong, about 10 mm. long and 5 mm. broad, rounded at apex, gradually narrowed at base; stamens numerous, the filaments slender, 5–6 mm. long, the anthers yellow, slightly sagittate; ovary cylindric-ovoid, about 3 mm. long and 2 mm. across, glabrous; styles 3–5 mm. long. Fruit globose, about 2 cm. in diameter, glabrous, not lenticellate.

Actinidia kolomikta is here considered as composed of two varieties, a typical form in eastern Siberia, Manchuria, Korea, and Japan, and another variety in western China.

KEY TO THE VARIETIES

A. Leaves generally smaller, slightly narrower, to 10 × 8 cm., rarely larger, with or mostly without scattered setose hairs; peduncles and pedicels usually glabrate . . . . a. var. *kolomikta.*

AA. Leaves generally larger and broader, to 15 × 12.5 cm., often with scattered setose hairs; penduncles and pedicels usually rusty tomentose . . . . b. var. *gagnepainii.*

10a. **Actinidia kolomikta** (Maxim. & Rupr.) Maxim. var. **kolomikta.**

Actinidia kolomikta (Maxim. & Rupr.) Maxim. in Mém. Acad. Sci. St. Pétersb. Sav. Etrang **9:** 63. 1859 (Prim. Fl. Amur.); Dunn in Jour. Linn. Soc. Bot. **39:** 404. 1911.

Prunus? kolomikta Maxim. & Rupr. in Bull. Phys. Math. Acad. Sci. St. Pétersb. **15:** 129. 1856.

Kolomikta mandshurica Regel in Bull. Phys. Math. Acad. Sci. St. Pétersb. **15:** 219. 1857.

Trochostigma kolomikta Rupr. in Bull. Phys. Math. Acad. Sci. St. Pétersb. **15:** 262. 1857.

Leaves ovate to oblong-ovate, sometimes discolored or variegated, about 6–11 cm. long and 3–8 cm. broad, glabrous on both surfaces to sparsely or slightly setose above and sparingly pubescent along the costa and veins beneath; peduncles and pedicels glabrous to sparsely pubescent.

Eastern Siberia, Sakhalin, Manchuria, Korea, and Japan, in thickets at altitudes of 150–1600 meters. Flowers white, June–July.

EASTERN SIBERIA: Amur, *Maximowicz s. n.* (GH, NY, US), *S. E. Enander s. n.* (A), *Korzinsky s. n.* (A, GH, US), *V. Komarov 1088* (US); Vladivostok, *N. Palczewsky s. n.* (A, NY), *D. L. Topping 2168* (A), *Goldenstaedt s. n.* (GH), *C. S. Sargent s. n.* (A).

SAKHALIN: Sakhalin, *F. Schmidt s. n.* (GH), *G. Faurie 469* (A); Ohdomari, *K. Uno 19923* (A. US), *E. H. Wilson s. n.* (A).

MANCHURIA: Ad fl. Amur, *R. Maack s. n.* (GH); Er-tao-tien-tzu, *P. H. & D. H. Dorsett 3068* (US); Kao-ling-tzu, *P. H. & D. H. Dorsett 5985* (A, N, US), *V. Skvortzov s. n.* (A); Mifun Station, *V. Skvortzov s. n.* (A); Mao-erh-shan Station, *V. Skvortzov s. n.* (A); Hsing-an, *V. Komarov 1088* (A, NY); Kirin, O-mu Hsien, *H. W. Kung 1897* (NY); coast of Manchuria, *C. Wilford s. n.* (GH)

KOREA: Taiyudo, prov. N. Heian, *E. H. Wilson 8604* (A, US); Kongo-san, prov. Kogen, *E. H. Wilson 10485* (A, US).

JAPAN: Hokkaido: Shibetsu, *K. Miyabe s. n.* (A); Hyukogen, *K. Uno 16305* (A); Iburi, *S. Hashimoto s. n.* (A); Konoma, *Maximowicz s. n.* (GH); Mt. Moiwa, *E. Tokukuchi s. n.* (GH); Kushiro, *E. H. Wilson s. n.* (A); Morinan jama *E. H. Wilson s. n.* (A); Meakan, *T. Tanaka 222* (A, US). Hondo: Sinano, *K. Shiota 3320* (A); Mino, *K. Shiota 4904* (A), *9698* (A), *M. Kentaro 3322* (A); Fujiyama, *P. H. Dorsett & W. J. Morse 374* (A, US); Huzisan, *T. Sawada 2230* (A); Juzogatake, *G. Faurie 5390* (A); Rikuchu, *E. H. Wilson s. n.* (A); Lake Chuzenji, *E. H. Wilson s. n.* (A), *J. G. Jack s. n.* (A); Miyachine, *G. Faurie 6912* (A).

10b. **Actinidia kolomikta** (Rupr. & Maxim.) Maxim. var. **gagnepainii** (Nakai), comb. nov.

Actinidia gagnepainii Nakai in Bot. Mag. Tokyo **47:** 258. 1933.

Actinidia kolomikta sensu Hemsl. in Jour. Linn. Soc. Bot. **23:** 79. 1886, p.p.; Dunn in Jour. Linn. Soc. Bot. **39:** 404. 1911, p.p.; Rehder in Sarg. Pl. Wils. **2:** 380. 1916; non Maxim.

Leaves ovate to ovate-oblong, sometimes discolored or variegated, about 6–15 cm. long and 5–12.5 cm. broad, usually with scattered setose hairs along the veins on both surfaces, sometimes glabrous; peduncles and pedicels more or less rusty-tomentose.

Western China (Shensi, Hupeh, Szechuan, and Sikang), in thickets at altitudes of 1800–3600 meters. Flowers white, May–June.

CHINA: Hupeh: Western Hupeh, *A. Henry s. n.* (NY), *5622* (NY), *6922A* (NY), *8806* (GH). Szechuan: Kuan Hsien, *E. H. Wilson 2008* (A, US), *2009* (A, GH, US), *W. P. Fang 2239* (A), *F. T. Wang 20591* (A); Wen-ch'üan Hsien, *E. H. Wilson 1058* (A), *1058A* (A, US), *F. T. Wang 21097* (A); O-mei-shan, *E. H. Wilson 4761* (A, US), *W. P. Fang 2801* (A, NY), *2865* (A), *F. T. Wang 23356* (A), *W. W. Ma 2579* (A), *S. C. Sun & K. Chang 930* (A), *1141* (A), *1358* (A), *H. C. Chow 8235* (A), *12379* (A), Wa-wu-shan, *E. H. Wilson 854a* (A, GH, US); Nan-ch'üan Hsien, *W. P. Fang 910* (A, NY); O-pien Hsien, *T. T. Yü 856* (A); Ma-pien Hsien, *F. T. Wang 23010* (A), *23093* (A); between Hai-tang and P'ing-yu-p'u, *H. Smith 1986* (A); P'ing-shan Hsien, *F. T. Wang 22704* (A); "Tsing-chuan-fin Hsien," *F. T. Wang 22350* (A). Sikang: No precise locality, *E. A. Pratt 101* p.p. (GH); K'ang-ting Hsien (Tachienlu), *E. H. Wilson 2005* (A, GH); Yueh-sui Hsien, *T. T. Yü 943* (A).

Nakai separates the western Chinese plant as a distinct species, *A. gagnepainii,* basing it on *Henry 8806, 8994, Wilson 4761, Pratt 830,* and *David s. n.* According to him, the western Chinese plant differs from *A. kolomikta* as follows: "The Chinese *Actinidia* has more vigorous shoots, broader leaves with more brownish and thicker hairs on the veins, and more rigid hairs on the surface. The leaves never become white or crimson like *A. kolomikta.* Its flowers are similar to those of *A. kolomikta* but the pedicels are more robust."

These characters, as can be easily seen, are all relative and necessarily inconstant. There are no fundamental structural differences between the plant from northeastern Asia and that of western China. Rehder, following Dunn, gives *A. platyphylla* A. Gray ex Miq. as a synonym of *A. kolomikta* and remarks: "The plant from western China does not show any obvious difference from the Japanese plant except that the leaves are generally larger and broader."

Leaving out for the time being the problem of typification and identity of *A. platyphylla,* which will be discussed in connection with *A. arguta,* it is sufficient to say that the western Chinese plant, for which a much larger series of specimens than at Nakai's disposal is now at hand, does not show fundamental differences which warrant specific separation from the typical form of *A. kolomikta.* Instead, one is impressed by the close similarity and resemblance in all respects between the plants from the two areas. Recognizing two separate and distinct species on the basis of such slender grounds would obscure entirely their close genetic kinship. Nakai mentions that the leaves of the western Chinese plant "never become white or crimson like *A. kolomikta*." This is an erroneous statement, as in the large series of specimens now available, many specimens, such as *Wilson 854a, 2005,* and *2008,* have equally white or crimson blotched leaves. This further attests the close relationship between these plants. It seems that the plant from western China deserves only to be recognized as a variety, as it has a distinct geographical range. This differentiation is also in line with another widespread species of the genus, *A. polygama,* where the western Chinese form is only slightly different from the plant in northeastern Asia.

11. **Actinidia polygama** (Sieb. & Zucc.) Maxim. in Mém. Acad. Sci. St. Pétersb. Sav. Étrang. **9:** 64. 1859 (Prim. Fl. Amur.).

Climbing shrubs, to 5 m., the stem slender; branches glabrous or the very young shoots sometimes lightly puberulous; pith large, white, solid. Leaves membranaceous, sometimes the whole leaf white or yellowish or the upper half variegated with a blotch of white or pale yellow, ovate, 7–12.5 cm. long, 4.5–8.5 cm. wide, the apex long-acuminate, the base acute to rounded to truncate, very rarely subcordatulate, the margins finely serrulate, dark green and glabrous or rarely sparsely setose above, slightly paler beneath and setose along the costa and the main veins or glabrous, the costa and veins slender, inconspicuous above, distinct and elevated beneath, the secondary veins 6 or 7 per side, arcuate-ascending, strongly anastomosing, the veinlets reticulate, inconspicuous above, subconspicuous beneath; petioles slender, 2–4.5 cm. long, glabrous or sparsely setose. Flowers white, solitary or 2- or 3-fascicled, lateral, the pedicels slender, 6–10 mm. long, more or less puberulous; sepals 5, ovate, sometimes unequal, about 7 mm. long and 4.5 mm. wide, acute at apex, more or less glabrous, the margins finely ciliate, the base somewhat cuneate; petals 5, oblong-ovate, 12–13 mm. long, 5.5–10 mm. wide, the apex rounded to obtuse, the base broad; stamens numerous, the filaments slender, filiform, 5–6 mm. long, the anthers yellow or brown, 1.5–2 mm. long, the apex pointed, the base sagittate; rudimentary ovary in staminate flowers very small, globose; ovary bottle-shaped, 3.5–4.5 mm. long, about 2 mm. in diameter, glabrous, the styles about 3 mm. long. Fruit globose to ovoid, about 2.5 cm. across, yellow, glabrous, not lenticellate, the apex rostrate.

Nakai separates some of the plants formerly referred to *A. polygama* from Szechuan and Hupeh as a distinct species, *A. lecomtei.* The latter has also the distinct solid white pith and "white or brownish crisped hairs on the principal veins like *Actinidia polygama,* but lacks of rigid glands. Its anthers are not yellow, but are purplish or purple." The specimens quoted by him are *Farges 406*, type, *Farges 79 p. p.*, *Henry s.n., 1788, 6644 p. p.*, *David s. n.*

Nakai at the same time considers *A. polygama*, of Manchuria, Korea, and Japan, as also present in western China, citing *Wilson 1363* and *1363a* from Hupeh. These collections are also available for the present study. Number *1363* agrees in all respects with the other collections from western China, especially in the nearly glabrous leaves and the brown anthers. Number *1363a*, apparently from a younger shoot, has leaves that are very sparsely setose on both surfaces, evidently the so-called rigid glands of Nakai. The anthers are also brownish.

With a very large series of specimens from China proper, Manchuria, Korea, and Japan, I am convinced that the widespread species *A. polygama*, as currently accepted, can at most be differentiated into two geographical varieties, one in the east, in Japan, Korea, and Manchuria, and one in the west, in western China, but not as two species coexisting in western China. The typical form in the east has yellow anthers and leaves with scattered setose hairs on the veins on both surfaces. Extending from Korea inland to Manchuria, the plants become more and more glabrate. The plant of western China, here considered as representing a separate variety, has nearly glabrous leaves only occasionally setose on one or both surfaces or slightly hairy along the veins on the lower surface only. The anthers are brownish in color, generally of a darker shade than the typical form in the dried state. In all other characters, the two varieties seem exactly identical.

Actinidia polygama has been much confused in literature and herbaria with *A. kolomikta*, but, as Rehder has noted, it is readily distinguished by the large solid white pith of its branches. In *A. kolomikta*, as well as most other related species, the pith is lamellate and mostly brownish in color. *Actinidia kolomikta* has also distinctly cordate leaves, while in *A. polygama* the leaf-bases are rounded to subacute but never cordate. Also in *A. kolomikta* the ovary is cylindric-ovoid and not bottle-shaped as in *A. polygama* and other allied species.

Key to the Varieties

A. Leaves more or less sparsely setose along the veins beneath; anthers yellow (Manchuria, Korea, Japan) .... 11a. var. *polygama*.

AA. Leaves generally glabrous, rarely sparsely setose beneath; anthers brown (western China) .. .. 11b. var. *lecomtei*.

11a. **Actinidia polygama** (Sieb. & Zucc.) Maxim. var. **polygama**.

Actinidia polygama (Sieb. & Zucc.) Maxim. in Mém. Acad. Sci. St. Pétersb. Sav. Étrang. **9:** 64 1859 (Prim. Fl. Amur.); Miq. in Ann. Mus. Bot. Lugd.-Bat. **3:** 15. 1867 (Prol. Fl. Jap. 203); Dunn in Jour. Linn. Soc. Bot. **39:** 403. 1911; Nakai in Bot. Mag. Tokyo **47:** 254. 1913, p. p.

Trochostigma polygama Sieb. & Zucc. in Abh. Phys.-Math. Cl. Akad. Wiss. Münch. **3:** 727, *t. 2. f. 2.* 1843.

Trochostigma volubilis Sieb. & Zucc. in loc. cit.

Actinidia volubilis (Sieb. & Zucc.) Planch. ex Miq. in Ann. Mus. Bot. Lugd.-Bat. **3:** 15. 1867 (Prol. Fl. Jap. 203).

Leaves glabrous or sometimes sparsely setose above, more or less sparsely setose along the veins on the lower surface; anthers yellow.

Sakhalin, Manchuria, Korea, Japan. Flowers white.

JAPAN: Hokkaido: Without precise localities, *Maximowicz s. n.* (GH, NY), *E. H. Wilson 7312* (US); Muroran,*C. S. Sargent s. n.* (A); Sapporo, *J. G. Jack s. n.* (A, GH), *Sapporo Agr. Coll. s. n.* (A); *K. Miyabe s. n.* (A). *Tokubuchi s. n.* (GH), *E. H. Wilson s. n.* (A). Hondo: Nikko, *J. G. Jack s. n.* (A, GH), *E. H. Wilson s. n.* (A); Mino prov., *Shiota 3317* (A), *8038* (A); Hyogoken, *K. Uno 19136* (A); Takao-san, Musashi prov., *E. H. Wilson s. n.* (A), *P. H. Dorsett & W. J. Morse 794* (US); Mt. Mitsumune, Musashi prov., *No. coll.* (US); Mt. Tanigawa, Niigata, *S. Suzuki 398026* (A); Nanokawa, Tosa, *No coll.* (GH, US); Yoshino, Yamato, *Tokyo Mus. 75* (US); Asama, *G. Faurie 6127* (A). Kiusiu: Fukuoka, *T. Tanaka 206* (A). Tsushima, *C. Wilford s. n.* (GH).

KOREA: Keijyo, prov Keiki, *E. H. Wilson 8752* (A, US), *10608* (A, US); Oo-ryong-too, *E. H. Wilson 8501* (A); Tanyudo, prov. Heian, *E. H. Wilson 8675* (A); Konga-san, prov. Kogan, *E. H. Wilson 10533* (A, US); Quelpaert, *T. Taquet 989* (A), *2681* (A), *2682* (A), *2684* (A), *2689* (A).

CHINA: Manchuria: Bay possiet, *Maximowicz s. n.* (GH, NY, US); Port Deans, Dundas, *Maximowicz s. n.* (GH); Mao-erh-shan Station, *B. V. Skvortzov s. n.* (A); Mifun Station, *B. V. Skvortzov s. n.* (A), *P. H. Dorsett 41757* (A, GH, NY, US).

Two species of *Trochostigma* described by Siebold & Zuccarini from Japan, *T. polygama*, and *T. volubilis*, have long been recognized as representing the same species of *Actinidia*, the earlier name being *A. polygama* adopted by Maximowicz (1859) and also by Miquel (1867). Also see Nakai for his listing for various misapplied names based on Japanese plants of this species.

Trochostigma repanda Sieb. & Zucc. was included in the synonymy of *A. polygama* by Maximowicz (in Bull. Acad. Sci. St. Pétersb. **31:** 19. 1887) together with *T. polygama* and *T. volubilis*. This was followed by most subsequent authors and a combination in *Actinidia* was effected by Honda as *Actinidia repanda* (Sieb. & Zucc.) Honda ex Koidz. in Acta Phytotax. Geob. **9:** 97, in clavi, 1940. However, the type of this species, as indicated by A. C. Smith, represents a species of *Schisandra*, actually the same as the well-known *S. nigra* Maxim. of Japan and Korea, which is now properly known as *Schisandra repanda* (Sieb. & Zucc.) A. C. Smith. See Sargentia **7:** 143–146. 1947, for a full discussion.

11b. **Actinidia polygama** (Sieb. & Zucc.) Maxim. var. **lecomtei** (Nakai) comb. nov.

Actinidia lecomtei Nakai in Bot. Mag. Tokyo **47:** 253. 1933.

Actinidia melanandra sensu Finet & Gagnep. in Bull. Soc. Bot. France **52:** Mém. **4:** 21. 1905, p. p. (Contr. Fl. As. Or.); Dunn in Jour. Linn. Soc. Bot. **39:** 403. 1911, p. p.; non Franch.

Actinidia polygama sensu Finet & Gagnep. l.c., p.p.; Rehder in Sarg. Pl. Wils. **2:** 380. 1915; Nakai in Bot. Mag. Tokyo **47:** 254. 1933, p. p.; Chun in Sunyatsenia **1:** 273. 1934; non Maxim.

Leaves glabrous or rarely sparsely setose above, generally glabrous on the lower surface, rarely very sparsely setose; anthers dark brown.

Western China (western Hupeh, Szechuan, and southern Shensi), in thickets at altitudes of 1350–2100 meters. Flowers white, June–July.

CHINA: Shensi: T'ai-pei-shan, *W. Purdom 891* (A, US), *G. Fenzel 878* (A). Hupeh: Without precise localities, *E. H. Wilson 5922* (GH), *5922A* (GH), *5922B* (GH), *7637* (GH); Fang Hsien, *E. H. Wilson 2013* p. p. (A); Hsing-shan Hsien, *E. H. Wilson 2013 p. p.* (A, GH, US); Wu-tu-ho, *W. Y. Chun 3641* (A); "Gia-che-yuan," *W. Y. Chun 4205* (A, US). Szechuan: Wa-shan, *E. H. Wilson 934A* p. p. (A, GH, US), *2010* (A, GH, US); Pao-hsing Hsien (Muping), *E. H. Wilson 934A* p. p. (A, US) *K. L. Chu 3760* (A), *3870* (A); South Wushan, *A. Henry 5764* (A, GH), *5922* (US), *5922A* (A), *E. H. Wilson 1363* (A, NY, US), *1363A* (A, NY, US); Ch'eng-k'ou Hsien, *R. P. Farges 406* (NY).

The citation of Chun in literature refers to the collection *S. P. Ko 53081*, from Kwangtung. I have not been able to consult this collection and therefore am not sure as to the propriety of referring it to this variety, as it is geographically distinct from the known range.

Some of the herbarium specimens from eastern China alleged to be *A. polygama* are found to represent an entirely different and little-known species, *A. valvata* Dunn.

12. **Actinidia valvata** Dunn in Jour. Linn. Soc. Bot. **39:** 404. 1911.

Climbing shrubs to 13 m., the young branches glabrous to sometimes grayish pubescent, pale; pith small, white, solid or slightly lamellate. Leaves chartaceous, ovate to ovate-lanceolate, 6–10 cm. long, 3–5 cm. broad, acute to long-acuminate at apex, cordate to acute or rarely truncate at base, sometimes unequally so, the margins minutely serrulate, concolored or slightly paler beneath, glabrous on both surfaces or sometimes slightly pubescent in the nerve-axils beneath, the costa and veins inconspicuous to subconspicuous above, distinct and raised beneath, the secondary veins 5 or 6 per side, arcuate-ascending, anastomosing, inconspicuous above, conspicuous or subconspicuous beneath; petioles slender, 1–2 cm. long, glabrous. Flowers 1–3-fascicled, axillary; pedicels very slender, 1–1.3 cm. long, sparsely puberulous; bracts linear, minute; sepals 2 or 3, concave, strictly valvate, more or less unequal, ovate, 7–9 mm. long, 4–6 mm. wide, acute at apex, glabrous or slightly puberulous without; petals 7 or 8, white, imbricate, oblong, 1–1.2 cm. long, about 6 mm. wide, acute to rounded at apex, attenuate at base; stamens many, the filaments slender, about 5 mm. long, the anthers yellow; ovary bottle-shaped, glabrous. Fruit globose or ovoid, about 2–2.5 cm. across, yellow or orange, glabrous, not lenticellate, with persistent calyx at base.

Eastern China (northern Kiangsi, southern Anhwei, southern Kiangsu, and Chekiang), in thickets at altitudes of 200–800 meters. Flowers white, May.

CHINA: Kiangsi: Yung-hsing Hsien, *H. H. Hu 804* (A). Anhwei: Huang-shan, *R. C. Ching 3054* (A, US); Ch'ung-yün, *A. N. Steward 7226* (A, US). Kiangsu: I-shing Hsien, *Ching & Tso 551* (A), *Y. L. Keng 2589* (A); Nanking, *W. Y. Chun 2117* (A), *2139* (A). Chekiang: Ch'ang-hua Hsien, *F. N. Meyer 1532* (A, NY), *Y. L. Keng 590* (A); Tien-mu-shan, *H. H. Hu 1659* (A), *T. Tang & W. Y. Hsia 117* (A); T'ien-tai-shan, *C. Y. Chiao 14392* (A, US).

Dunn's type is from Lu-shan, Kiangsi, *Bullock 121*, which has not been seen by me. The description is clear and the species distinct, but since its publication it has not been recorded by any other author. Actually it appears to be a common plant of the coastal provinces of eastern China. Specimens in the herbaria are mostly erroneously identified as *A. polygama*, a species apparently not present in these provinces. The species has indeed the general appearance of *A. polygama*, and the two are genetically close, as evidenced by the presence of the very distinct, solid white pith in the branches of both. The pith, however, is much smaller in *A. valvata* and sometimes it is slightly lamellate. *Actinidia valvata*, moreover, is readily distinguished from *A. polygama*, and for that matter also from all other species of the genus, in the unique form of the calyx, which is irregularly split into 2 or 3 concave sepals.

13. **Actinidia tetramera** Maxim. in Acta Hort. Petrop. **11:** 35. 1890; Dunn in Jour. Linn. Soc. Bot. **39:** 404. 1911; Rehder in Sarg. Pl. Wils. **2:** 381. 1915.

Clematoclethra giraldii Diels in Bot. Jahrb. **29:** 472. 1900.

Actinidia rubricaulis sensu Dunn in Jour. Linn. Soc. Bot. **39:** 407. 1911, p. p., (*quoad Wilson 4764, 3271*), non Dunn in Kew Bull. **1906:** 2. 1906.

High climbing shrubs to 13 m., the branches grayish to reddish brown, glabrous, the very young branchlets sometimes puberulous; pith small, lamellate, brown. Leaves chartaceous, sometimes variegated with blotches of white or pink, narrowly oblong-ovate, about 5–10 cm. long and 2.5–4 cm. broad, long-acuminate at apex, obliquely cuneate to truncate or rarely subcordate at base, serrulate at margins, glabrous on both surfaces to slightly setose on the costa beneath, with tufts of white hairs in the axils of secondary veins beneath, the two surfaces concolored, the costa and veins inconspicuous to subconspicuous above, raised and subconspicuous beneath, the secondary veins very slender, 6–8 per side, arcuately ascending, anastomosing, the veinlets reticulate, subconspicuous to inconspicuous beneath; petioles 1.5–3 cm. long, glabrous or nearly so. Inflorescences glabrous or nearly so, the flowers 2- or 3-fascicled or solitary; pedicels slender, 1–2 cm. long; bracts minute, linear; sepals 4, very rarely 5, ovate, 4–5 mm. long, 2–3 mm. broad, acute to rounded at apex, the margins ciliate; petals 4, rarely 5, oblong, about 7 mm. long and 5 mm. broad, rounded at apex; stamens numerous, the filaments very slender, about 4 mm. long, the anthers yellow, oblong, about 2 mm. long, rounded at both ends, broader but not sagittate at base; ovary cylindric to slightly bottle-shaped, glabrous, the styles about 3 mm. long. Fruit ovoid, about 1.5–2 cm. long, 0.7–1.5 cm. across, brown, glabrous, not lenticellate.

Western China (Kansu, Shensi, western Hupeh, Szechuan, and Sikang), in thickets at altitudes of 1300–2700 meters. Flowers white, sometimes tinged with pink, June.

CHINA: Kansu: T'ien-shiu Hsien, *F. Fenzel s. n.* (A); Lower Tebbu Country, *J. F. Rock 14728* (A), *15026* (A). Shensi: T'ai-pei-shan, *W. Purdom 892* (A, US); "Kan-y-san," *J. Giraldi s. n.* (A). Hupeh: Without precise locality, *E. H. Wilson 6821* (GH); Fang Hsien, *E. H. Wilson 2011* (A, US), *4322* p. p. (A, US); Hsing-shan Hsien, *E. H. Wilson 2096* (A, US). Sikang: K'ang-ting Hsien, *C.Y. Chiao 1635* (A). Szechuan: Sung-p'an Hsien, *E. H. Wilson 4557* (A), Pao-hsing Hsien (Muping), *E. H. Wilson 809a* (A); Kuan Hsien, *E H. Wilson 2006* (A), *4322* p. p. (A); Ch'eng-k'ou Hsien, *R. P. Farges 530* (NY, ISOTYPE); O-mei-shan, *E. H. Wilson 4764* (A), *W. P. Fang 3063* (A), *6559* (A), *16625* (A), *C. L. Sun 2166* (A), *S. C. Sun & K. Chang 292* (A).

This species is related to *A. kolomikta* but can be readily distinguished by its smaller narrower oblong-ovate leaves, bearded in the axils of the secondary veins beneath but otherwise glabrous or rarely setose on the costa, and also by the tetramerous flowers. Both species have similar brown lamellate piths. The leaves of *A. tetramera*, like those of *A. kolomikta*, are frequently variegated. The flowers, especially the pistillate ones, are occasionally 5-merous.

Clematoclethra giraldii Diels is given in the synonymy by Rehder. A photograph of the holotype is in the herbarium of the Arnold Arboretum.

Plants from O-mei-shan, Szechuan province, at the southernmost limit of the species, have slightly smaller flowers, of generally darker reddish color, and shorter peduncles, and they may prove to represent a variety of the species when more material is made available.

14. **Actinidia maloides** sp. nov.

Frutex scandens, 5–6 m. altus, ramis teretibus longitudinaliter sulcatis, purpureo-nigrescentibus vel cinnamomeis, glabris, ramulis novellis leviter puberulis; medulla parva brunnea lamellata; foliis chartaceis, interdum variegatis, oblongo-ovatis, circiter 5.5–8.5 cm. longis et 3–3.5 cm. latis, apice acuminatis, basi latis, plus minusve cordatis interdum rotundatis, valde inaequalibus, margine minute serrulatis, utrinque concoloribus glabris vel supra sparse setosis subtus parcissime secus venas pubescentibus, costa supra subprominente subtus prominente, nervis lateralibus utrinsecus 6–8, supra paulo impressis subtus elevatis prominentibus, arcuato-adscendentibus, prope marginem anastomosantibus, venis reticulatis subtus subprominentibus; petiolis 1.5–2.5 cm. longis, glabris vel puberulis; inflorescentiis axillaribus puberulis, 2–4-, plerumque 3-floris, pedunculis gracilibus, ad 1.5 cm. longis, pedicellis ad 1 cm. longis, bracteis nullis; sepalis 5, ovatis, purpureo-rubescentibus, glabris vel glabratis, circiter 5 mm. longis et 3 mm. latis, acutis, margine minute ciliatis; petalis 5, obovatis, circiter 8 mm. longis et 7 mm. latis, rotundatis, pallide roseis, ad apicem rubescentibus; staminibus numerosis, filamentis gracilibus, circiter 3–4 mm. longis, antheris flavis oblongis circiter 2.5 mm. longis, rotundatis, basi sagittatis; ovario rudimentario minute globoso, glabro, stylis numerosis; fructibus brunneis oblongis ad 2 cm. longis et 1.2 cm. diametro, glabris, elenticellatis; seminibus ovoideis compressis, circiter 2 mm. longis et 1.5 mm. crassis, testa in sicco minute reticulata.

Western China (Sikang), on mountain slopes among thickets at an altitude of about 2000 meters. Flowers pink, May–June.

CHINA: Sikang: Yueh-sui Hsien, *T. T. Yü 927* (A, TYPE); Han-yüan Hsien, *E. H. Wilson 854* (A, fruit).

This species is of the alliance of *A. kolomikta*. It has similarly variegated leaves characteristic of some of the species of this general group. It is apparently most closely related to *A. tetramera* Maxim., but can be distinguished by the consistently 5-merous, pink flowers, with purplish red calyx and sagittate anthers, and the broad leaves which usually have broad, cordate bases.

The pink petals are red toward the upper margins, like the flowering crab apple. In flower this clearly is the most showy species of the genus.

15. **Actinidia kwangsiensis** sp. nov.

Frutex scandens, circiter 3 m. altus, ramulis oppositis, atrobrunneis, lenticellis parvis pallide dispersis, glabris, ramulis novellis plus minusve ferrugineo-pubescentibus; medulla brunnea lamellata; foliis subcoriaceis, ovatis vel oblongo-ovatis, 8–9.5 cm. longis, 4–5 cm. latis, apice longe caudato-acuminatis, basi oblique rotundatis, margine adpresse minute serrulatis, supra atro-viridibus glabris, subtus pallidis, secus venas leviter ferrugineo-granuloso-pubescentibus, costa supra prominente, subtus elevata, nervis lateralibus utrinsecus 5–7, arcuato-adscendentibus, prope marginem anastomosantibus, venulis minute reticulatis, subtus subprominentibus; petiolis 2–3 cm. longis, plus minusve ferrugineo-glanduloso-pubescentibus; inflorescentiis sub anthesi ignotis; ovario distincte ampullifero, glabro, stylis circiter 2.5 mm. longis; inflorescentiis post anthesin axillaribus, 1- vel 2-fructibus, plus minusve ferrugineo-granuloso-pubescentibus, pedunculis 5–7 mm. longis; pedicellis ad 1.8 cm. longis; fructibus immaturis viridibus, oblongis, circiter 2 cm. longis et 1 cm. crassis, glabris, apice valde rostratis.

Southern China, in Kwangsi, in open thickets, at an altitude of 1000 meters. Flowers unknown.

CHINA: Kwangsi: Yin-tung, Min-shan, N. of Lu-chen, near the Kweichow border, *R. C. Ching 6185* (NY, TYPE).

This species is admittedly established on rather inadequate material, but it seems clearly to represent an undescribed species. Its glabrous bottle-shaped ovary indicates distinctly and definitely its alliance with either the dark-flowered *A. purpurea* Rehd. or with the pale flowered *A. melanandra* Franch. It can be distinguished from the former by the smaller, narrower leaves and the brown pith, and from the latter by its leaves being not glaucous beneath. It is also distinct in having opposite branches, although the material at hand is not sufficient to indicate whether or not this is constant.

There is also the possibility that this may be the same as *A. longicauda* F. Chun, here classified as an imperfectly known species. However, as Chun's species is based on a specimen with staminate flowers only, while the present species is based on a young fruiting specimen, it is impossible critically to compare the two.

16. **Actinidia melanandra** Franch. in Jour. de Bot. **8:** 278. 1894; Dunn in Jour. Linn. Soc. Bot. **39:** 402. 1911, p. p.; Rehder in Sarg. Pl. Wils. **2:** 378. 1915; Hand.-Mazz. Symb. Sin. **7:** 390. 1931; Nakai in Bot. Mag. Tokyo **47:** 252. 1933.

Actinidia rufa var. *parvifolia* Dunn in op. cit. 403. 1911.

High climbing shrubs to 7 m.; branches reddish, the very young shoots sometimes puberulous and slightly glaucous; pith lamellate, more or less whitish. Leaves chartaceous, elliptic or ovate to oblong-ovate or oblong-lanceolate, about 6–9.5 cm. long and 2.5–4 cm. broad, acuminate at apex, cuneate to rounded or truncate at base, sometimes unequal, the margins minutely serrulate, the teeth ascending, glabrous on both surfaces except for small tufts of rusty hairs in the axils of the secondary nerves on the lower surface, green above, glaucous beneath, the costa and veins slender, subconspicuous above, more or less raised and distinct beneath, the secondary nerves about 4–6 per side, arcuately ascending, anastomosing, the veinlets reticulate, inconspicuous to subconspicuous on both surfaces; petioles slender, 2.5–3 cm. long, glabrous or slightly puberulous. Inflorescence in 3- 5-flowered cymes or the flowers solitary, the peduncles and pedicels slightly puberulous, slender; pedicels to 1.8 cm. long; bracts linear, minute. Flowers white; sepals 5, occasionally 4, ovate, 6–7 mm. long, 3–4 mm. broad, acute at apex, glabrous, the margins sometimes ciliate, the base more or less connate; petals 5, rarely 4, white, sometimes brownish toward the base, oblong, 1.1–1.3 cm. long, 4–7 mm. broad, rounded at apex, gradually narrowed at base; stamens numerous, the filaments slender, about 3 mm. long, the anthers blackish when dry, slender, about 2 mm. long, acute and pointed at apex and sagittate at base; ovary bottle-shaped, glabrous, 6–7 mm. long, 2–3 mm. in diameter; styles 3.4 mm. long. Fruit ellipsoid to ovoid, glabrous, smooth, about 3 cm. long and 2.5 cm. across, not lenticellate.

CHINA: Hupeh: Western Hupeh, *E. H. Wilson 1068* (A, NY, US), *1068a* (A, NY, US), *5938a* (GH); Fang Hsien, *E. H. Wilson 4459* (A).

Szechuan: Kuan Hsien, *W. P. Fang 2364* (A, NY); Ch'eng-k'ou Hsien, *R. P. Farges 79* (NY).

Dunn describes very briefly *A. rufa* var. *parvifolia,* basing it on *Henry 5938a, 6644,* and *6794,* all from Hupeh. This is reduced to *A. melanandra* by Rehder. This species is readily distinguished from other species of this general region by the glaucous under surfaces of the leaves, which are glabrous except for the tufts of brownish hairs in the axils of the secondary veins on the lower surface. I cannot verify Handel-Mazzetti's record of this species in northeastern Yunnan, based on *Teng 260.* In the past *A. melanandra* has often been erroneously attributed by various authors to species of other regions, but it seems that the range of the present species is limited to western China (in western Hupeh and Szechuan, and possibly also in northern Yunnan).

17. **Actinidia hypoleuca** Nakai in Bot. Mag. Tokyo **38:** 312. 1904, **47:** 256. 1933.

Actinidia melanandra sensu Finet & Gagnep. in Bull. Soc. Bot. France **52,** Mém. **4:** 21. 1905, p. p. (quoted Japanese plants), non Franch.
Actinidia japonica Nakai in Bot. Mag. Tokyo **28:** 311. 1914.

Climbing shrubs; branches grayish, the young branchlets much darker, glabrous, without lenticels or with small inconspicuous lenticels on older branches only; pith brown, lamellate, sometimes nearly solid. Leaves subchartaceous, ovate to ovate-oblong, about 2.5–7 cm. long, 2.5–4.5 cm. broad, abruptly acuminate at apex, broadly acute to rounded or truncate at base, the margins finely serrulate, glabrous and dark above, glaucous and glabrous beneath except with tufts of brown pubescence in the nerve-axils, the costa and veins inconspicuous above, dark above, glaucous and glabrous beneath except with tufts of brown veins about 4 or 5 per side, straight or slightly arcuate-ascending, anastomosing, the veinlets finely reticulate, inconspicuous above, subconspicuous beneath; petioles 2–3.5 cm. long, dark purple, glabrous. Inflorescences in small axillary cymes of 1–5 or more flowers, glabrous or slightly pubescent, the peduncles slender, to 5 mm. long, the pedicels slender, to 10 mm. long. Flowers white; sepals 5, ovate-oblong, to 6 mm. long and 3 mm. broad, glabrous or puberulous, acute to obtuse at apex, the margins often ciliate; petals 5, obovate, to 12 mm. long and 7 mm. broad, rounded at apex; stamens numerous, the filaments slender, about 3 mm. long, the anthers purple, oblong, about 2 mm. long, rounded at apex, slightly sagittate at base; ovary bottle-shaped, glabrous, about 5 mm. long and 2 mm. across, the styles 3–4 mm. long. Fruit ovoid, about 1.5 cm. across, glabrous, not lenticellate, slightly rostrate at apex.

Southern and central Japan. Flowers white.

JAPAN: Hondo: Satsuma prov., *G. Masamune s. n.* (NY); Mino prov., *K. Shiota 4972* (A), *5722* (A), *6341* (A), *9699* (A); Kai prov., Tasko, *K. Sakurai s. n.* (A); Nonokawa, Tosa, *K. Watanabe s. n.* (GH). Sikoku: Nagasaki, *R. Oldham 95* (GH).

This species differs from the closely allied *A. arguta* in the generally smaller leaves, which are usually glaucous beneath. Among the herbarium specimens, various degrees appear in the shade of leaf color, ranging from green to glaucous in leaves even from the same specimen. Nakai speaks of *A. arguta* as "easily discriminated from *A. hypoleuca* in the field by its green foliages."

The name *A. japonica* was first given by Nakai in Bot. Mag. Tokyo **27:** (163). 1913, in his key to Japanese species of *Actinidia,* and later a description was given in 1915. This species name is given as a synonym of *A. hypoleuca* Nakai (mistakenly as "*A. hypoglauca* Nakai") in Koidzumi's key (in Acta Phytotax. Geob. **9:** 97. 1940). The original description, though brief, is sufficient to prove that this reduction is justified. It is strange to note, however, that this name is never mentioned by Nakai himself in his subsequent discussions of this genus.

18. **Actinidia purpurea** Rehder in Sarg. Pl. Wils. **2:** 378. 1915, in Jour. Arnold Arb. **15:** 96. 1934; Hand.-Mazz. Symb. Sin. **7:** 390. 1931; Nakai in Bot. Mag. Tokyo **47:** 253. 1933.

Actinidia melanandra Franch. var. *latifolia* E. Pritz. ex Diels in Bot. Jarhb. **29:** 470. 1900. *Syn. nov.*

Actinidia rufa var. *arguta* Dunn in Jour. Linn. Soc. Bot. **39:** 402. 1911, p. p. (quoted *Henry 11008*). *Syn. nov.*

Actinidia rufa var. *typica* Dunn in loc. cit., p. p. (quoted *Henry 5622*). *Syn. nov.*

Actinidia chartacea Hu in Bull. Fan Mem. Inst. Biol. Bot. **10:** 128. 1940. *Syn. nov.*

High climbing shrubs to 20 m.; branches glabrous or the very young branchlets puberulous, rarely tomentose, grayish brown; pith white, lamellate. Leaves thickly chartaceous, elliptic to elliptic-ovate or broad-ovate, 8–12 cm. long, 4.5–6.5 cm. broad, acute to acuminate at apex, acute to rounded or truncate at base, usually oblique, the margins serrulate, with appressed teeth, glabrous and dull above, nearly concolored or slightly paler beneath, glabrous or sparsely setose or tomentose along the costa and veins on the lower surface with or without tufts of whitish or yellowish hairs in the nerve-axils, the costa and nerves slender, subconspicuous above, distinct and elevated beneath, the secondary veins about 5 or 6 per side, arcuate-ascending, anastomosing, the veinlets reticulate, inconspicuous above, subconspicuous beneath; petioles 3–5 cm. long, glabrous or rarely tomentulose. Inflorescences in axillary cymes, puberulous, the staminate cymes often many-flowered, the pistillate usually 3-flowered. Flowers white; sepals 5, ovate, 4–7 mm. long, more or less unequal, obtuse at apex, often turning blackish on drying, glabrous or rarely puberulous, the margins ciliate; petals 5, ovate to oblong-ovate, often unequal, 7–12 mm. long, 4–7 mm. broad; stamens numerous, the filaments slender, 3–4 mm. long, the anthers oblong, blackish, 2 mm. long, the base divergent; ovary bottle-shaped, glabrous, about 6 mm. long and 2 mm. across, the styles about 4 mm. long. Fruit ovoid or oblong, about 2–2.5 cm. long, purplish, glabrous, the apex rostrate.

CHINA: Hupeh: Without precise locality, *E. H. Wilson 1029a* (A), *5622* (G); Nan-t'o, *E. H. Wilson 1165* (A, NY, US). Hunan: Heng-shan, *H. Handel-Mazzetti 12212* (A). Szechuan: Without precise locality, *E. H. Wilson 3269* (A); Pao-hsing Hsien (Mu-ping), *E. H. Wilson 1314* p. p. (A, US, GH, TYPE:), *1314a* (A); Mo-tien-ling, *F. T. Wang 22445* (A), *22478* (A); O-mei-shan, *Y. S. Liu 1230* (A), *C. Y. Chiao & C. S. Fan 286* (A), *836* (A), *H. C. Chow 7645* (A), *12179* (A). Sikang: Kan-ting Hsien (Tachienlu), *E. H. Wilson 1314 p. p.* (A), *C. Y. Chiao 2029* (A), *2040* (A). Yunnan: Without precise localities, *F. Ducloux 465* (NY), *G. Forrest 14845* (A), *16223* (A), *H. T. Tsai 57168* (A), *57569* (A), *57325* (A); Yangtze-Mekong divide, *H. Handel-Mazzetti 7873* (A); Mekong-Salwin divide, *G. Forrest 19483* (A, US), *J. F. Rock 22720* (A, NY); Wei-hsi Hsien, *H. T. Tsai 57911* (A), *C. W. Wang 63608* (A), *63704* (A), *64046* (A), *68660* (A), *70423* (A); Chung-tien, *K. M. Feng 3341* (A); south of Red River, from Man-mei, *A. Henry 9694* (A, NY); Meng-tzu, *A. Henry 11008* (A, NY, US); Lan-p'ing Hsien, *H. T. Tsai 54000* (A); P'ing-pien Hsien, *H. T. Tsai 62468* (A); Lan-ts'ang Hsien, *C. W. Wang 76627* (A). Kweichow: San-ho Hsien, *Y. Tsiang 6435* (NY); Tu-shan Hsien, *Y. Tsiang 6761* (NY).

This species is the counterpart of *A. arguta* in southwestern China, and it differs from the latter in the relatively longer, narrower leaves that are never setose and with appressed serrations close to the margins, the generally smaller flowers, and the long, dark, purple-colored fruits. It was originally included in the concept of *A. arguta* Dunn, who cited specimens such as *Henry 5622* and *11008* which were later designated as types of Rehder's *A. purpurea*. *Wilson 1512* from Kiangsi, a sterile specimen with setose hairs, evidently does not belong here as originally cited by Rehder but should be referred to *A. arguta*.

A photograph of the type of *A. melanandra* Franch. var. *latifolia* Pritzel is also in the herbarium of the Arnold Arboretum. It is from Nan-ch'üan, in Szechuan province, collected by V. Rosthorn in 1891. The original description is very brief, referring only to the size of the leaves, "foliis latis 8–9 × 6–7.5 cm.", but the photograph clearly shows that not *A. melanandra* Franch. but *A. purpurea* Rehder is represented.

Actinidia chartacea Hu, another name to be reduced, is from northwestern Szechuan, "Mo-Tien-Ling . . . . F. T. Wang, no. 2245a (type), Aug. 31, 1930." Hu compares his plant with *A. kolomikta* Maxim. and also with *A. latifolia* Merr., the latter being a widely different plant with stellate tomentum and spotted fruit. Hu's type is not now available, but two collections made by the same collector from the type locality at the same time when the type was collected, *F. T. Wang 22445* and *22478*, clearly represent the same plant. They are unquestionably *A. purpurea*. As Hu's description also fits the latter species perfectly, it is believed desirable also to reduce *A. chartacea* to synonymy.

The species *A. purpurea*, as mentioned above, is very close to *A. arguta*, and it remains to be seen whether it will eventually be advisable to revert to the broader concept of Dunn and treat this as a variety of *A. arguta*.

19. **Actinidia arguta** (Sieb. & Zucc.) Planchon ex Miq. in Ann. Mus. Bot. Lugd.-Bat. **3:** 15. 1867.

Climbing shrubs to 7 m.; branches glabrous or the very young branchlets puberulous, rarely tomentose, grayish brown, the lenticels absent on younger branches, small and inconspicuous on mature ones; pith white to brown, lamellate. Leaves membranaceous to chartaceous, elliptic-ovate to broadly ovate, 8–12 cm. long, 4.5–7.5 cm. broad, abruptly acuminate at apex, rounded to subcordate at base, rarely cuneate, usually oblique, the margins sharply serrate, glabrous and dull above, nearly concolored or slightly paler beneath, glabrous to rusty-tomentose to setose on one or both surfaces, especially beneath, with or without tufts of whitish or yellowish hairs in the axils of the secondary veins beneath, the costa and veins slender, subconspicuous above, distinct and raised beneath, the secondary veins about 5 or 6 per side, arcuate-ascending, anastomosing, the veinlets reticulate, inconspicuous above, subconspicuous beneath; petioles 3.5–8 cm. long, glabrous or rusty-tomentose, sometimes setose. Flowers white, in axillary cymes, puberulous, the staminate cymes often many-flowered, the pistillate with 1–3 or more flowers; sepals 5, ovate, 5–7 mm. long, obtuse at apex, the margins ciliate, glabrous or rarely puberulous without; petals white; brownish at base, ovate to oblong-ovate, often unequal, 7–12 mm. long, 4–7 mm. broad; stamens numerous, the filaments slender, 3–4 mm. long, the anthers blackish when dry, oblong, 2 mm. long sagittate at base; ovary bottle-shaped, about 6 mm. long and 2 mm. across, glabrous, the styles about 4 mm. long. Fruit ovoid or oblong, about 2–2.5 cm. long, greenish yellow, glabrous, not lenticellate, the apex rostrate.

Actinidia arguta was broadly defined by Dunn to include forms ranging from Yunnan to Manchuria and Japan. Subsequently the species *A. purpurea* was segregated by Rehder and the species *A. platyphylla* A. Gray reinstated by Japanese botanists. The present study, based on a large series of specimens from all these localities, suggests that it is advisable to return to the somewhat broad concept of Dunn. The several varieties here recognized occur in more or less contiguous areas and pass into each other imperceptibly by intergrading forms. Clearly this is another of the very widespread, more or less polymorphic species characteristic of the genus *Actinidia*. As a species in its broad sense, it probably should include also *A. purpurea* and *A. hypoleuca*; it is characterized by the long-petioled, more or less membranaceous leaves, generally glabrous except for the veins and the nerve-axils, the petals frequently purplish at base, the purple sagittate anthers, the glabrous bottle-shaped ovary, and the smooth short-rostrate fruits.

KEY TO THE VARIETIES

A. Leaves membranaceous to chartaceous, rounded to subcordate at base, glabrous or setose along the costa beneath.
  B. Leaves membranaceous to subchartaceous; young shoots and leaves as well as inflorescence glabrate except along the veins of the lower surfaces of the leaves. . . . . a. var. *arguta.*
  BB. Leaves subchartaceous; young shoots and leaves as well as inflorescence usually rusty-tomentose. . . . . b. var. *rufa.*
AA. Leaves chartaceous, relatively shorter, broader, cordate at base, more setose on the veins beneath. . . . . c. var. *cordifolia.*

19a. **Actinidia arguta** var. **arguta.**

Actinidia arguta (Sieb. & Zucc.) Planchon ex Miq. in Ann. Mus. Bot. Lugd.-Bat. **3:** 15. 1867; Nakai in Bot. Mag. Tokyo **47:** 256. 1933.

Trochostigma arguta Sieb. & Zucc. in Abh. Akad. Wiss. München **3:** 727. 1843.

Actinidia rufa var. *arguta* Dunn in Jour. Linn. Soc. Bot. **39:** 402. 1911.

Actinidia giraldii Diels in Bot. Jahrb. **36:** Beibl. **82:** 75. 1905; Dunn in Jour. Linn. Soc. Bot. **39:** 403. 1911. *Syn. nov.*

Actinidia megalocarpa Nakai ex Nakai & Kitagawa in Rep. 1st Sci. Exp. Manch. IV. **1:** 9, *t. 3.* 1933 (Pl. Nov. Jehol.) *Syn. nov.*

Leaves membranaceous to subchartaceous, elliptic-ovate to broad-ovate, 8–12 cm. long, 4.5–7.5 cm. broad, abruptly acuminate at apex, rounded to subrounded at base, rarely cuneate, usually oblique, glabrous or sparsely setose along the costa and veins on both surfaces, especially beneath, with or without tufts of whitish or yellowish hairs in the nerve-axils beneath; inflorescences puberulous.

Eastern Siberia, Manchuria, and northern China to Korea and Japan, in thickets at altitudes of 100–2000 meters. Flowers white, the anthers purple, June.

CHINA: Manchuria: Hsiao-ling, *P. H. & J. H. Dorsett 29* (US), *P. H. Dorsett 4086* (A, NY); Sui-fen-ho, *B. V. Skvortzov s. n.* (A); Kao-ling-tzu, *B. V. Skvortzov s. n.* (A); Mao-erh-shan Station, *B. V. Shvortzòv s. n.* (A); Mifun Station, *B. V. Skvortzov s. n.* (A); Port Bruce, *Maximowicz s. n.* (GH). Chahar: Yang-chia-p'ing, *C. W. Wang 61824* (A); "Pao-feng-ssu," *C. W. Wang 60813* (A), *60816* (A). Hopei: Without precise locality, *C. F. Li 11167* (NY); Ming-ling, *K. M. Liou 618* (NY). Shansi: Ling-shih Hsien, *T. Tang 904* (NY); Chieh-hsiu Hsien, *H. Smith 5444* (A). Shensi: Kuan-yin-shan, *J. Giraldi s. n.* (A). Honan: Sung Hsien, *J. Hers 501* (A), *567* (A), *1265* (A); Lu-shih Hsien, *J. Hers 867* (A), *1143* (A), *1180* (A). Shantung: Lao-shan, *C. Y. Chiao 2856* (A, NY, US). Kiangsu: Tung-hai Hsien (Haichow), *J. Hers 645* (A). Anhwei: Wu-yuan Hsien, *R. C. Ching 3254* (A); Huang-shan, *R. C. Ching 3046* (A). Chekiang: T'ien-mu-shan, *H. H. Hu 1583* (A).

KOREA: Pyongyang. *Mrs. R. K. Smith s. n.* (US); Taiyudo, prov. Heian, *E. H. Wilson 8642* (A, US), Kongo-san, prov. Kogan, *R. K. Beattie 10454* (A, US), *E. H. Wilson 10718* (A); Mt. Aiensan, *U. Faurie 496* (A).

JAPAN: Hokkaido: Sapporo, *S. Takenobu s. n.* (GH), *S. Arimoto s. n.* (GH), *Y. Tokubuchi s. n.* (GH), *E. Tokubuchi s. n.* (GH), *C. Wilford s. n.* (GH), *Maximowicz s. n.* (GH, US); Abashiri, *E. H. Wilson s. n.* (A).

Hondo: Yoshino (Yamoto), *Tokyo Mus. 76* (US); Yokohama, *Maximowicz s. n.* (US); Hakone, Sengoku, *T. Sawada 2218* (A); Mino prov., *K. Shiota 7712* (A), *7781* (A); Lake Chuzenji, *J. G. Jack s. n.* (A), *E. H. Wilson s. n.* (A), *C. S. Sargent s. n.* (A); Mt. Tamigawa, Niigata, *S. Suzuki 993024* (A). Shikoku: Iyo, *Y. Ikkaku 9527* (A).

The specific names *A. arguta* and *A. rufa* are effected by Miquel who credits them to Planchon. They are based on *Trochostigma arguta* Sieb. & Zucc. and *T. rufa* Sieb. & Zucc. respectively. Dunn considers them as separate varieties of the same species, *A. rufa* var. *typica* and *A. rufa* var. *arguta*. Nakai maintains them as two distinct species. Maximowicz in 1886 was the first to unite the two species, and he took up the name *A. arguta* for the aggregate. This view is followed by most subsequent authors. As noted by Rehder, *A. arguta*, the name chosen by the first author to unite the concepts, must be adopted.

Nakai considers as *A. arguta* the common species in Japan which is found nearly everywhere, while, *A. rufa*, considered by him as distinct, is limited only to the extreme south in Kiusiu as well as the Liukius. As the two are differentiated by him only in the degree of indument, they seem hardly to merit specific recognition. Among the available specimens, it is hard to find constant differences. Thus these two are retained as varieties as given earlier by Dunn, but the range of *A. arguta* var. *rufa* is found not to be strictly limited to the south as indicated by Nakai. A specimen of Oldham's collection, probably from Korea, which bears Nakai's identification as "*A. rufa*" clearly belongs to this same form. Rehder and others treat *A. rufa* and *A. arguta* as exact synonyms.

A photograph of the holotype of *A. giraldii* Diels, *Giraldi 4065*, from southern Shensi, is in the herbarium of the Arnold Arboretum. It matches exactly a specimen in the same herbarium collected by Giraldi in 1897 from the same locality and determined by Rehder as *A. purpurea*. The setose leaves as shown by the specimen and described by Diels, clearly indicate that *A. giraldii* is referable to *A. arguta* rather than *A. purpurea*.

Nakai's *A. megalocarpa* from Jehol, Chang-Shan-Yu, based on "N. H. K. Sept. 13, 1933," differs, according to the author, from *A. arguta* in the thinner leaves and larger fruits. The latter measure 2 × 4 cm. Basing one's opinion on his description and illustration, it seems quite safe to refer this name to *A. arguta*.

Among the above cited specimens is a collection made by C. Y. Chiao, no. 2856, from Lau Shan, Shantung. This was originally determined as *A. polygama*, but the lamellate instead of solid pith clearly eliminates it from that species. Four specimens of this number are observed, all of them sterile. These specimens, so far as the vegetative characters can show, belong to *A. arguta*. I suspect that the record of *A. polygama* from Lau Shan, Shantung, as given by Gilg & Loesener in Bot. Jahrb. **39:** Beibl. **75:** 52. 1904, based on a Zimmerman collection, should actually be referred to *A. arguta*.

The pith of *A. arguta* is sometimes solid and at other times, especially at the very central part, it becomes compactly lamellate, particularly in older stems. When the pith is solid, it is small, of very firm texture, and slightly pinkish colored like the wood; thus it is very different from the solid, pure white, very large, and spongy pith of *A. polygama*.

19b. **Actinidia arguta** var. **rufa** (Sieb. & Zucc.) Maximowicz in Bull. Acad. Imp. Sci. St. Pétersb. **31:** 1886, in Mel. Biol. **12:** 424. 1886.

Trochostigma rufa Sieb. & Zucc. in Abh. Akad. Wiss. München **3:** 727, *t. II, f. d8–d13.* 1843.

Actinidia rufa Planchon ex Miq. in Ann. Mus. Bot. Lugd.-Bat. **3:** 15. 1876 (Pro. Fl. Jap. 203); Nakai in Bot. Mag. Tokyo **47:** 257. 1933.

Actinidia callosa var. *rufa* Makino in Bot. Mag. Tokyo **16:** 147. 1901.

Actinidia rufa var. *typica* Dunn in Jour. Linn. Soc. Bot. **39:** 402. 1911.

Leaves subchartaceous, ovate to broad-ovate, 6–10 cm. long, 5–10 cm. broad, cordate to truncate at base, glabrous except in the nerve-axils on the under surfaces; inflorescence mostly tomentose.

Liukiu, Korea, and Japan. Flowers white, anthers purple, June.

JAPAN: Hondo: Kai prov., Pass Sasaro, *No. coll.* (US).

KOREA: "Korea arch ?, Pt. Hamilton," *Oldham 94* (GH).

LIUKIU: Takanosima & Onsima, *C. Wright 31* (GH).

19c. **Actinidia arguta** var. **cordifolia** (Miq.) Bean, Trees & Shrubs Brit. Isl. **1:** 162. 1914.

Actinidia cordifolia Miq. in Ann. Mus. Bot. Lugd.-Bat. **3:** 15. 1876. (Prol. Fl. Jap.).

Actinidia platyphylla A. Gray ex Miq. l. c.; Nakai in Bot. Mag. Tokyo **47:** 258. 1933.

Actinidia rufa var. *cordifolia* Dunn in Jour. Linn. Soc. Bot. **39:** 403. 1911.

Actinidia rufa var. *dulcisisma* Koidzumi in Bot. Mag. Tokyo **44:** 100. 1930. *Syn. nov.*

Leaves subchartaceous, broad-ovate, about 4–9 cm. long. 5–10 cm. broad, distinctly cordate at base, the costa and veins more setose beneath; inflorescence rusty-tomentose.

Japan and Korea, in thickets. Flowers white, anthers purple, June.

JAPAN: Hokkaido: Cape Sangar, *J. Small s. n.* (GH, TYPE of *A. platyphylla* Gray); between Shojiko & Kofu, *Dorsett & Morse 560* (US); Niigata pref., Mt. Tanigawa, *S. Suzuki 398025* (A). Hondo: Misaka Pass, *E. H. Wilson s. n.* (A); Nanokawa, Tosa, *K. Watanabe s. n.* (GH); Kai, Gunnai, *K. Sakurai s. n.* (A)

KOREA: Oo-ryong-too, *E H. Wilson 8542* (A).

There is some confusion with regard to the synonymy of this variety. Miquel's *A. cordifolia* is based on "Unicum exemplar legit Pierot in sylva ad upain fluvii Asija Gawa prope Kojanosa ins. Kiusiu." When Dunn proposed the variety *A. rufa* var. *cordifolia,* it was clearly based on Miquel's *A. cordifolia* as the latter is cited in the synonymy. Among the two specimens he cited is "Cape Sangar, *Wright.*" This is evidently the type collection of *A. platyphylla* A. Gray, quoted by Miquel as a number of J. Small. The holotype is in the Gray Herbarium, a J. Small specimen in C. Wright's collection. Dunn was apparently unaware of this fact, as he cited, "fide Bretschneider," *A. platyphylla* A. Gray in the synonymy of *A. kolomikta* Maxim. This was followed by Rehder, in Sarg. Pl. Wils. **2:** 381. 1915. Nakai has had access to the type of *A. platyphylla* A. Gray, as he cited the Wright number from both Gray and Paris, and relegated *A. rufa* var. *cordifolia* Dunn to the synonymy of *A. platyphylla* A. Gray. However, the species *A. cordifolia* Miq., the basis of Dunn's variety, was cited by Nakai under *A. arguta* Planch. ex Miq. He gives no reason for doing so, and apparently he has not had access to the type of *A. cordifolia* Miq., a Pierot number from Kiusiu. In Rehder's Bibliography (Bibl. Cult. Trees & Shrubs 459. 1949) both *A. cordifolia* Miq. and *A. platyphylla* A. Gray are listed in the synonymy of *A. arguta* var. *cordifolia* (Miq.) Bean.

Koidzumi, in Bot. Mag. Tokyo **44:** 100. 1930, considers *A. arguta* var. *cordifolia* Dunn as distinct from *A. cordifolia* Miq. *Actinidia arguta* is recognized by him as a synonym of *A. platyphylla* A. Gray, of which he cites no specimen. *Actinidia arguta* var. *cordifolia* Dunn is renamed *A. rufa* var. *dulcissima* Koidz., of which no description is given but for which two collections, *Pierot 445* and *C. Wright s. n.*, are cited. The Pierot collection from Kiusiu is most probably that on which Dunn based his species. No reason is given by Koidzumi for renaming Dunn's variety. As I consider that *A. rufa* var. *cordifolia* Dunn, *A. cordifolia* Miq., and *A. platyphylla* A. Gray are all synonymous with *A. arguta* var. *cordifolia*, Koidzumi's varietal name is thus also included. That this name is superfluous may have been later realized by Koidzumi himself, as in his key to the Japanese species of *Actinidia* (in Acta Phytotax. Geob. **9:** 97–99. 1940) *A. cordifolia* Miq. is again recognized by him, while his own *A. rufa* var. *dulcissima* is not mentioned at all.

20. **Actinidia rubricaulis** Dunn in Kew Bull. **1906:** 2. 1906, in Jour. Linn. Soc. Bot. **39:** 407. 1911 p. p. (excluding *Wilson 3271 & 4764*).

Large climbing shrubs; branches reddish brown to purple, lenticellate, glabrous to minutely hirsute when young; pith solid, whitish, firm. Leaves chartaceous, oblong-lanceolate to ovate-oblong, about 8–10.5 cm. long and 1.2–3.8 cm. broad, acuminate at apex, cordate to subrounded at base, generally oblique, the margins laxly serulate, the teeth sometimes glandular, glabrous on both surfaces, the upper surface dark, the lower much paler, the costa and veins inconspicuous above, distinct and raised beneath, the secondary veins 6 or 7 per side, distinctly arcuate-ascending, anastomosing, the veinlets reticulate, inconspicuous above, subconspicuous beneath; petioles 1–2.5 cm. long, glabrous or minutely hirtellous. Flowers usually scattered on short lateral branches, the peduncles solitary, the lower ones lateral, the upper axillary or the flowers in axillary fascicles of up to 5; pedicels or peduncles glabrous, to 1.3 cm. long, with or without a minute linear bract at the middle;

sepals 5, mostly unequal, oblong, to 4.5 mm. long and 3 mm. broad, obtuse to rounded at apex, the margins usually ciliate; petals 5, often unequal, oblong-lanceolate, to 7.5 mm. long and 4.5 mm. broad, rounded at apex; stamens numerous, the filaments slender, 3.5 mm. long, the anthers ovoid, yellow, about 1.5 mm. long, rounded at apex, slightly sagittate at base; rudimentary ovary pellucid-pilose. Fruit ovoid, about 1.6 cm. long and 1.3 cm. across, glabrous, lenticellate; persistent sepals reflexed, the styles about 2–3 mm. long.

Southwestern China, in southern Yunnan only, in mountain forests at altitudes of about 1500–2300 meters. Flowers whitish.

CHINA: Yunnan: Feng-ch'un-ling, south of Red River, *A. Henry 10696* (A, NY, US, COTYPES); Meng-tsu, *A. Henry 11334* (A, NY, COTYPES); P'ing-pien Hsien, *H. T. Tsai 62669* (A).

The two Henry numbers are the two original collections cited by Dunn. In 1911, Dunn also listed *Wilson 3271 & 4764*, from O-mei-shan, as belonging to this species. However, in Rehder's treatment (in Sarg. Pl. Wils. **2**: 381. 1915), these two numbers are included in *A. tetramera* Maxim. I agree with Rehder that these two should not be referred to *A. rubricaulis*. The latter species, therefore, is limited in its range to southern Yunnan.

Dunn describes the plant as wholly glabrous, but upon close examination the young shoots are found to be minutely hirsute. *Henry 10696* is from a male flowering plant with narrow oblong-lanceolate leaves. *Henry 11334* is a fruiting specimen with quite different leaves, which are ovate-oblong, relatively much shorter and broader. In other characters the two are clearly of the same species, as especially evidenced by the firm solid pith, which appears to be a very characteristic feature of this species, overlooked by Dunn. The field labels show that the two collections are from two different localities and are not from the same place, as cited by Dunn. *Tsai 62669* is a young fruiting specimen, the only collection of the species since it was described from the original material.

Only rudimentary ovaries in the staminate flowers are observed. Dunn originally described these as "praeter lanan circa stylos glabrum." In his later revision of the genus, he characterized the species as having glabrous ovaries and he accordingly differentiated it in his key from *A. callosa* and *A. coriacea,* which have pubescent ovaries. This was apparently due to his inclusion of the two Wilson collections noted above that should properly be placed in *A. tetramera,* a species with distinctly glabrous ovaries.

Another characteristic feature of this species which Dunn fails to note is the presence of flowers usually on short lateral branches, especially on the lower leafless part. This is true in both staminate and pistillate specimens. This phenomenon is also found in *A. coriacea,* another species with solid pith, and it indicates their close relationship. The flower color of *A. rubricaulis* is not recorded by Dunn, but is indicated by the collector on one sheet (NY) of *Henry 10696* as whitish.

21. **Actinidia fortunatii** Finet & Gagnep. in Bull. Soc. Bot. France **53:** 574. 1906, as *A. fortunati*; Dunn in Jour. Linn. Soc. Bot. **39:** 409. 1911; Lév. Fl. Kouy-Tcheou 413. 1915; Rehder in Jour. Arnold Arb. **15:** 97. 1934.

Actinidia dielsii Lév. in Rep. Sp. Nov. **13:** 175. 1914.

Actinidia glaucophylla F. Chun in Sunyatsenia **7:** 11, *pl. 3.* 1948. *Syn. nov.*

High climbing shrubs to 10 m.; branches dark reddish brown, glabrous, the young branchlets sometimes with densely rusty-pubescent buds; pith small, lamellate, white. Leaves thin- to thick-chartaceous, lanceolate to elliptic-lanceolate, rarely ovate-oblong, about 8–14 cm. long and 1.8–3.5 cm. broad, sometimes to 14 cm. long and 7.5 cm. broad, long-acuminate to rarely acute at apex, obliquely but distinctly cordatulate at base, the upper surface generally green, glabrous, rarely sparsely setose and slightly puberulous along the costa when young, the lower surface glabrous, mostly glaucous, sometimes puberulous along the costa and veins when young, the costa and veins subconspicuous above, elevated and distinct beneath, the secondary veins about 8–10 per side, the veinlets reticulate, inconspicuous above, subconspicuous to conspicuous beneath; petioles 1–2 cm. long, glabrous, sometimes pubescent. Flowers reddish, the staminate in short, small cymes, the pistillate often solitary; pedicels slender, to 5 mm. long, slightly pubescent to glabrate; bracts linear, minute; sepals 5, ovate, about 4 mm. long and 2.5 mm. broad, often unequal, obtuse at apex, glabrate; petals 5, obovate, about 7 mm. long and 3.5 mm. broad, rounded at apex; stamens numerous, the filaments 3–4 mm. long, the anthers yellow, 1–1.5 mm. long, rounded at apex, slightly sagittate at base; ovary conical-ovoid, slightly pellucid-pilose, later glabrate. Fruit cylindric, oblong, to about 2.2 cm. long and 2 cm. across, glabrous, lenticellate, blackish.

Southern China (southern Hunan, Kweichow, Kwangsi, and Kwangtung), in thickets at altitudes of 400–1300 meters. Flowers reddish or pinkish, June.

CHINA: Hunan: Hsin-ning Hsien, *C. S. Fan & Y. Y. Li 497* (A). Kweichow: Kuei-ting, *Y. Tsiang 5480* (NY). Kwangsi: Ling-ch'üan Hsien, *W. T. Tsang 28427* (US); N. Lu-chen, *R. C. Ching 5828* (NY), *6085* (NY). Kwangtung: Lo-ch'ang, *C. L. Tso 20682* (NY), *W. T. Tsang 20803* (NY); Yao-shan, *S. S. Sin 9460* (NY); Ju-yüan Hsien, *S. P. Ko 52844* (A).

This species is not classified by Dunn in his key. He says: "In the absence of fruit or female flowers it is not possible to decide into which of the three sections it falls. Its long narrow cordate leaves distinguish it from all other species here enumerated."

A photograph of the type, *Cavalerie & Fortunat 235,* from Kweichow, is in the herbarium of the Arnold Arboretum. The specimens now available show that the fruits are oblong, glabrous, and lenticellate. It is clearly associated with the *A. callosa* group and especially with *A. coriacea,* which has similarly reddish flowers.

Actinidia dielsii Lév., as noted by Rehder, is reduced to the synonymy of *A. fortunatii* by Léveillé himself. *Actinidia glaucophylla* F. Chun is based on *S. P. Ko 52835* (type), *52844* and *52886*, all from Ju-yüan, Kwangtung. Of these, a specimen of *52844* is available. This specimen, as well as the original description and illustration, shows that without doubt the species in question belongs to *A. fortunatii*, a very characteristic species readily recognized by the narrow elliptic-lanceolate leaves with a distinct cordatulate base and by the reddish flowers.

The series of specimens now available shows that the species is also a very variable one. The indumentum and leaves, as well as the flower-color, show variations. While the plant has a decidedly glabrous appearance, hairs may be found occasionally on young shoots, buds, and pedicels. *Tsang 20803*, a vegetative shoot, has the stem rusty-tomentose and the leaves hairy on the costa on both surfaces. Some of the leaves are also sparsely setose above. The leaves of the different specimens may be very distinctly glaucous in some and partly glaucous, slightly glaucous, or not at all glaucous in others. *Ching 5828*, evidently a very vigorous flowering branch, has unusually large broad leaves measuring 14 cm. long and 7.5 cm. broad. In spite of this great difference in size, all other characters indicate that it clearly belongs to this species, which is of polymorphic habit like most other species of the genus.

22. **Actinidia coriacea** (Finet & Gagnep.) Dunn in Jour. Linn. Soc. Bot. **39:** 405. 1911; Rehder in Sarg. Pl. Wils. **2:** 384. 1915; Stapf in Bot. Mag. **152:** *t. 9140.* 1928; Hand.-Mazz. Symb. Sin. **7:** 390. 1931.

Actinidia callosa Lindl. var. *coriacea* Finet & Gagnep. in Bull. Soc. Bot. France **52:** Mém. **4:** 20 1905 (Contr. Fl. As. Or.).

Climbing shrubs to 10 cm.; branches reddish brown, glabrous or nearly so; pith solid, firm, whitish or yellowish. Leaves thickly coriaceous, oblong to oblong-ovate, about 10–16 cm. long, 3–5 cm. broad, acuminate at apex, shortly acute to cuneate at base, usually oblique, the margins more or less remotely mucronulate-serrate to sharply serrate toward the apex, the tips of serrations often reddish-glandular, glabrous on both surfaces, the upper surface green, the lower paler, the costa sulcate above, thick and slightly raised beneath, the secondary veins about 6 or 7 per side, slender, arcuate-ascending, anastomosing, inconspicuous above, scarcely raised and subconspicuous beneath, the veinlets reticulate, inconspicuous on both surfaces; petioles 1.5–2.5 cm. long, glabrous. Flowers reddish, solitary or in 2–4-flowered cymes arranged along short branches which are leafy above and leafless below, the lower flowers lateral, the upper axillary; pedicels slender, up to 2.2 cm. long, glabrous; sepals 5, ovate, about 4–5 mm. long and 3.5 mm. broad, obtuse at apex, glabrous without, sometimes white-puberulent inside, ciliate along the margins; petals 5, suborbicular, red with whitish or yellowish margins, about 7–10 mm. long and 4–7 mm. broad, the apex rounded, the base narrowed; stamens numerous, the filaments red, about 3–4 mm. long; anthers yellow; ovary conical, about 2.5 mm. long and 1.5 mm. across, densely white-pubescent, the styles to 3 mm. long. Fruit ovoid or globose, to 2 cm. long, glabrous, brown, white-lenticellate.

Southwestern China (from Kweichow and Szechuan to northwestern Yunnan), in thickets at altitudes of 200–1000 meters. Flowers red, May–June.

CHINA: Szechuan: Without precise localities, *E. H. Wilson 3272* (A), *3272a* (A), *E. Faber 72* (NY); Cheng-k'ou Hsien, *R. P. Farges 1946* (NY); Hung-ya Hsien, *E. H. Wilson 932* (A, GH, NY); O-mei-shan, *E. H. Wilson 4760* (A), *W. P. Fang 3306* (A), *12756* (A, US), *Chiao & Fan 132* (A), *Y. S. Liu 2145* (A); O-pien Hsien, *Y. S. Liu 2003* (A); Lu-shan Hsien, *K. L. Chu 4044* (A); Nan-ch'uan Hsien, *W. P. Fang 796* (A, NY, US), *5654* (A, NY); Ch'ia-ting Hsien, *S. C. Sun & K. Chang 25* (A), *1512* (A), *L. Y. Tai 643* (A), *832* (A), *1289* (A), *1541* (A); Ch'i-chiang Hsien, *W. P. Fang 1430*, (A, NY); Kuan Hsien, *W. P. Fang 2113* (A, NY); Chiang-yu Hsien, *W. P. Fang 2223* (A). Sikang: Tien-ch'üan Hsien, *L. Y. Tai 4172* (A). Kweichow: Tsun-i Hsien, *Steward, Chiao & Cheo 136* (A, NY, US); Shih-ch'ien Hsien, *Y. Tsiang 4108* (NY); T'ung-tzu Hsien, *Y. Tsiang 5010* (NY); Tu-yun Hsien, *Y. Tsiang 5698* (NY); Chiang-k'ou Hsien, *Y. Tsiang 7507* (NY); Yin-chiang Hsien, *Y. Tsiang 7610* (NY), *7894* (NY).

This distinct species is characterized by the coriaceous, remotely glandular-serrulate leaves, and by the red flowers borne on separate leafless branches or along the leafless portion of the shoots. The pith is characteristically solid, firm, and more or less whitish or yellowish.

23. **Actinidia asymmetrica** F. Chun in Sunyatsenia **7:** 13. 1948.

Climbing shrubs; branches reddish brown, longitudinally sulcate, glabrous, without lenticels or sometimes with a few pale oblong lenticels; pith white, medium-sized, lamellate. Leaves membranaceous or chartaceous, ovate-oblong, about 7–10 cm. long and 3.5–5.3 cm. broad, acute to acuminate at apex, auriculate-cordate at base, often unequally so, the margins irregularly callose-denticulate, glabrous on both surfaces, paler or even glabrescent on the lower surface, the costa and veins subconspicuous above, distinct and raised beneath, the secondary veins about 5–7 per side, arcuate-ascending, ending in the marginal teeth, the veinlets reticulate, inconspicuous except for a few parallel cross-bars; petioles 2–2.25 cm. long, glabrous; inflorescences in short 3–5-flowered axillary cymes, sometimes the flowers solitary; peduncles 1–1.5 cm. long, glabrous; pedicels 4–5 mm. long; bracts minute, subulate. Flowers pink; sepals 5, subequal, oblong, about 6 mm. long and 3 mm. broad, acute to obtuse at apex, glabrous, the margins slightly ciliate; petals 5, obovate to obovate-oblong, about 8 mm. long and 6 mm. broad, rounded at apex, contracted at base; stamens numerous, the filaments about 3 mm. long, the anthers yellow, about 1.8 mm. long, ovary cylindric-oblong, about 3 mm. long and 2 mm. across, densely yellowish-villose, the styles about 2 mm. long. Fruit cylindrical ovoid, about 2.2 cm. long and 8–10 mm. across, brown, with lenticels, glabrous or slightly pubescent toward the tip; seeds oval, 1.5 mm. long, 1 mm. broad, foveolate-reticulate.

Southern China, in Kwangsi only, on mountain slopes at an altitude of about 1360 meters. Flowers reddish.

CHINA: Kwangsi: Ling-yüan Hsien, *Steward & Cheo 672* (NY); Nan-ning Hsien, Shih-wan-ta-shan, *R. C. Ching 8362* (NY); Shang-ssu Hsien, Shih-wan-ta-shan *W. T. Tsang 23833* (NY), *24120* (NY).

The type, a flowering specimen, is *Liu 566* (*Sunyatsen Herb. 86950*), from Wu-ming, Ta-ming-shan, Kwangsi. It has not been seen by me. Among the above cited specimens, the Ching and Tsang numbers are fruiting specimens. *Steward & Cheo 672* has female flowers and young fruits.

The fruit of this species, not known when it was first described, appears to be very characteristic in its nodding position and slender shape. This species is also distinctly characterized by the leaf with auriculate-cordate base. Chun emphasizes particularly the asymmetrical shape of the leaf-blade, but this is not an exclusive character for the species. Most species of the genus have some leaves that are asymmetrical in shape. It is a common phenomenon in most climbing vines and is probably due largely to environmental rather than genetic factors.

24. **Actinidia pilosula** (Finet & Gagnep.) Stapf ex Hand.-Mazz. Symb. Sin. **7:** 390. 1933.

Actinidia callosa Lindl. var. *pilosula* Finet & Gagnep. in Bull. Soc. Bot. France **52:** Mém. **4:** 19, 20. 1907; Dunn in Jour. Linn. Soc. Bot. **39:** 406. 1911.

Climbing shrubs to 7 m.; branches reddish brown, with scattered short ovoid lenticels, glabrous or the young branchlets sparsely whitish-pubescent; pith more or less large, white, thinly lamellate. Leaves membranaceous, ovate-oblong, 5–12 cm. long, 3–6.5 cm. broad, acuminate at apex, broadly truncate at base, often unequal, the margins finely mucronulate-serrulate, the teeth more or less glandular, dark green above, nearly concolored or very slightly paler beneath, slightly but distinctly white-pubescent along the costa, the costa and veins subconspicuous above, purplish and conspicuous but not raised beneath, the secondary veins about 7 or 8 per side, arcuate-ascending, anastomosing, the veinlets reticulate, inconspicuous to subconspicuous beneath, ending in the marginal teeth; petioles purplish, long, slender, about 2–3.5 cm. long, white-pubescent to glabrate. Inflorescence in axillary cymes of about 5–7 flowers, brownish-tomentose; peduncles 1–1.5 cm. long; pedicels to 1 cm. long; bracts linear, small, 0–3 to a pedicel. Flowers brownish yellow; sepals 5, ovate, about 4–5 mm. long and 2–2.5 mm. broad, obtuse at apex, glabrous to slightly pubescent, the margins often ciliate; petals 5, obovate-oblong, about 7–9 mm. long and 4–5 mm. broad, rounded at apex; stamens numerous, the filaments slender, to

5 mm. long, the anthers yellow, ovoid, about 1 mm. long, rounded at both ends, the base not divergent; ovary elongate-cylindric, to 5 mm. long and 2.5 mm. across, pubescent when young, becoming glabrous, the styles about 2 mm. long. Young fruits oblong-cylindric, glabrous, not lenticellate, with persistent reflexed sepals.

Southwestern China (Yunnan) and northern Burma, in forest at altitudes of 2100–3300 meters. Flowers brownish yellow, June.

CHINA: Yunnan: Without precise locality, *G. Forrest 6385* (A), *13910* (A), *19245* (A); "Tsekou," *R. P. Soulie 1396* (A, ISOTYPE); Mekong Valley, *J. F. Rock 8948* (A, NY, US), *Handel-Mazzetti 8825* (A); Mekong-Yangtze divide, *G. Forrest 19442* (A), *J. F. Rock 25067* (A); Yung-shan Hsien, *H. T. Tsai 51000* (A).

BURMA: Northern Burma, Adung Valley, *F. K. Ward 9559a* (A).

The type is from "Yunnan; Thra-na at Tsekou, 10–20 juin 1893, no 1396 (Soulie)", of which a duplicate is cited. This species is amply different from *A. callosa* in the very thin broadly truncate leaves, often hairy and setose above, the large thinly lamellate pith, and the brownish yellow flowers. The degree of pubescence varies considerably.

The specific combination was published by Handel-Mazzetti from the herbarium name indicated by Stapf. When Handel-Mazzetti published it he cited three collections, *Forrest 13910* and *Handel-Mazzetti 9042* and *9046*. *Forrest 13910* was once identified by W. W. Smith as "*A. championii* var. *mollis* Dunn." This number and *Handel-Mazzetti 9042* are available, and they clearly prove to be *A. callosa* var. *pubescens* and not *A. pilosula* as Handel-Mazzetti originally indicated. The two are very different from *A. pilosula* in leaf and pith, as well as in floral characters. Clearly *A. pilosula* should be typified by Finet and Gagnepain's type, not by the specimens mistakenly identified by Handel-Mazzetti (and possibly also by Stapf) when the combination was effected and published.

The three yellow-flowered species, *A. pilosula*, *A. trichogyna*, and *A. venosa* are intimately related to each other. They are generally distinguishable, but at times intermediate forms are found. It may eventually prove desirable to combine the three as varieties of one species.

25. **Actinidia venosa** Rehder in Sarg. Pl. Wils. **2:** 385. 1915; Hand.-Mazz. Symb. Sin. **7:** 390. 1931, p. p.

Actinidia callosa forma D. Dunn in Jour. Linn. Soc. Bot. **39:** 406. 1911.

Climbing shrubs to 9 cm.; branches purplish brown, with oblong whitish lenticels, the young branchlets puberulous to tomentose, soon glabrescent; pith large, white, lamellate. Leaves thin-chartaceous, ovate or ovate-oblong to elliptic and elliptic-oblong, about 5–15 cm. long, 3–6 cm. broad, rarely to 7.5 cm. broad, acuminate to long-acuminate at apex, mostly rounded at base and sometimes subcordate, usually obliquely so, the margins denticulate-serrulate, the upper surface dark green, glabrous or rarely sparsely setose when young, the lower surface slightly paler, more or less tomentose on the veins when young, soon glabrescent or glabrous, the costa and veins conspicuous above, strongly raised and prominent beneath, the secondary veins 7–11 per side, nearly straight or arcuately ascending, anastomosing, the veinlets reticulate, with numerous closely parallel strongly raised and very prominent cross-bars; petioles slender, 1.5–4 cm. long, puberulous or glabrate at first, soon glabrous. Inflorescences in axillary cymes of 1–7 flowers, rusty-tomentose, the peduncles 5–10 mm. long, the pedicels almost as long; sepals ovate-oblong, about 5 mm. long, obtuse at apex, rusty-tomentose; petals elliptic-oblong, about 8–10 mm. long and 5–6 mm. broad, rounded at apex; stamens numerous, the filaments slender, 5–6 mm. long, the anthers oblong, 2–3 mm. long, rounded at apex, densely villose, the styles 3–4 mm. long. Fruit ovoid or subglobose, about 1.5 cm. long, brown, glabrous.

Western China (Sikang, Szechuan, and northern Yunnan) and northeastern India (Khasia), in thickets at altitudes of 1000–3650 meters. Flowers buff-yellow, June–July.

CHINA: Szechuan: Without precise locality, *E. H. Wilson 3275* (A); Kuan Hsien, *W. P. Fang 2220* (A, NY), *2258* (A, NY); Mao Hsien, *W. P. Fang 21947* (A), *21958* (A); Wen-ch'üan Hsien, *E. H. Wilson 888 p. p.* (A), *1029* (A, TYPE); "Yang-ching" Hsien, *E. H. Wilson 891 p. p.* (A, GH, US); O-mei-shan, *E. H. Wilson 4765* (A), *W. P. Fang 12835* (A), *F. T. Wang 23348* (A), *H. C. Chow 8108* (A), *1225* (A), *12310* (A), *L. Y. Tai 34* (A), *S. C. Sun & K. Chang 273* (A); Wa-shan, *E. H. Wilson 888 p. p.* (A), *891 p. p.* (A); Wa-wu-shan, *E. H. Wilson 888 p. p.* (A); Pao-hsing Hsien, *K. L. Chu 3269* (A). Sikang: Kan-ting (Tachienlu), *A. E. Pratt 101* (GH); *E. H. Wilson 1029* (GH, US), *C. Y. Chiao 1650* (A), *2046* (A). Yunnan: Without precise locality, *H. T. Tsai 57375* (A); "Sua-kia," *E. E. Maire 28* (A); Chienchuan-Mekong divide, *G. Forrest 21521* (A, US), *22278* (A, US), *22283* (A); Yun-lu-shan, Yangtze-Mekong watershed, *J. F. Rock 25067* (NY); Shun-ning, *T. T. Yü 16219* (A); Chung-tien, *K. M. Feng 1786* (A); Li-chiang, *R. C. Ching 20462* (A), *21464* (A); Wei-hsi Hsien, *H. T. Tsai 57998* (A), *59692* (A), *C. W. Wang 63802* (A), *64031* (A), *64054* (A), *68110* (A); Lan-p'ing, *H. T. Tsai 53741* (A).

INDIA: Khasia, *J. D Hooker & T. Thomson s. n.* (GH).

This species is related to *A. callosa* but is distinguished by the broader leaves with a larger number of secondary veins, by numerous, distinctly raised, very prominent, more or less parallel cross-bars, and by the large white pith and the yellow flowers. The specimens cited belong to the typical form of the species, which may be designated as forma *venosa*.

25a. **Actinidia venosa** Rehder forma **pubescens** f. nov.

A f. *venosa* foliis subtus pubescentibus differt.

Western China, in eastern Sikang only, at altitudes of 2700–3200 meters.

CHINA: Sikang: Hui-li Hsien, *T. T. Yü 1451* (A, TYPE); "Yenyuen," Yalung River, *H. Handel-Mazzetti 5406* (A).

A form characterized by the leaves being more or less densely pubescent below. Only young fruiting specimens are observed. The fruit is brownish.

26. **Actinidia trichogyna** Franch. in Jour. de Bot. **8:** 278. 1894; Rehder in Sarg. Pl. Wils. **2:** 384. 1915.

Actinidia callosa Lindl var. *trichogyna* Finet & Gagnep. in Bull. Soc. Bot. France **52:** Mém. **4:** 20. 1906 (Contr. Fl. As. Or.); Dunn in Jour. Linn. Soc. Bot. **39:** 406. 1911.

Climbing shrubs to 7 m.; branches dark reddish brown, with oblong pale lenticels, the young branchlets puberulous to tomentose, soon glabrescent; pith large, white lamellate. Leaves thin-chartaceous, ovate to ovate-oblong to elliptic-ovate, about 5.5–8.5 cm. long and 3–5 cm. broad, acute to acuminate at apex, broad-truncate or rounded to subcordate at base, often obliquely so, the margins mucronulate-serrulate, the upper surface dark green, more or less tomentose along the costa and veins, soon glabrous, the lower surface glabrous or slightly puberulous along the costa, glaucous, the costa and veins inconspicuous above, purple and distinct but not raised beneath, the secondary veins about 5 or 6 per side, rarely more, arcuate-ascending, anastomosing, the veinlets finely reticulate, often in parallel cross-bars, inconspicuous above, purple and subconspicuous beneath; petioles 2–3 cm. long, tomentose to glabrate, purple. Inflorescence in axillary cymes of 1–3 flowers, tomentose, the peduncles about 5 mm. long, the pedicels about the same in length. Flowers yellow; sepals 5, ovate, about 4 mm. long and 2.5 mm. broad, acute to obtuse at apex, tomentose to glabrate; petals 5, obovate-oblong, about 8 mm. long and 4 mm. broad, rounded at apex; stamens numerous, the filaments very slender, about 3–4 mm. long, the anthers yellow, oval, about 1 mm. long, rounded at apex, the base not divergent; ovary subglobose, about 2–3 mm. long, densely villose, the styles about 3 mm. long. Fruit subglobose, about 1 cm. across, brown, glabrous.

Western China (western Hupeh and eastern Szechuan to northwestern Yunnan), in scrubs and thickets at altitudes of 2800–3000 meters. Flowers yellow, tinged rose, June.

CHINA: Hupeh: Western Hupeh, *A. Henry 7135* (GH), *E. H. Wilson 2204* (A, US). Szechuan: Chen-k'ou Hsien, *Farges 370* (NY, isotype). Yunnan: Without precise locality, *G. Forrest 7906* (A), *17781* (A); Chienchuan-Mekong divide, *G. Forrest 21522* (A, US), *J. F. Rock 8618* (A, US); Mekong-Yangtze divide, *J. F. Rock 9403* (A, US), *10373* (A, US); Li-chiang, *R. C. Ching 20841* (A), *22004* (A); Salwin-Chiuchiang divide, *T. T. Yü 19248* (A).

This species is in close alliance with *A. pilosula* and *A. venosa,* both with broad-based leaves, tomentose inflorescences, large white piths, and yellow flowers. It can, however, be distinguished particularly by its glaucous leaves. In this character it resembles *A. sabiaefolia,* a species of eastern China, but the latter has smaller, crenate-serrulate leaves and glabrous sepals. In the glaucous leaves, *A. trichogyna* also resembles *A. melanandra* Franch., of western China, but the latter has purple instead of yellow anthers and also narrower leaf-bases which are not rounded to subcordate.

27. **Actinidia glabra** sp. nov.

Frutex scandens, 6–14 m. altus, omnino glaber; ramis purpureo-nigrescentibus, plus minusve striatis, lenticellis pallidis parvis punctiformibus, medulla ampla brunnea lamellata; foliis subcoriaceis, utrinque glabris, oblongo-ovatis, circiter 6–9 cm. longis et 3–4.5 cm. latis, apice acutis vel acuminatis, interdum obtusis, basi oblique cuneatis vel subrotundatis, margine integris vel apicem versus sparse et minute serrulatis, supra atroviridibus nitidis, subtus glaucescentibus, costa utrinque prominente, nervis lateralibus utrinsecus 6 vel 7, arcuato-adscendentibus, prope marginem anastomosantibus, venulis reticulatis utrinque conspicuis; petiolis 1.5–2.2 cm. longis; inflorescentiis ignotis; fructibus plerumque solitarii, axillaribus, ovoideis, circiter 2.5 cm. longis et 2 cm. latis, flavide brunneis, glabris, lenticellis pallide dispersis, seminibus brunneis ovoideis, leviter compressis, circiter 3 mm. longis et 2 mm. crassis, testa in sicco reticulata.

Southern China, in Kwangsi, in thickets. Flowers unknown.

CHINA: Kwangsi: Shih-wan-ta-shan, S. of Nan-ning, *R. C. Ching 7875* (NY, TYPE); Shang-ssu Hsien, Sih-wan-ta-shan, Teng-lung Village, *W. T. Tsang 24135* (NY).

Although flowers are not known, this seems to be a distinct species because of its entirely glabrous habit. It is one of the alliance of *A. callosa* Lindl., from which it can be distinguished by the more coriaceous, nearly entire leaves, brown lamellate pith, and smaller, brown fruits.

28. **Actinidia sabiaefolia** Dunn in Jour. Linn. Soc. Bot. **38:** 357. 1908; Chun in Sunyatsenia **4:** 190. 1940.

Actinidia callosa Lindl. var. *sabiaefolia* Dunn in op. cit. **39:** 406. 1911.

Climbing shrubs; branches dark reddish, glabrous, sparsely lenticellate, the lenticels short, oval, pale; pith small, brown, lamellate. Leaves chartaceous, ovate, about 5–6 cm. long and 2.5–3 cm. broad, acute to sometimes obtuse at apex, rounded at base, sometimes obliquely so, the margins inconspicuously crenate-mucronulate, glabrous, and very dark above, much paler and more or less glabrous beneath, the costa and veins inconspicuous above, purplish and distinct but not raised beneath, the secondary veins about 5 per side, arcuately ascending, anastomosing, the veinlets reticulate, purple and conspicuous beneath; petioles purplish, about 2 cm. long, glabrous, sometimes more or less glaucous. Inflorescences in axillary cymes of 1–3 flowers, glabrous throughout, the peduncles to 5 mm. long; pedicels to 1 cm. long; bracts minute. Flowers dioecious, white; sepals 5, ovate, 2–3 mm. long, obtuse to rounded at apex, more or less ciliate along the margins; petals 5, obovate, 5–6 mm. long, 3.5–4 mm. broad, rounded at apex; stamens numerous, the filaments slender, about 2 mm. long, the anthers yellow, oval, scarcely 1 mm. long, rounded at apex, not divergent at base; ovary ovoid, about 2 mm. long, densely reddish-tomentose, the styles about 2 mm. long.

Southeastern China (Kwangtung, Kwangsi, and Fukien), in mountain forests. Flowers white.

CHINA: Fukien: Nan-p'ing (Yenping), *Hongkong Herb. 1120* (A), *2402* (A, ISOTYPE).

This taxon was first described by Dunn as a distinct species, but subsequently he treated it as a variety of *A. callosa.* Chun, who records the plant from Kwangtung and Kwangsi and adds a description of the fruit, is of the opinion that it should be reinstated as a species. It differs from *A. callosa* and its varieties in the consistently smaller, more or less glaucous leaves, and in the smaller flowers. I have seen no specimens other than Dunn's original collections. A larger series of specimens, from Fukien and the neighbouring provinces of Kwangtung and Kwangsi, is desirable for study of the variations in this species and its relationship with *A. callosa* and its many varieites.

29. **Actinidia callosa** Lindl. Nat. Syst. ed. 2. 439. 1835.

Climbing shrubs to 7 m.; branches glabrous or the young branchlets tomentose, dark gray to reddish brown, with distinct conspicuous long yellowish lenticels; pith solid, firm, light orange colored, or sometimes slightly and irregularly lamellate in the center. Leaves chartaceous, obovate to ovate-elliptic or sometimes ovate-lanceolate, about 5–13 cm. long and 2.5–6.5 cm. broad, acuminate at apex, rounded to subcuneate at base, usually obliquely so, the margins serrulate or sometimes crenately serrulate or subentire, glabrous or both surfaces tomentose in the nerve-axils or along the veins on the lower surface, dark and more or less shining above, pale beneath, the secondary veins about 5–7 per side, more or less straight or arcuate-ascending, anastomosing, the veins or their branches ending in the marginal teeth, the veinlets reticulate, inconspicuous above, subconspicuous beneath; petioles 2–5.5 cm. long, reddish, glabrous or more or less slightly pubescent. Inflorescences in axillary 1–5-flowered cymes, glabrate or slightly tomentose, the peduncles 2.5–15 mm. long, the pedicels 5–20 mm. long, slender. Flowers white; sepals ovate, about 6 mm. long and 4 mm. broad, obtuse at apex, glabrous or tomentose, the margins sometimes ciliate; petals broadly oblong-obovate, about 10 mm. long and 7 mm. broad, rounded to obtuse at apex; stamens numerous, the filaments slender, 4–6 mm. long, the anthers yellow, oval, about 2 mm. long, obtuse at apex, divergent at base; ovary oblong-ovoid, elliptic, about 3–4 cm. long and 2–2.5 cm. across, glabrous, grayish green, with gray or brown lenticels.

Actinidia callosa is a very variable species, covering a wide geographic area from Taiwan to south-central and western China, and to northeastern India and Malaysia. Besides the typical form, which extends from southern China all the way to Java, there are many other varieties of more limited geographical ranges that can be recognized. A few other species, such as *A. venosa*, *A. trichogyna*, and *A. sabiaefolia*, were formerly included in *A. callosa* by Dunn in his very broad concept of the species. They possess, however, not only definite and more limited ranges but also several distinct and constant characters, and they are here treated as distinct entities closely associated with *A. callosa.*

KEY TO THE VARIETIES

A. Pedicels and calyces glabrous.
  B. Leaves glabrous throughout, not tomentose in the nerve-axils beneath. .... a. var. *callosa.*
  BB. Leaves white-tomentose in the nerve-axils on the lower surface, otherwise glabrous. .... b. var. *henryi.*
AA. Pedicels and calyces tomentose.
  B. Leaves white-tomentose in the nerve-axils on the lower surface, otherwise glabrous. .... c. var. *formosana.*
  BB. Leaves tomentose along the costa and nerves on the lower surface.
    C. Tomentum on leaves rusty-granular, present along veins only. .... d. var. *indochinensis.*
    CC. Leaves more or less densely villose-pubescent all over the lower surface. .... e. var. *pubescens.*

29a. Actinidia callosa var. **callosa.**

Actinidia callosa Lindl Nat. Syst. ed. 2. 439. 1835; Dunn in Jour. Linn. Soc. Bot. **39:** 405. 1911; Lév. Fl. Kouy-Tcheou 413. 1915; Rehder in Sarg. Pl. Wils. **2:** 382. 1915; Koord. Exk. Fl. Java **2:** 602. 1912, Fl. Tjib. **2:** 179. 1923; Baker in Jour. Bot. **62:** Suppl. 9. 1924; Van Steenis in Bull. Bot. Gard. Buitenz. III. **13:** 174. 1934, Fl. Males. I. **4:** 37. 1948.

Leaves chartaceous, obovate to ovate-elliptic, rarely ovate-lanceolate, about 3–13 cm. long and 2.5–6 cm. broad, acuminate at apex, glabrous on both surfaces; pedicels and calyces glabrous.

Southern Asia, from southern China, Indo-China, and northeastern India to Malaysia, in forests and thickets, at altitudes of 300–2400 meters. Flowers white, rarely yellowish, April–May.

CHINA: Anhwei: Hsiu-ning Hsien, *R. C. Ching 3321* (A), Wu-yüan Hsien, *R. C. Ching 3267* (A). Chekiang: Li-shui Hsien, *Y. L. Keng 4235* (A), *H. H. Hu 464* (A); Ch'ing-yüan, *R. C. Ching 2487* (A). Kiangsi: Lung-nan Hsien, *S. K. Lau 4690* (US). Fukien: Ch'ung-an Hsien, *H. H. Hu 1336* (A); Ku-shan, *H. H. Chung 6706* (A). Hunan: Ch'ang-ning Hsien, *Fan & Li 176* (A); I-chang Hsien, *W. T. Tsang 23757* (US). Kwangsi: Ling-yun Hsien, *Steward & Cheo 97* (NY), *428* (A, NY), *1306* (A); Yung Hsien, *Steward & Cheo 906* (A, NY); Kwei-lin Hsien, *W. T. Tsang 28494* (US). Yunnan: without precise localities, *G. Forrest 12057* (A), *15834* (A), *17939* (A); Mekong-Salwin divide, west of Wei-hsi, *J. F. Rock 23278* (A); Shweli-Salwin divide, *G. Forrest 24261* (US), *24380* (US); Shun-ning, *T. T. Yü 15998* (A), *16150* (A), *16613* (A); Mien-ning, *T. T. Yü 17780* (A); south of Red River, *A. Henry 10056* (US), *10056A* (A, US), *10056B* (A, NY); Meng-tzu, *A. Henry 10824* (A, NY), *10824A* (A, NY); Pi-tsieh Hsien, *H. T. Tsai 52784* (A); Fo-hai, *C. W. Wang 73984* (A), *77266* (A); P'ing-pien Hsien, *H. T. Tsai 62630* (A); Chen hsiung Hsien, *H. T. Tsai 52686* (A); Liang-shan

Hsien, *H. T. Tsai 51342* (A). Kwangtung: Lo-ch'ang, *Y. Tsiang 1305* (A), *1470* (A), *C. L. Tso 20489* (NY), *20536* (NY); Chao-chou Hsien, *R. Mell 383* (A); Tseng-chen Hsien, *W. T. Tsang 20304* (NY, US); Ta-pu Hsien, *W. T. Tsang 21150* (A, NY); Wen-yüan Hsien, *S. K. Lau 2117* (A); Ju-yuan, *S. P. Ko 52555* (A), *52563* (A).

INDIA: Nepal, *Wallich 6634* (NY, ISOTYPE); Garhwal, *East India Co. 305* (GH), *A. E. Osmaston 822* (A); Sikkim, *J. D. Hooker s. n.* (GH); W. Nepal, Rikbar, Doti district, *Bis Ram 400* (A); Dehra Dun, *Mulkh Raj Beli s. n.* (A), *T. Hisain s. n.* (A); Pittoragart, E. Almoan, *A. E. Osmaston 1476* (A).

INDO-CHINA: Tonkin, Chapa, *A. Pételot 6343* (A), *6344* (A); Laokay, Tonkin, *A. Pételot 8582* (A).

This typical form of the species covers a wide range and exhibits considerable variation, especially in the shape, size, and margin of leaves. These variations, however, are not constant and they do not seem to be associated with either other morphological characters or geographical ranges. Considering the variable nature of individual plants in this genus, it is not attempted to further divide these forms taxonomically.

29b. **Actinidia callosa** var. **henryi** Maxim. in Acta Hort. Petrop. **11:** 36. 1890; Lév. Fl. Kouy-Tcheou 413. 1915; Rehder in Sarg. Pl. Wils. **2:** 382. 1915.

Actinidia curvidens Dunn in Kew Bull. **1906:** 1. 1906; Hand.-Mazz. Symb. Sin. **7:** 390. 1931.

Actinidia callosa var. *typica* forma C. Dunn in Jour. Linn. Soc. Bot. **39:** 409. 1911.

Actinidia callosa sensu Diels in Bot. Jahrb. **29:** 470. 1900. non Lindl.

Actinidia venosa sensu Hand.-Mazz. Symb. Sin. **7:** 390. 1931, p. p., non Rehder.

Leaves chartaceous, oblong-lanceolate to ovate, about 6–12 cm. long and 3–6.5 cm. broad, acuminate at apex, glabrous on both surfaces except for tufts of white tomentum in the axils of the secondary nerves on the lower surface; pedicels and calyces more or less glabrous.

Southwestern China (western Hupeh, Szechuan, and western Kweichow to southwestern Hunan) in thickets, at altitudes of 1700–3500 meters. Flowers white, May–June.

CHINA: Hupeh: I-chang and vicinity, *A. Henry 3494* (A, GH, US), *3564* (GH), *3955* (GH, NY, US), *4377* (US) (all four numbers COTYPES of *A. curvidens* Dunn), *4377A* (GH), *5797* (A, GH, US), *6494* (GH), *E. H. Wilson 348* (A, NY, US), *512* (A, GH, US), *2096* (GH), *2204* (NY); Fang Hsien, *E. H. Wilson 2012* (A, GH, US); Pa-tung Hsien, *H. C. Chow 240* (A, NY), *836* (A, NY); Chien-shih Hsien, *H. C. Chow 1633* (A, NY); Küan-yin-t'ang, *W. Y. Chun 5232* (A); "Suao-ya-tsze," *W. Y. Chun 3627* (A). Szechuan: Without precise locality, *A. Henry 7243* (GH); Wa-shan, *E. H. Wilson 2016* (A, US); Cheng-k'ou Hsien, *R. P. Farges s. n.* (NY); Nan-ch'uan, *Bock & Rosthorn 1824* (A), *W. P. Fang 827* (A), *1079* (A), *1105* (A), *1113* (A), *1350* (A); Kuan Hsien, *F. T. Wang 20812a* (A); O-mei-shan, *E. H. Wilson 4762* (A), *W. P. Fang 2475* (A), *7667* (A), *Chiao & Fan 376* (A); Ma-pien Hsien, *F. T. Wang 23087* (A); O-pien Hsien, *T. T. Yü 738* (A), *846* (A), *Y. S. Liu 2083* (A). Kweichow: Kwei-ting, *H. Handel-Mazzetti*

10635 (A); Fan-ching-shan, *Steward, Chiao & Cheo 587* (A, NY); Tung-tzu, *Y. Tsiang 5168* (NY); Tu-yun, *Y. Tsiang 5669* (NY), *5748* (NY), *6075* (NY).

Actinidia curvidens Dunn was reduced by Dunn himself to this variety, which was recognized by him as a form of *A. callosa*. This taxon closely resembles the typical variety of the species, but it may be distinguished by the presence of hairs in the nerve-axils on the lower surface of the leaves.

29c. **Actinidia callosa** var. **formosana** Finet & Gagnep. in Bull. Soc. Bot. France **52:** Mém. **4:** 20. 1905 (Contr. Fl. As. Or.); Dunn in Jour. Linn. Soc. Bot. **39:** 406. 1911; Hayata, Icon. Pl. Formos, **4:** 2. 1914.

Actinidia formosana Hayata, Icon. Pl. Formos. **8:** 12. 1919; Kanehira, Formos. Trees rev. ed. 449, *f. 407*. 1936.

Leaves chartaceous, oblong-lanceolate to ovate, about 6–14 cm. long and 2.5–6 cm. broad, shortly acuminate at apex, glabrous on both surfaces except for tufts of white tomentum in the axils of the secondary veins on the lower surface; pedicels rusty-tomentose; sepals rusty-tomentose on both surfaces.

China, in Taiwan only, from the central to the northern part of the island, in forests at altitudes of 1160–2000 meters. Flowers, April–May.

CHINA: Taiwan: Tamsui, *Morse 1388* (A); Taipei, *E. H. Wilson 10195* (A), *10257* (A), *10258* (A), *T. Tanaka & Y. Shimada 11010* (NY, US), *S. Sasaki s. n.* (A), *S. Suzuki s. n.* (A); Chiao-pan-shan, *Y. Shimada s. n.* (A); Mt. Arisan, *E. H. Wilson 10862* (A), *10897* (A); Rengachi, *T. Hayashi 21221* (A).

This Taiwan plant is very close to the mainland forms. It resembles the variety *henryi* of western China, in having tufts of hairs in the vein-axils on the lower leaf-surface. The leaves are usually strongly bicolored, like those of plants of the typical form of the species from the neighboring provinces of Fukien and Kwangtung.

29d. **Actinidia callosa** var. **indochinensis** (Merrill) comb. nov.

Actinidia indochinensis Merrill in Jour. Arnold Arb. **19:** 53. 1938.

Young branchlets and inflorescences rusty-granular-tomentose; leaves subchartaceous when young, becoming coriaceous when mature, ovate, 6–10 cm. long, 2.5–6 cm. broad, dark and glabrous above, paler and rusty-granular-tomentose along the costa and veins beneath, the margins subentire to inconspicuously and remotely crenate-serrulate toward the apex.

Southwestern China, in Yunnan, and Indo-China, in Tonkin, in forests at altitudes of 1400–1900 meters. Flowers white, April.

CHINA: Yunnan: Without precise locality, *J. C. Liu & C. Wang 85443* (A).

INDO-CHINA: Tonkin, Chapa, *A. Pételot s. n.* (A), *4406* (US), *5938* (A, TYPE), *5940* (A); Tonkin, Lao-kay, *E. Poilane 17004* (A), *21688* (A).

This variety is distinguished by the granular indumentum on the young branchlets, inflorescences, and along the costa and veins of the lower leaf-surface.

29e. **Actinidia callosa** var. **pubescens** Dunn in Jour. Linn. Soc. Bot. **39:** 406. 1911; Van Steenis, Fl. Males. I. **4:** 39. 1948.

Saurauia tomentosa Korth. ex Koord. & Val. Bidjr. **3:** 280. 1896, *nomen.*
Actinidia pubescens Ridley in Jour. Fed. Mal. Stat. Mus. **8**(4): 18. 1917.

Leaves chartaceous, ovate, about 6.5–12 cm. long and 4–8 cm. broad, acute at apex, rounded to truncate at base, thinly tomentose all over the lower surface; pedicels and calyces rusty-tomentose.

Southwestern China (Yunnan) and Assam to Malaysia (Malay Peninsula, Sumatra, Java?), in forests at altitudes of 2000–2500 meters.

CHINA: Yunnan: Mekong-Salwin divide, "Alulaka," *T. T. Yü 19107* (A); Salwin valley, "Sekai," *T. T. Yü 23001* (A); near "Bahan," *H. Handel-Mazzetti 9042* (A); Meng-tzu, *A. Henry 10780* (A, NY, US); without precise locality, *G. Forrest 18017* (A).

This variety is distinct in its broader leaves, which are conspicuously and evenly white-tomentose throughout the lower leaf-surface. I have not seen specimens from India and Malaysia. This variety may prove to merit specific recognition.

Forrest 13910, identified by W. W. Smith as *A. championii* var. *mollis* Dunn, actually belongs here. Handel-Mazzetti (Symb. Sin. **7:** 390, 391. 1931) refers this plant, as well as his own *9042* and *9046*, to *A. pilosula* (Finet & Gagnep.) Stapf, a new combination based on *A. callosa* Lindl. var. *pilosula* Finet & Gagnep., with "*A. championii* var. *mollis* W. W. Smith in Not. R. Bot. Gard. Edinbgh., XVII., 305 (1930), non Dunn," given in the synonymy. *Handel-Mazzetti's 9042* is available, and this is clearly the same plant as Smith's and should also be referred here. *Actinidia pilosula* Stapf, based on *A. callosa* Lindl. var. *pilosula* Finet & Gagnep. should be typified by the latter, and it is here considered as a species distinct from *A. callosa*.

30. **Actinidia latifolia** (Gardn. & Champ.) Merr. in Jour. Roy. As. Soc. Strait. Br. **86:** 330. 1922.

Climbing shrubs to 7 m. high; branches reddish brown, with pale oblong to lanceolate lenticels, rusty-tomentose on young branchlets; pith solid, whitish, firm, becoming hollow in the center when old. Leaves chartaceous, broadly ovate or obovate or suborbicular to oblong-ovate or oblong-obovate, about 5.5–11 cm. long and 3–9 cm. broad, acute to acuminate at apex, cuneate, rounded, or truncate to reniform-cordate at base, the margins subentire with remote minute callose teeth, the upper surface green, glabrate, puberulous or densely puberulous, the lower surface pale, covered sparsely or densely by a pale appressed stellate-tomentum, the costa and veins inconspicuous to subconspicuous above, distinct and elevated beneath, the secondary veins about 6 or 7 per side, slightly arcuate-ascending, anastomosing, the veinlets with many distinct cross-bars below, the reticulations hidden by the indumentum or not; petioles 2–4 cm. long, tomentose. Inflorescences in axillary or lateral, many-flowered, 3 or 4-branched cymes, to 10 cm. long, densely rusty-stellate-tomentose; peduncles 1.5–8 cm. long, forked at top; pedicels 0.5–1.5 cm. long, elongating and enlarging in fruit; bracts minute, linear. Flowers brownish yellow; sepals 5, ovate, about 4–5 mm. long and 3–4 mm. broad, acute to obtuse, tomentose without; petals 5, about 6–8 cm. long and 3–4 mm. wide, obtuse to rounded, pubescent without; stamens numerous, the filaments slender, 2–3 or sometimes to 5 mm. long, the anthers linear-oblong, about 1–2 mm. long, the connective projected and pointed at top, the base not divergent; ovary globose, about 2 mm. long, densely pilose, the styles 2–3 mm. long, slender. Fruit subglobose to ovoid, about 3–4 cm. long and 2–3 cm. across, brown, lenticellate, glabrous when mature or pubescent at the base and top only.

A distinct species readily recognized by the more or less characteristic leaves and inflorescences. The leaves are generally broadly ovate, with dense stellate tomentum beneath. The leaf-bases vary considerably in shape. The inflorescence is much more elaborate than any other species of the genus; it is large, generally long-peduncled, much-branched, and bearing many flowers. There is some variation in the size of the inflorescence. In spite of its wide range and variations in leaf-shape and size of inflorescence, *A. latifolia* is a relatively uniform species. In addition to the typical form, two varieties, apparently both of local and rare occurrence, may be recognized.

Key to the Varieties

A. Tomentum dense, closed on the lower leaf-surface, the reticulations of veinlets obscure.
  B. Upper surface of leaves very sparsely puberulous or glabrate; lower surface densely stellate-tomentose. .... a. var. *latifolia*.
  BB. Upper surface of leaves densely puberulous; lower surface more thickly stellate-tomentose. .... b. var. *mollis*.
AA. Tomentum thin, open on the lower leaf-surface, the reticulations of veinlets distinct. . ... c. var. *indochinensis*.

30a. **Actinidia latifolia** var. **latifolia**.

Actinidia latifolia (Gardn. & Champ.) Merr. in Jour. Roy. As. Soc. Strait. Br. **86:** 330. 1922; Nakai in Bot. Mag. Tokyo **41:** 521. 1927; Sasaki in Trans. Nat. Hist. Soc. Formosa **19:** 480. 1929; Hand.-Mazz. Symb. Sin. **7:** 391. 1931; Kanehira, Formosan Trees rev. ed. 450. 1936; Van Steenis, Fl. Males. I. **4:** 39, *f. 1*. 1948.

Heptaca ? latifolia Gardn & Champ. in Hook. Jour. Bot. Kew Gard. Misc. **1:** 243. 1849.

Kadsura pubescens Miq. Fl. Ind. Bat. Suppl. 620. 1862; Kurz in Jour. As. Soc. Beng. **45**(2): 119. 1876.

Actinidia championi Benth. Fl. Hongk. 26. 1861; Matsum. & Hayata in Jour. Coll. Sci. Univ. Tokyo **22:** 47. 1906 (Enum. Pl. Formos.); Finet & Gagnep. in Lécomte, Fl Gén. Indo-Chine **1:** 28. 1907; Hayata in Jour. Coll. Sci. Univ. Tokyo **30**(1): 44. 1911 (Mat. Fl. Formos.), Icon. Pl.

Formos. **1:** 88. 1911; Dunn in Jour. Linn. Soc. Bot. **39:** 407. 1911; Ridl. Fl. Mal. Pen. **1:** 206. 1922.

Actinidia miquelii King in Jour. As. Soc. Beng. **59**(2): 196. 1896, *nomen,* in Ann. Roy. Bot. Gard. Calcutta **5:** 145, *t. 176.* 1896.

Actinidia gnaphalocarpa Hayata, Icon. Pl. Formos. **9:** 97. 1920.

Leaves broadly ovate to obovate or sub-orbicular, about 5.5–11 cm. long and 3–9 cm. wide, acuminate at apex, cuneate or rounded to reniform-cordate at base, the upper surface glabrate or puberulous, the lower surface covered by a pale appressed stellate tomentum obliterating the veinlet-reticulations.

Southeastern and southern China (Taiwan, Kwangtung, Kwangsi, Hunan, Fukien, Chekiang), Indo-China, Siam, and Malaysia (Perak, Jehore, Sumatra), in thickets at altitudes of 350–1500 meters. Flowers brownish yellow, April.

MALAY PENINSULA: Perak, *No. coll. 5232* (A); Penang, *Singapore Bot. Gard. 32620* (A); Kedah, *Singapore Bot. Gard. 35014* (A).

INDO-CHINA: Without precise locality, *M. Poilane 8060* (A). Tonkin: Laokay, *A. Pételot 8649* (A); Chapa, *A. Pételot 8747* (A); Laos: Bassae, *M. Poilane 15877* (A). Annam: Dong-cho, Auang-tri, *M. Poilane 10713* (A).

CHINA: Taiwan: Bankinsing, *A. Henry 825* (A); Horisha, Nanto, *E. H. Wilson 11173* (A, US); Rengachi, *T. Hayashi 21244* (A). Chekiang: Ch'ung-an Hsien, *Y. L. Keng 654* (A). Fukien: Ku-shan, *J. B. Norton 1365* (US), *1366* (US), *H. H. Chung 7202* (A, NY); Ku-t'ien Hsien, *H. H. Chung 4019* (A). Kiangsi: P'ing-hsiang Hsien, *Wang-Te-Hui 205* (A); Huang-shu-lin, between Ning-tu and Ch'ang-t'ling, *Wang-Te-Hui 370* (A); Yung-hsin Hsien, *H. H. Hu 803* (A); Ting-nan Hsien, *H. H. Hu 1077* (A); "Hong San," *G. L. Gressitt 1453* (A); Lung-nan Hsien, *S. K. Lau 444* (A, US); Ch'ien-nan Hsien, *S. K. Lau 3987* (A, US). Kweichow: Sanhao, *Y. Tsiang 6403* (NY). Kwangsi: N. Lo-chen, *R. C. Ching 5709* (NY), *6003* (NY); W. Pai-se, *R. C. Ching 7378* (NY); S. Nan-ning, Shih-wan-ta-shan, *R. C. Ching 8178* (NY), *8438* (NY); Shang-ssu Hsien, Shih-wan-tai-shan, *W. T. Tsang 22225* (A), *24543* (NY); Ch'üan Hsien, *W. T. Tsang 27694* (US); Kuei-lin, *W. T. Tsang 28284* (US). Hongkong: *C. Wright s. n.* (GH, US, ISOTYPES), *Ford, s. n.* (A, NY, US), *Hongkong Herb. 8017* (A); *Herb. Kew 53* (GH, ISOTYPE of *A. championi* Benth.). Kwangtung: "Lung-tau Shan," *Canton Christ. Coll. 12120* (US); Ta-pu Hsien, *W. T. Tsang 21074* (A, NY), *21715* (A, NY); Ying-te Hsien, *T. M. Tsui 565* (NY, US); Lo-ch'ang Hsien, *W. T. Tsang 20843* (NY), *C. L. Tso 20965* (NY). Hainan: Hainan, *C. Wang 33505* (NY); Ling-men, *J. L. Gressitt 1164* (A); Lien-hua-lin, *F. A McClure 8061* (A); Wu-chih-shan (Five Finger Mt.) *F. A. McClure 9487* (NY); Pao-ting Hsien, *F. C. How 71995* (A), *72701* (A); Yai Hsien (Yaichow), *H. Y. Liang 62264* (A, NY, US), *62597* (NY); Hung-mao-shan, *Tsang & Fung 291* (A); "Dung-ka," *N. K. Chun & C. L. Tso 43328* (A, NY), *43496* (A, NY, US); Ling-shui Hsien, *H. Fung 20096* (A, NY, US); Lin-kao Hsien, *W. T. Tsang 239* (A, US), *470* (A, NY, US), *723* (A, US); Ch'eng-mai Hsien, *C. I. Lei 619* (NY, US), *907* (NY, US).

The reduction of *A. miquelii* King was first made by Dunn, who listed *Heptaca ? latifolia* Gardn. & Champ. in the synonymy of *A. championi*

Benth. This earlier name was subsequently adopted by Merrill. A photograph of the type specimen, *Champion s. n.*, from Hongkong, is in the herbarium of the Arnold Arboretum. The reduction of *A. gnaphalocarpa* Hayata was made by Sasaki and followed by Kanehira and others. A photograph of Hayata's type (in A, US) and collections of Taiwan plants indicate that this reduction is necessary.

30b. **Actinidia latifolia** var. **mollis** (Dunn) Hand.-Mazz. Symb. Sin. **7:** 391. 1931.

Actinidia championi Benth. var. *mollis* Dunn in Jour. Linn. Soc. Bot. **39:** 407. 1911.

Leaves ovate to oblong-ovate or oblong-obovate, about 10–12 cm. long and 5.5–7 cm. wide, acute to acuminate at apex, broadly acute to rounded or truncate at base, the upper surface more or less densely puberulous, the lower surface very densely and thickly stellate-tomentose, the tomentum obliterating the veinlet-reticulations.

Southwestern China (in southern Yunnan only), in mountain forests at altitudes of 1400–1500 meters. Flowers yellow, June.

CHINA: Yunnan: No precise locality, *J. C. Liu & C. Wang 83077* (A); Ssu-mao Hsien, *A. Henry 12041* (A, NY, ISOTYPES); P'ing-pien Hsien, *H. T. Tsai 55411* (A), 60153 (A), *60193* (A), *60310* (A), *61405* (A), *62271* (A).

30c. **Actinidia latifolia** var. **indochinensis** (Li) comb. nov.

Actinidia indochinensis Li in Jour. Arnold Arb. **24:** 366. 1943.

Leaves ovate to elliptic-ovate, 7–21.5 cm. long, 4.5–6.8 cm. wide, acute to shortly acuminate at apex, acute to broadly acutish at base, the upper surface glabrous, the lower surface scattered stellate-tomentose, the veinlet-reticulations distinct.

Indo-China, in Tonkin only. Flowers May–June.

INDO-CHINA: Tonkin: Dam-ha, *W. T. Tsang 29907* (A, TYPE).

31. **Actinidia eriantha** Benth. in Jour. Linn. Soc. Bot. **5:** 55. 1861; Dunn in Jour. Linn. Soc. Bot. **39:** 408. 1911; Chun in Sunyatsenia **1:** 271, *pl. 37*. 1934; Rehder in Jour. Arnold Arb. **18:** 222. 1937.

Actinidia davidii Franch. in Nouv. Arch. Mus. Paris sér. 2. **5:** 57. 1884; Dunn in loc. cit. **39:** 408. 1911; Hand.-Mazz. Symb. Sin. **7:** 391. 1931; Chun in op. cit. **2:** 63. 1934.

Actinidia lanata Hemsl in Ann. Bot. **9:** 146. 1895; Dunn in op. cit. **38:** 355. 1908, **39:** 409. 1911; Dunn & Tutcher in Kew Bull. Add. Ser. **10:** 44. 1912; Rehder in Jour. Arnold Arb. **15:** 97. 1934.

Climbing shrubs to 10 m.; branches grayish to dark grayish, glabrate or tomentose, with conspicuous oblong concolored lenticels, the young branches densely white-villose; pith white, medium-sized, lamellate. Leaves chartaceous, broadly ovate to ovate or oblong-ovate, about 8–16 cm. long and 5.5–11 cm. broad, obtuse to acute or shortly acuminate at apex, rounded, truncate to subcordate at base, the margins subentire and with minute scattered callose teeth or minutely mucronulate-serrulate, green and hispid-puberulous above to nearly glabrous, usually pilose along the costa, pale and densely white-stellate-tomentose beneath, the costa and veins subconspicous to inconspicuous above, raised and distinct beneath, the secondary veins about 7 or 8 per side, arcuate-ascending, anastomosing, the reticulations with many cross-bars, raised and distinct beneath; petioles short, stout, 1.5–2.5 cm. long, densely and thickly white-villose. Inflorescences in short axillary cymes of 1–4 flowers, densely and thickly white-villose; peduncles scarcely to 1.5 cm. long; pedicels very short, 3–5 mm. long. Flowers lanrge, rose pink; sepals broadly ovate, about 7 mm. long and 5 mm. broad, obtuse, densely villose without; petals 5, ovate, about 1.5 cm. long and 1.1 cm. broad, rounded, the margins often slightly fringed; stamens very numerous, the filaments slender, subequal, 5–7 mm. long, the anthers yellow, oblong, about 1 mm. long, pointed at tip, rounded at base; ovary globose, densely villose, the styles 3–4 mm. long. Fruit ovoid, about 3.5 cm. long and 3 cm. across, densely and thickly pale villose.

Southeastern China (Chekiang, Kiangsi, southern Hunan, Kweichow, Fukien, Kwangsi, Kwangtung), in thickets, at altitudes of 250–1000 meters. Flowers white or pinkish, June.

CHINA: Chekiang: Yung-chia Hsien (Wenchow), *R. C. Ching 1872* (A, US), *Y. Tsiang 1401* (A); Lung-ch'üan Hsien, *R. C. Ching 2479* (A, US), *H. H. Hu 463* (A). Hunan: Ch'ang-ning Hsien, *C. S. Fan & Y. Y. Li 212* (A). Kweichow: Kuei-ting, *Y. Tsiang 5483* (NY). Fukien: "Shiu-kia," *Hongkong Herb. 2397* (A); Nan-p'ing (Yenping), *H. H. Chung 3283* (A), *3365* (A), *Chou Kuang Hou 8979* (A); Ku-shan, *J. B. Norton 136* (US), *H. H. Chung 6641* (A). Kwangsi: N. Lo-chen, *R. C. Ching 6132* (A, US); Kwei-lin Hsien, *W. T. Tsang 28428* (US). Kwangtung: Lien-p'ing Hsien, *R. Mell 604* (A); Lo-ch'ang Hsien, *C. L. Tso 20538* (A, NY), *20927* (NY); Chia-ying Hsien (Mei), *W. T. Tsang 21384* (A, NY); Yuan Hsien, *S. K. Lau 2272* (A); "Lung-tau Mt.", *Canton Christ Coll. 12297* (NY, US).

Dunn recognized *A. eriantha* Benth., *A. davidii* Franch., and *A. lanata* Hemsl. as three distinct species. He apparently did not see Bentham's or Franchet's types. He misinterpreted *A. davidii* as a species without stellate tomentum, and accordingly this species was misplaced in his key. Bentham's species is based on "*Lindley*, from S. China" and Franchet's on a collection made by David, from "Kiang-si oriental. Automme 1873." A photograph of *Lindley 1836* is reproduced in Sunyatsenia **1:** 273, *t. 37.* 1934, by Chun, who considers *A. eriantha* Benth, and *A. lanata* Hemsl. as distinct species. He says that *A. eriantha* "is easily distinguished from *A. lanata* Hemsl. by the densely whitish woolly indumentum on the under surface of the leaves, inflorescences, and fruit, and by the filiform, not linear, filaments of the stamens." He considers *A. lanata* as having a fulvous or tawny indumentum.

Rehder, however, in Jour. Arnold Arb. **18:** 222. 1937, states that none of the distinguishing characters given by Chun and others seem to be dependable and considers the two names to be actually synonymous. I am tentatively following Rehder's opinion. Hemsley's type is from

"*China*: Kwangtung along the Northwest river, Mr. Ford's native collector; 228 of 1890 collection." This is a young fruiting specimens, which I have not seen. Hemsley describes the indumentum as "ferrugineo-lanatis vel tomentosis," and compares it with *A. fulvicoma* Hance. It is possible that his species is referable to the latter, conceivably to var. *hirsuta*.

From the original description, it seems certain that *A. davidii* Franch. also belongs to *A. eriantha* Benth., as noted earlier by Handel-Mazzetti (Symb. Sin. **7:** 391. 1931) and others.

32. **Actinidia chinensis** Planchon in London Jour. Bot. **6:** 303. 1847.

Climbing shrubs to 8 m.; branches reddish brown, with paler oblong lenticels, the young branchlets brownish-pubescent or setose; pith large, lamellate, whitish or yellowish. Leaves thin- or thick-chartaceous, those of the sterile branches broadly ovate to elliptic, very shortly acuminate to cuspidate at apex, those of flowering branches suborbicular, shortly cuspidate, rounded or truncate at apex, rounded to more or less cordate at base, 6–17 cm. long, 6–15 cm. broad, the margins minutely denticulate, the teeth produced by tips of veinlets, the upper surface dark green, more or less puberulous, more densely so on the costa and nerves, or densely scabrid-hispid throughout, the lower surface very pale, densely whitish-stellate-tomentose, the costa and veins subconspicuous above, raised and distinct beneath, the secondary nerves about 5–8 per side, strongly patent, straight or arcuate-ascending, anastomosing, the branchlets ending in the marginal teeth, the veinlets in parallel cross-bars, more or less conspicous; petioles 3.5–7.5 cm. long, more or less densely pubescent. Inflorescences in few-flowered cymes, from axils of fallen leaves, pubescent; peduncles about 1.5 cm. long; pedicels 1–2 cm. long; bracts minute, linear. Flowers orange-yellow, the staminate slightly smaller; sepals 5, sometimes 3 or 4, ovate-oblong, about 8–10 mm. long and 6–8 mm. wide, obtuse to acute at apex, brownish-tomentose without; petals 5, broadly obovate, shortly clawed, rounded at top, about 1.4–1.5 cm. long, 1–1.2 cm. broad; stamens very numerous, the filaments filiform, unequal, about 5–10 mm. long, the anthers oblong, 1.5 mm. long, acute to obtuse at apex, slightly sagittate at base; ovary subglobose, about 6–7 mm. across, densely brownish-villose, the styles linear, about 5–6 mm. long. Fruit subglobose to ellipsoid, about 3 cm. across, densely brownish-hirsute all over; seeds oblong-ellipsoid, 2–3 mm. long, foveolate-reticulate.

This is the common *Yang-tao* of China, widespread in most parts of the country but especially common along the Yangtze valley. The leaves vary from emarginate to truncate to those on young shoots sometimes shortly acutish or cuspidate. The plants from the island of Taiwan have the leaves relatively longer and much narrower, always acute to shortly acuminate, and also relatively thinner when compared with mainland plants. The upper surfaces of the leaves are more or less densely long hispid-setose. This insular form, only sterile material being available, is herein recognized as a variety.

KEY TO THE VARIETIES

A. Leaves thicker, generally orbicular, truncate to emarginate at apex, hispid mostly along the veins only; stems and petioles soft-pubescent when young, glabrous when mature. (Mainland China). . . . . a. var. *chinensis*.

AA. Leaves thinner, generally ovate, acute to shortly acuminate at apex, scabrid-hispid above; stems and petioles densely hispid-setose. (Taiwan). . . . . b. var. *setosa*.

32a. **Actinidia chinensis** var. **chinensis.**

Actinidia chinensis Planchon in London Jour. Bot. **6:** 303. 1837; Oliv. in Hook. Icon. Pl. **15:** *t. 1593*. 1887; Dunn in Jour. Linn. Soc. Bot. **39:** 408. 1911; Sprague in Bot. Mag. **140:** *t. 8538*. 1914; Rehder in Sarg. Pl. Wils. **2:** 385. 1915; Merr. & Chun in Sunyatsenia **1:** 70. 1930; Hand.-Mazz. Symb. Sin. **7:** 391. 1931.

Young branchlets and petioles setose, brownish-pubescent; leaves chartaceous, mostly suborbicular, about 6–12 cm. long and broad, emarginate to shortly cuspidate at apex, rounded to more or less cordate at base, the upper surface more or less puberulous, more densely so on the costa and nerves, the lower surface densely whitish-stellate-tomentose.

Widely distributed in western, central, eastern, and southern China, in thickets and forests, on slopes or in ravines, at altitudes of 200–2300 meters. Flowers whitish, changing to buff yellow.

CHINA: Shensi: Tai-pei-shan, *W. Purdom 657* (A, US). Honan: Yung-ning, *J. Hers 422* (A), *464* (A); Chi-kung-shan, *A. N. Steward 9772* (A, US). Kiangsu: I-hsing Hsien, *Ching & Tso 523* (A). Anhwei: Chiu-hua-shan, *R. C. Ching 2639* (A, US), *2678* (A); Huang-shan, *R. C. Ching 2910* (A), *W. C. Cheng 3977* (US). Hupeh: Western Hupeh, *A. Henry 1166* (US), *2076* (GH), *5834* (GH, US), *5834A* (GH, NY), *5834B* (US), *E. H. Wilson 185* (A, NY, US), *720* (NY); I-ch'ang, *E. H. Wilson 347 p. p.* (A); Ch'ang-yang Hsien, *E. H. Wilson 993* (A, NY, US); "Lan-tan," *P. C. Sylvestri 1467* (A); "Zan-lan-scan," *P. C. Sylvestri 6157* (A); Wu-tu-ho, *W. Y. Chun 3638* (A), *3980* (A, US); Pa-tung Hsien, *H. C. Chow 289* (A, NY), *750* (A, NY). Szechuan: S. Wu-shan, *A. Henry s. n.* (A); Wen-ch'üan Hsien, *E. H. Wilson 347 p. p.* (A, GH); Mo-tien-ling, *F. T. Wang 22445* (A); Nan-ch'üan Hsien, *C. Bock & K. A. v. Rosthorn 1997* (A), *W. P. Fang 1084* (A), *1096* (A); O-mei-shan, *W. P. Fang 2613* (A), *C. L. Sun 2042* (A), *2094* (A), *2136* (A), *T. C. Lee 2746* (A), *2990* (A), *H. C. Chow 7800* (A), *Sun & Chang 784* (A); Ma-pien Hsien, *F. T. Wang 22859* (A); O-pien Hsien, *Y. S. Liu 1355* (A). Sikang: K'ang-ting, *W. C. Cheng 1728* (NY, US), *1729* (A); Ning-yüan Hsien, *C. Schneider 993* (A), Tien-ch'üan Hsien, *T. C. Tai 5135* (A). Chekiang: Mo-kan-shan, *Cheo & Wilson 12709* (GH, NY), *F. N. Meyer 1568* (A); Ch'ang-hua Hsien, *F. N. Meyer 1537* (A); T'ien-mu Shan, *R. C. Ching 5090* (A); S. Yin Hsien (Ningpo), *D. Macregor s. n.* (A); T'ien-t'ai Shan, *R. C. Ching 1438* (A, US); Lung-ch'üan Hsien, *H. H. Hu 480* (A); Ch'ing-yüan, *Y. L. Keng 360* (A). Kiangsi: Lu-shan, *T. L. Bullock 120D* (US), *A. N. Steward 2646* (A, US), *H. H. Chung & C. S. Sun 664* (A, NY); I-huang, *Y. Tsiang 10085* (NY); Ch'ien-shan Hsien, *C. S. Fan & Y. Y. Li 92* (A). Hunan: Hsing-hua Hsien, *H. Handel-Mazzetti 548* (A); Heng-shan, *H. Handel-Mazzetti 729* (A). Kweichow: Fan-ching-shan, *Steward, Chiao & Cheo 430* (A, NY, US); T'ung-tzu Hsien, *Y. Tsiang 5178* (NY); Tu-yün Hsien, *Y. Tsiang 5730* (NY); Ta-ting Hsien, *Y. Tsiang 8949* (NY). Yunnan: Yung-shan Hsien, *H. T. Tsai 51180* (A). Kwangtung: Lo-ch'ang Hsien, *C. L. Tso 20704* (NY).

32b. **Actinidia chinensis** var. **setosa** var. nov.

Actinidia chinensis sensu Nemoto, Fl. Jap. Suppl. 474. 1936; Suzuki in Masamune, Short Fl. Formos. 137. 1936; Kanehira, Formosan Trees. rev. ed. 449, *t. 406*. 1936; non Planch.

A typo speciei caulibus petiolisque dense ferrugineis hispido-setosis differt; foliis tenuibus, late ovatis, 12–17 cm. longis, 10–15 cm. latis, apice acutis vel breviter acuminatis, superne plus minusve dense scabride hispidulis, inferne stellato-tomentosis.

China, in Taiwan only, at altitudes of 1300–2600 meters.

CHINA: Taiwan: Mt Arisan, *E. H. Wilson 10802* (US, TYPE; A, ISOTYPE), Oct. 18, 1918, *R. Kanehira 2994* (NY).

33. **Actinidia fulvicoma** Hance in Jour. Bot. **23:** 321. 1885.

Climbing shrubs to 10 m.; branches reddish brown to grayish, with inconspicuous lenticels, the young branchlets densely brownish-tomentose, the older branches glabrous or nearly so; pith whitish, lamellate. Leaves membranaceous or chartaceous to coriaceous, ovate to oblong to oblong-ovate, about 7–15 cm. long, 3–9 cm. broad, acuminate to long-acuminate at apex, rounded to cordate at base, the margins setose-denticulate, the upper surface green, densely to sparsely hirsute to scabrid-hirsute especially along the costa, the lower surface very pale densely yellowish stellate-tomentose, the costa and veins subconspicuous above, raised and distinct beneath, the secondary veins about 8 per side, patent-ascending, anastomosing, the veinlets reticulate, with numerous cross-bars, obliterated by the indumentum beneath; petioles 1.5–4 cm. long, brownish-tomentose. Inflorescences in short few-flowered axillary cymes or the flowers solitary, densely brownish villose-pubescent; peduncles to 1 cm. long; pedicels 1 cm. or less long; bracts minute, linear. Flowers white; sepals 5, ovate, about 6–7 mm. long and 3–4 mm. broad, acute at apex, densely villose without; petals 5, obovate, 7–10 mm. long, 5–7 mm. wide; stamens numerous, the filaments about 3–4 mm. long, the anthers yellow, triangular-ovoid, about 1 mm. long, the apex acute, the base sagittate; ovary subglobose, about 3 mm. across, densely villose, the styles about 3 mm. long. Fruit oblong, to 2.7 cm. long and 2 cm. across, brown, with pale scattered lenticels, glabrous or sparsely pubescent when mature, the persistent calyx erect, not reflexed.

Actinidia fulvicoma Hance is a close relative of *A. eriantha* Benth. and has the same general range in southeastern China. It can, however, be readily distinguished from the latter by its relatively narrower and longer leaves which are pubescent above, its more hirsute stems and petioles, its yellowish or brownish indumentum, and its nearly glabrous mature fruit. In *A. eriantha* the young stems and petioles are softly and shortly downy, the indumentum is whitish, and the mature fruit is densely hairy.

The species is composed of three varieties which have more or less distinct but contiguous ranges. The typical variety is found in Chekiang, southern Kiangsi, southwestern Hunan, eastern Kweichow, and northern Kwangtung. Variety *pachyphylla* is found only in Kwangtung, and var. *hirsuta* in Kweichow.

KEY TO THE VARIETIES

A. Leaves chartaceous to thinly coriaceous; stems soft-brownish-hairy....... a. var. *fulvicoma.*

AA. Leaves coriaceous; stems with short brownish hirsute hairs............ b. var. *pachyphylla.*

AAA. Leaves more or less membranaceous; stems densely long brownish hirsute.......... c. var. *hirsuta.*

33a. **Actinidia fulvicoma** var. **fulvicoma.**

Actinidia fulvicoma Hance in Jour. Bot. **23:** 321. 1885; Dunn in Jour. Linn. Soc. Bot. **39:** 409. 1911; Hand.-Mazz. Symb. Sin. **7:** 391. 1931.

Young branchlets and petioles soft-brownish-tomentose; leaves chartaceous to thinly coriaceous, ovate to oblong-ovate, about 7–14 cm. long and 3.5–7 cm. broad, long-acuminate at apex, rounded to cordate at base, the margins setose-denticulate, the upper surface hirsute to scabrid-hirsute especially along the costa, the lower surface yellowish stellate-tomentose.

Southeastern to southern China (Chekiang, southern Kiangsi, southern Hunan, Kwangsi, Kwangtung), on slopes or in valleys, in shade or open, at altitudes of 500–800 meters. Flowers white, June.

CHINA: Chekiang: Without precise locality, *Barchet 65* (US). Kiangsi: Ch'ung-i Hsien, *H. H. Hu 931* (A); Ta-yü Hsien, *H. H. Hu 952* (A); Ch'ien-nan Hsien, *S. K. Lau 4050* (US). Hunan: Sing-ning Hsien, *C. S. Fan & Y. Y. Li 680* (A); Heng-shan, *H. Handel-Mazzetti 12182* (A). Kweichow: San-ho Hsien, *Y. Tsiang 6380* (NY). Kwangsi: Hsing-yeh Hsien, *R. C. Ching 6880* (NY), *7177* (NY); Lo-chen, Hsien, *R. C. Ching 5583* (NY), *5678* (NY), *6152* (NY). Kwangtung: Lo-ch'ang Hsien, *C. L. Tso 20841* (N.Y.)

33b. **Actinidia fulvicoma** var. **pachyphylla** (Dunn) comb. nov.

Actinidia pachyphylla Dunn in Jour. Linn. Soc. Bot. **39:** 409. 1911.

Young branchlets and petioles brownish short-hirsute; leaves chartaceous to coriaceous, oblong to oblong-ovate, about 10–15 cm. long and 3–7 cm. broad, acuminate at apex, rounded to cordate at base, the margins setose-denticulate, the upper surface hirsute to scabrid-hirsute especially along the costa, the lower surface stellate-tomentose.

Southern China, in Kwangtung, in thickets at altitudes of 500–1000 meters. Flowers white, May–June.

CHINA: Kwangtung: Lo-ch'ang Hsien, *C. L. Tso 20713* (NY), *W. T. Tsang 20987* (NY); Lien-p'ing, *R. Mell 603* (A); Yang-shan Hsien, *T. M. Tsui 748* (NY); Pei-shan to Tai-ping, *W. Y. Chun 5662* (A); Lung-men Hsien, *W. T. Tsang 20519* (NY, US).

The type of *A. pachphylla* Dunn, "Swatow, Fung Wan Shan of Phoenix Mountain, *Hong Kong Herb.*", has not been seen. Dunn's species can be distinguished from *A. fulvicoma* only in the thicker leaves. The above cited specimens seem to be referable to this concept, which I recognized as a variety of *A. fulvicoma*. The leaves are generally larger and narrower, varying from chartaceous to thickly coriaceous, sometimes even in a single collection. The thickness of the leaves may be influenced to a certain degree by variations in habitat.

33c. **Actinidia fulvicoma** var. **hirsuta** Finet & Gagnep. in Bull. Soc. Bot. France **52:** Mem. **4:** 18. **1907** (Contr. Fl. As. Or.); Hand.-Mazz. Symb. Sin. **7:** 391. 1931.

Young stems and petioles densely brownish long-hirsute; leaves membranaceous to thinly chartaceous, ovate to oblong-ovate, about 7–14 cm. long and 4–9 cm. broad, long-acuminate at apex, rounded to cordate at base, the margins setose-denticulate, the upper surface densely setose, the lower surface densely stellate-tomentose.

Southwestern China, in Kweichow and western Kwangsi, at altitudes of 500–1000 meters. Flower white, June–July.

CHINA: Kweichow: *R. P. Bodinier 2427* (NY, ISOTYPE); Kuei-ting, *Y. Tsiang 5586* (NY). *H. Handel-Mazzetti 10571* (A); Tu-yun Hsien, *Y. Tsiang 5727* (NY). Kwangsi: Ling-yün Hsien, *A. N. Steward & C. C. Cheo 656* (A, NY).

Dunn, who examined *Bodinier 2427*, the type, did not recognize this variety, as he considered the specimen "apparently from secondary flowering branch and does not differ from corresponding parts of Hance's type." Handel-Mazzetti, however, reinstated the variety. From the above cited specimens, it seems that in Kweichow and western Kwangsi the species has thinner and more setose leaves, as well as more densely hirsute stems and petioles, indicating the existence of a geographical variety.

34. **Actinidia lanceolata** Dunn in Jour. Linn. Soc. Bot. **38:** 356. 1908, **39:** 408. 1911.

Climbing shrubs to 20 m.; branches reddish brown, glabrous, the young branchlets densely ferrugineous-puberulous; pith small, brown, lamellate. Leaves chartaceous, lanceolate to ovate-lanceolate, about 4–7 cm. long and 2–3 cm. broad, acuminate at apex, cuneate at base, the margins minutely setose-denticulate, the upper surface dark, sparsely and minutely puberulous to nearly glabrous, the lower surface glaucescent, appressed with white stellate-tomentum, the costa and veins scarcely conspicuous above, raised and distinct and covered with brownish pubescence beneath, the secondary veins about 4 or 5 per side, patent-ascending, anastomosing, the veins or their branches ending in the marginal teeth, the veinlets in parallel cross-bars, inconspicuous; petioles 1–1.5 cm. long, brownish pubescent. Inflorescence in axillary cymes, 3–6-flowered, ferrugineous-puberulous; peduncles 3–6 mm. long; pedicels 2–4 mm. long; bracts linear, minute. Flowers greenish; sepals 5, ovate, about 3–4 mm. long and 1.5 mm. broad, rounded at apex, ferrugineous-puberulous without; petals 5, oblong, about 4–5 mm. long and 1.5–2 mm. broad, slightly larger than the sepals, acute or rounded at apex; stamens numerous, the filaments 2–3 mm. long, the anthers yellow, oblong, small, about 1 mm. long, rounded at both ends; ovary subglobose, about 1.5 mm. long, densely ferrugineous-tomentose, the styles about 1.5 mm. long. Fruit very small, ovoid, about 10 mm. long and 7 mm. across, brown, glabrous, with pale roundish lenticels, the persistent sepals reflexed.

Southeastern China (southern Chekiang, southern Kiangsi, Fukien, and northern Kwangtung), on mountain slopes or along river banks, at altitudes of 200–600 meters. Flowers greenish, May–June.

CHINA: Chekiang: Hsien-chü Hsien, *Y. L. Keng 467* (A), *R. C. Ching 1595* (A, NY, US), *1714* (A, NY, US); P'ing-yang, *R. C. Ching 2074* (A, NY, US); Chiang-shan, *R. C. Ching 2582* (A, NY, US). Kiangsi: Yung-hsiu, *Y. Tsiang 10635* (NY). Fukien: Nan-p'ing (Yenping), *Hongkong Herb. 2399* (A, ISOTYPE). Kwangtung: Ta-pu Hsien, *W. T. Tsang 21222* (A).

This species was described by Dunn from Fukien, based on a single collection, *Hongkong Herb. 2399,* collected on his expedition to central and western Fukien in 1905. A duplicate of this number is available. The known range of the species now extends to the neighboring provinces of Chekiang, Kiangsi, and Kwangtung.

This is a most distinct species, strongly characterized by its small leaves with appressed whitish stellate hairs on the lower surface, the small greenish flowers, and the very small fruits. It little suggests relationships with other species. The stellate-tomentum on the under surface of the leaves is so fine and appressed that Dunn failed to note and describe it in his original description. Later, in his revision of the genus, however, he properly keyed it with other stellate-tomentose species. It is very distinct in this group of species in the cuneate leaf-bases, as well as in the characters mentioned.

IMPERFECTLY KNOWN SPECIES

35. **Actinidia kiusiana** Koidzumi, Pl. Nov. Amami-Oshim. 9. 1928, in Bot. Mag. Tokyo **43:** (421–422). **1929,** in Acta Phytotax. Geob. **9:** 98, in clavi. **1940.**

A species of the Liukiu Islands and Kiusiu, Japan, of which no specimens are available to me. As the original description, which is very short, was published in an obscure work, it is reproduced below:

"Actinidia (Vestitae) kiusiana Koidz, nov. sp.

This plant seems to be near to *Actinidia strigosa* Hook. of Himalaya, but readily distinguished by the leaves cordate at the base and hispid even in the upper surface.

Arbor ascendens ramis molliter puberulis strigoso-hispidis. Folia membranacea oblongo-ovata 8, 5–13 cm. longa, 4–6 cm. lata, acuta, basi cordata, mucronato-serrata, utraque latere 7–9-penninervia, laxe hispida in utraque pagina, petiolis 2–6 cm longis hispidis.

Nom. Jap. Nagaba-shirakuchizulu.

Hab. The Loochoo archipelago: insula Tanegashima.

Ranges. Kiusiu: prov. Hiuga, Minaminakagun, Ichiimura; Prov. Buzen, Usagun, mount. Gongenzen.

Type specimens: in Herb. Bot. Inst. Kyoto Imp. Univ. Japan."

As the description is based on vegetative parts only, it is not possible to ascertain the real identity of the species. I have not seen any specimens of this genus from the Liukius and Japan that have strigose stems. The nearest species of this group is *A. arisanensis* Hayata of Taiwan, which is a very variable plant. From the brief original description, *A. kiusiana* indeed appears close to *A. arisanensis* and the two may prove to be conspecific.

36. **Actinidia longicauda** F. Chun in Sunyatsenia **7: 14. 1948.**

The type, *C. S. Chen 81944*, collected from "Kwangsi; Chuen Hsien, Shan-Chuan Hsiang, Ku-Kien An," has not been seen by me. The species known only from the original collection. The flowers are reddish, and they bloom in June.

Chun compares this species with *A. kolomikta* and *A. venosa*, saying that it "Differs from *A. kolomikta* Maxim. in white not brownish pith, long acuminate and elliptic to elliptic-obovate, not broadly ovate-cordate abruptly caudate leaves and in smaller red flowers. The color of the flowers and the shape of the leaves also serve to distinguish it from *A. venosa* Rehd. which has, in addition a tomentose inflorescence and an ovoid subglobose ovary."

Since the fruit is not known, I cannot place it in the proper section from the description. The ovary, which is described as cylindric, the styles not being mentioned, may be the rudimentary ovary of the staminate flowers. The actual shape of the ovary, which is an important diagnostic character among the relatives of *A. kolomikta*, remains to be seen. See also *A. kwangsiensis* for further comments.

HYBRID

× **Actinidia fairchildii** Rehder in Jour. Arnold Arb. **20:** 421. 1939.

Actinidia arguta × *chinensis* Fairchild in Jour. Hered. **18:** 58, *f*. 7. 1927.

This is the only reported hybrid in the genus. It is a deliberate cross between a staminate plant of *A. arguta* and a pistillate plant of *A. chinensis,* the resulting hybrid showing characters intermediate between the two parent species. The hybrid was raised in Washington, D. C.

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STUDIES IN THE BORAGINACEAE, XXII NOTEWORTHY SPECIES, CHIEFLY ASIAN AND SOUTH AMERICAN

IVAN M. JOHNSTON

Cordia varronifolia, sp. nov.

Frutex 2 m. alta; ramulis plus minusve villulosis in sicco nigrescentibus; foliis elliptico-oblongis vel ovato-oblongis 4–9 cm. longis 2–4 cm. latis, apice obtusiusculis, basi obtusis rotundisve 2–5 mm. longe petiolatis, margine basim versus excepta saepe crenato-dentatis, supra abundanter minuteque areolato-bullatis setis mollibus brevibus basi bulbosis obsitis, subtus elevate reticulato-venosis griseo-villulosis; cymis paucifloris terminalibus vel rare extra-axillaribus initio glomeratis, posterius in cincinnos solitarios vel rare geminatos 1–2 cm. longos excurrentibus; calyce sub anthesi 15–20 mm. longo griseo-villoso 10-costato, tubo 10–12 mm. longo infra medium crassiore (4–8 mm. diametro) apice 3–4 mm. diametro basi rotundato, lobis subulatis flexuosis 5–9 mm. longis in alabastro liberis, sinibus obtusis latis; calyce fructifero ad 28 mm. longo, tubo 17 mm. longo 8–9 mm. crasso; corolla alba marcescenti persistente infundibuliformi 3–3.5 cm. longa, limbo 2.5–3.5 cm. diametro, lobis adscendentibus semi-circularibus 9–11 mm. latis 5–7 mm. longis apice emarginatis, sinibus angustis valde acutis, tubo 2–3 mm. crasso cylindrico ca. 10 mm. longo tubum calycis subaequilongo intus secus bases lineatas decurrentes filamentorum villuloso alibi glabro, fauce ampliata apice ad 12 mm. diametro; filamentis 10–12 mm. longis ca. 10 mm. supra basin tubi corollae orientibus; antheris oblongis ca. 2 mm. longis; ovario glabro 2.5 mm. longo infra medium 1 mm. crasso deinde sursum gradatim attenuato, 4-ovulato 4-loculato imam ad basin nectario annulato inconspicuo circumdato; stylo gracillimo villuloso 15–25 mm. longo 12–20 mm. supra basin furcato, lobis 4 stigmatiferis angustissime oblanceolatis 2–3 mm. longis; fructu exsicco ovoideo calyce persistenti et tubo corollae persistentis investo supra basin 4–5 mm. crasso deinde sursum angustato (conico, apice rostulato) basi rotundato.

PERU: Pión valley of the Maranon, dept. Cajamarca, prov. Cutervo, 1300–1400 m. alt., shrub 3 m. tall, fl. white, June 1915, *A. Weberbauer 7138* (TYPE, Gray Herb.).

This shrub of northern Peru has the areolate-bullate, frequently dentate leaves suggestive of members of *Cordia* § *Varronia*. Its elongate persisting ribbed calyx and the large persisting marcescent funnelform corollas suggest those of members of the section *Gerascanthus*. Actually, however, this Peruvian plant has close relations only with *C. parvifolia* DC. (*C. Greggii* Torr.) and *C. elaeagnoides* DC. of Mexico and so constitutes a third member of the section *Rhabdocalyx*. In size, form and organization of the corolla, calyx and fruit it is most similar to *C. parvifolia,* a species of the deserts of western and northern Mexico. Like that species, furthermore, its flowers appear to be heterostylic. Its fruits have all the distinctive characteristics of the section *Rhabdocalyx*. Indeed, the fruit is almost indistinguishable from that of *C. parvifolia* and *C. elaeagnoides,* being conic-ovoid, dry, and nut-like, having similar proportions and dimensions and developing completely ensheathed by the persistent calyx. The endocarp is thin and herbaceous in texture. It is not fleshy nor colored. The fruit is not a drupe. Its bony endocarp has walls about a millimeter thick and is 4-celled and apparently 4-seeded at maturity. This is a fruit very different from that developed by most Cordias and especially by members of the sections *Gerascanthus* and *Varronia,* cf. Johnston, Jour. Arnold Arb. **30:** 85 (1949) and **31:** 179 (1950).

Cordia iguaguana, sp. nov.

Arbor 8–20 m. alta; ramulis juventate tenuiter inconspicueque fulvo-tomentulosis, maturitate glabratis; foliis maturitate late lanceolatis 10–15 cm. longis 4–5 cm. latis glabris vel secus costa et petiolo pilulis minutis adpressis sparsissime donatis, apice acutis vel paullo attenuatis, basi obtusis vel rotundis 12–22 mm. longe petiolatis, supra nervis et nervulis abundantibus laeviter impressis ornatis, subtus pallidioribus nerviis (utrinque costae 5–7) et costa prominulis donatis; inflorescentia apice ramulorum hornotinorum foliis juvenilibus gestorum prodita multiflora paniculata vel corymbosa 12–15 mm. diametro; calyce clavato-cylindraceo ca. 11 mm. longo (apicem versus ad 3 mm. crasso) prominenter 10-costato, extus inconspicue puberulento saepe pilulis sparsis ad 0.2 mm. longis adpressis sparse donatis, costis saepe evidenter longitudinaliterque sulcatis, lobis 3–5 saepe inaequalibus obtusis triangularibus ca. 1 mm. longis, sinibus obtusis; corolla alba 23 mm. longa extus glaberrima, limbo ca. 25 mm. diametro, lobis 6–8 mm. longis 8–10 mm. latis supra basin latioribus rotundis vel apice plus minusve truncatis non rariter emarginatis, sinibus angustis acutis, tubo 8–8.5 mm. longo 1–1.5 mm. crasso intus infra medium tomentuloso, faucibus 12–15 mm. diametro ca. 5 mm. profundis, filamentis glabris ore tubi (8–9 supra basin tubi) affixis inaequalibus 1–3 mm. longis, antheris 1.5–3 mm. longis inaequalibus; pistillo (ovario cum stylo) glabro 13–14 mm. longo basi angusta nectario destituto ca. 10 mm. supra basin furcato parte ovuliferi fusiforma 1–1.5 mm. supra basin 0.8–1.2 mm. crasso deinde sursum in stylum gradatim transmutato; fructu ignoto.

PERU: Jaen, dept. Cajamarca, prov. Jean, 700–800 m. alt., tree 8–20 m. tall, fl. white, "Iguaguana," April 1912, *A. Weberbauer 6213* (TYPE, Gray Herb.).

A very well marked species of northwestern Peru, apparently restricted to the seasonally dry interandean valleys of the upper Marañon drainage, cf. Weberbauer, Bot. Jahrb. **50:** 92–3 (1914). The tree is locally known as "iguaguana." It is a member of the section *Gerascanthus*. Only three other species of this section are known from western South America. The best known is the widely distributed and variable *C. alliodora* (R. & P.) Oken, which is readily distinguished by its indument of stellate hairs and by the swellings on twigs and in the inflorescence which serve as ant-domatia. The other members of the section in the area have simple hairs only and are not myrmecophilous. All three are local in distribution and very distinct and easily distinguished. *Cordia Goeldiana* Huber, formerly known only from the state of Para, Brazil, has been recently found in northern Colombia (Pivijay, dept. Magdalena, **1948**, *R. Romero Castañeda 1106*). It has elongate oblong corolla-lobes which have parallel lateral margins. *Cordia macrantha* Chodat is a rare tree of western Ecuador, cf. Little, Caribbean Forester **9: 269** (**1948**). Like *C. iguaguana* it has broad rounded corolla-lobes. It differs from the Peruvian species in its larger elliptic leaves scantily though evidently villose-hispidulous on the lower surface. Its flowers are also much larger. The corolla is 35–43 mm. long, the limb is 35–40 mm. in diameter, and the sinus between the lobes are truncate rather than acute. The corolla is glabrous except for a tuft of hairs at the base of each filament. The ovary, unlike that of *C. iguaguana*, is short and broad. It is surrounded at the base by a well-developed collar-like nectary, and has the style arising abruptly from its broad summit. The evidence available indicates that *C. macrantha* and *C. iguaguana* are both heterostylic. The type of the latter is probably the long-style form of the species.

Cordia viridis (Rusby), comb. nov.

Bourreria viridis Rusby, Descr. 300 So. Amer. Pl. 100 (1920).

VENEZUELA: Lower Orinoco, 1896, *Rusby & Squires 259* (AA, ISOTYPE); Guayapo, Bajo Caura, Bolivar, 100 m. alt., 1939, *L. Williams 11745* (G); El Toro, La Paragua, Bolivar, 70 m. alt., 1940, *Williams 12699* (G).

A species of the lower Orinoco Valley which has been confused with *C. sericicalyx* DC. It is readily distinguished once its characters are recognized. The fruit is much larger and is elongate and arises erect, not obliquely from the calyx. Its leaves, though having a similar sparse minute strigosity, differ from those of *C. sericicalyx* in their more acuminate apex and more numerous (about 10) pairs of primary veins.

Cordia Bridgesii (Friesen), comb. nov.

Varronia Bridgesi Friesen, Bull. Soc. Bot. Genève ser. 2, **24:** 172, f. 9 (1933).

BOLIVIA: Rio Caine, Cochabamba, 1180 m. alt., sandy soil, shrub 3–5 dm. tall, fl. white, Jan. 1949, *M. Cardenas 4239* (G).

The above cited collection agrees with the original description and illustration in all significant details. The only exception is the shorter apical appendages on the calyx-lobes. The original description calls for free appendages 2 mm. long. The collection made by Cardenas has free appendicular tips 0.2–0.5 mm. long. The species is a very well marked one and was based on a specimen unprovided with precise locality data, collected by Thomas Bridges in Bolivia in 1844 or 45, probably during his journeys north and east of Cochabamba. It was accordingly obtained in the general area where Cardenas also found it.

Cordia lutea Lam. Ill. **1:** 421 (1791); Svenson, Am. Jour. Bot. **33:** 421 and 478 (1946).

Cordia marchionica Drake, Ill. Fl. Ins. Pacific 240 (1892) and Fl. Polynése Fr. 129 (1893); F. B. H. Brown, [Fl. Southeast. Polynesia **3:**] Bull. Bishop Mus. **130:** 243 (1935), — based on material from "Iles Marquises (*Mercier!*, *Jardin 54!*)."

MARQUESAS ISLANDS: Uahuka, 1921–22, *E. H. Quale 1737* (A); Hatutu, shrub on windward cliff, Sept. 27, 1922, *Quale 1556* (A).

It has been a surprise to discover that *Cordia marchionica* of the Marquesas is the same as the well-known and very distinct *C. lutea* of the Galapagos Islands and the adjacent drier portions of western Ecuador and northwestern Peru. Brown in his detailed account of the flora of southeastern Polynesia reports the plant from most of the islands in the Marquesas group and states that it is common there in dry exposed situations below 1000 m. alt., in places forming thickets or even becoming one of the dominant woody plants.

With the recognition of the Marquesas plant as identical with *C. lutea* of western South America the question arises as to the origin of the species in the archipelago. As a Polynesian plant with clear American relationships it can be used by those seeking evidence of direct floristic affinities between Polynesia and America, cf. A. M. Adamson, Bull. Bishop Mus. **139:** 31 (1936). It is conceivable that birds may have played a role in the spread of the species within the Marquesas, but considering the large size of its drupe, any suggestion of direct bird-transportation from America would be fantastic. That the species reached the Marquesas from America in ocean-drift seems equally unlikely. This *Cordia* is not a strand plant. It is a shrub or small tree of arid situations inland where the rainfall is not only scant but also limited to a very few months each year. The seeds of such plants must germinate promptly when moisture becomes available if the seedling is to become established during the short rainy season. Their seeds and any sheathing part of the fruit are necessarily permeable by water and accordingly unadapted for immersion in sea-water and so for successful ocean dispersal. Furthermore, a recent analysis of ocean-dispersed strand plants (Johnston, Sargentia **8:** 55, 1949) indicates that with very few exceptions such plants have been unsuccessful in colonization across the expanse of the eastern Pacific. It is unbelievable that this *Cordia* could succeed where so many better adapted plants have failed. Any theory that Polynesians may have contributed to its presence in the archipelago is untenable. The plant is said to be used only in making leis, scarcely an important economic use and hardly one to make it important to the native inhabitants. An aboriginal introduction of the plant from America might be expected only by way of Easter Island, that lonely outlier of Polynesia in the eastern Pacific. Although the environment of Easter Island would seem even more suitable for the *Cordia* than the Marquesas, the plant is absent there. I believe that it is significant that this *Cordia* was not found in the Marquesas by the early visitors to the islands. With its great abundance of large yellow flowers it is a plant not easily overlooked. I am willing to believe that the species was introduced into the Marquesas by the French during the 19th Century, probably as an ornamental plant.

Eritrichium laxum, sp. nov.

Perenne humile dense caespitosis griseum pilis 0.2–0.8 mm. longis saepe adpressis haud abundantibus vestitum; caulibus hornotinis floriferis debilibus gracillimis erectis vel plus minusve decumbentibus 1–6 (in statu fructifero rare ad 12) cm. longis; foliis hornotinis inferioribus 1.5–4 cm. longis spathulato-oblanceolatis 3–5 mm. latis sub apicem rotundum obtusumve latioribus deinde deorsum in petiolum gracilem anguste alatum gradatim attenuatis, subtus costatis sed enervatis; foliis superioribus paucis ad 1 cm. longis; foliis annotinis desiccatis plus minusve persistentibus saepe (praesertim petiolis) spiraliter tortuosis; inflorescentia laxiflora subracemiformi bracteis foliaceis paucis pedicellos haud suffulcientibus praedita; pedicellis sub anthesi 1–5 mm. longis vel eis medium versus vel infra medium caulis orientibus 5–15 mm. longis; pedicellis fructiferis 5–20 mm. longis gracillimis adscendentibus vel laxe recurvatis; lobis calycis anguste oblongis vel oblanceo-oblongis sparse strigosis ecostatis apice rotundis sub anthesi 1–1.5 mm. longis 0.4–0.5 mm. latis, maturitate ad 2 mm. longis et 0.5–0.6 mm. latis; corolla alba vel dilute caerulea medium versus flava 5–6 mm. diametro; lobis patentibus rotundis ca. 2.2 mm. longis et 2 mm. latis, tubo 1.3–1.7 mm. longo a basi 0.3–0.5 mm. crasso sursum ampliato apice 1.5–1.7 mm. diametro intus 0.2–0.3 mm. supra basin nectario lineato inconspicuo glabro donato, appendiculis faucium flavis vix prominentibus; filamentis 0.15 mm. longis ca. 0.7 mm. supra basin tubi corollae affixis, antheris 0.3 mm. longis; ovario 4-lobato glabro; stylo sub anthesi 0.4–0.5 mm. longo tempore fructifero persistenti 0.5–0.7 mm. longo; nuculis a gynobase hemispherica divergentibus dorsi-ventraliter compressis evidenter marginatis, sine margine 1.2–1.7 mm. longis 0.8–1 mm. latis, dorse obovatis plus minusve hispidulis, margine aculeos 0.3–0.6 mm. longos saepe adscendentes triangulares longe attenuatos apice glochidiatos composito saepissime circumdatis, facie ventrali glabris vel praesertim ultra medium muriculatis aliquantulum ultra medium cicatrice parva donatis ultra cicatricem usque ad apicem nuculi carina 0.3–0.4 mm. longa donatis alibi convexis.

TIBET: Tse La, Langong, lat. 28° 45′, long. 94° 00′, 14500 ft. alt., little tufts in dry cliff crevices, corolla creamy white, eye golden, very fragrant, *F. Ludlow, G. Sherriff & G. Taylor 5619* (TYPE, Gray Herb.); hills north of

Lhasa, 15000 ft., clumps under large boulders, fl. pale blue with yellow eye, *Ludlow & Sherriff 8806* (G); hills north of Lhasa, 14000 ft., under cliffs and rocks, fl. white to pale blue, *Ludlow & Sherriff 9704* (G); Nyenchengtang La, 4 days N. W. of Lhasa, 14000 ft., on grassy cliff-ledges and under rocks, fl. pale blue, *Ludlow & Sherriff 9648* (G).

CHINA: Chungtien Plateau, N. W. Yunnan, plant 1 in. high, on open stony slope, *K. M. Feng 1598* (G); Riutzila, one day from Atuntze, mountains of Moying, northeast of Yangtze-Mekong watershed, N. W. Yunnan, flower yellow, *J. F. Rock 10332* (G); Kon-ka-ling, Sikang, *T. T. Yu 13005* (G); Kansu, high rocks, 12–13,000 ft., Aug. 1914, *R. Farrer 634* (G).

A very well marked species of southeastern Tibet and adjoining western China where it appears to be the only representative of the genus. From a weak taproot and abundant fibrous roots the plant develops crowded short branched stems abundantly clothed with persisting remnants of old leaves. These hug the soil and form a very dense low cushiony growth which may become at least a decimeter in diameter. From it arise the functional basal leaves and the weak sparingly leafy fertile branches. The herbage is green or grayish green and not silvery silky as with most other species of the genus. The fruit is especially distinctive. The nutlets are dorsi-ventrally compressed and proportionately not so thick as those of other congeners. Furthermore, they have an attachment scar that is slightly, but still very clearly supramedial, rather than medial or inframedial. As a result they have a shorter ventral keel and the under face is low convex rather than boat-shaped or frustum-like. The only fully ripe nutlets studied are those of the type-collection and these were detached and found adherent to the foliage. Most of them have triangular marginal appendages of the type described, but a few have only a thickened marginal rim bearing a few reduced strongly inflexed (not spreading) appendages. This latter type of nutlet possibly may be produced from cleistogamic flowers at the base of the stems, as in *Actinocarya* (cf. Johnston, Jour. Arnold Arb. **21: 52. 1940**) or be the odd nutlet in a heteromomrphic fruit. The precise condition can be determined only when specimens in prime fruiting state become available for study.

Eritrichium elongatum Wight var. **Paysoni,** var. nov.

A forma genuina differt radice gracillima apice caules rosulasque foliorum perpaucas emittenti, innovationibus ut videtur biennis et post tempus fructiferum deciduis; caulibus fertilibus e rosulis foliorum annotinis erumpentibus 2–12 cm. altis rigidis erectis cymas terminales et laterales proferentibus; corolla 2–2.5 mm. diametro; nuculis margine evidenter dentato donatis.

UTAH: La Motte Peak, Uinta Mts., Summit Co., alpine meadows, 11500 ft., July 19, 1916, *E. B & L. B. Payson 5039* (G); Henry Forks Basin, Uinta Mts., Summit Co., stony slopes and ridges of open forks in upper tree zone above Henry Forks Lake, plants 2–10 (–12) cm. tall, 10850 ft. alt., Aug. 4, 1936, *Bassett Maguire, Dean Hobson, & Ruth Maguire 14385* (TYPE, Gray Herb.); Upper Henry Forks Basin, in stony soil north of Lake Blanchard, common above timber-line, 11200 ft. alt., plant 3–10 (–12) cm. tall, Aug. 4, 1936, *Maguire, Hobson & Maguire 14346* (G); Krebs Basin, Uinta Mts., Duchesne Co., 11400 ft. alt., southeast slopes, alpine tundra near first of the upper lakes, July 19, 1933, *F J. Hermann 5038* (G); Uinta Mts., 12000 ft., Aug. 1869, *S. Watson 849* (G)

Over twenty-five years ago I received a collection of the present plant from the late Edwin Payson, who wrote me at the time that having observed it in the field he believed it to be very different from the *Eritrichium elongatum* with which he was familiar in the mountains of Wyoming and Colorado. Despite Payson's belief that an undescribed species was involved, his plant was put away as one of the many minor forms of *E. elongatum*. Subsequently other obviously similar plants have been received. These all came from the Uinta Mts. of northeastern Utah, where no other representative of the genus is known. They all have relatively stout erect branched fertile stems and all appear to be relatively short-lived plants that never develop the woody caudex or achieve the dense pulvinate growth-form of usual *E. elongatum*. I suspect that the plants may live only a few years, probably only two or three. In any case the stems, along with the leaves of the rosette that clothe their base, all die back to the ground after the fruit is matured. There is accordingly no great accumulation of old leaves as in *E. elongatum*. The leafy mass at the base of the plant becomes only 1–5 cm. broad. The nutlets always have a dentate margin and are accordingly unlike the unarmed nutlets of the most common and widely distributed forms of *E. elongatum*. They are, however, very similar, in fact indistinguishable from those of the uncommon form of *E. elongatum*, the var. *argenteum*. The plant of the Uinta Mountains may possibly merit specific rank, but pending further observations by those who can study it in the field it seems best to treat it as a very well marked geographic variety. The name of Edwin Payson is properly associated with it.

Trigonotis ciliolata, sp. nov.

Herba repens; caulibus elongatis 1–1.5 mm. crassis hispidulis pilis divaricatis 0.5–1.2 mm. longis donatis; foliis alternis ovatis 15–22 mm. longis 8–16 mm. latis utrinque pilis 0.5–1 mm. longis rigidulis (in facie superiore laminae adscendentibus, in facie inferiore adscendentibus et erectis) e basi pustulata orientibus obsitis, apice obtusis apiculatis, basi obtusis asymmetricis in petiolum 1–2 mm. latum 2–5 mm. longum abrupte contractis; floribus caulinis solitariis extra-axillaribus saepe circa insertione petioli orientibus tempore anthesi 2–3 mm. longe pedicellatis, maturitate 10–15 mm. longe pedicellatis; sepalis lanceolatis sub anthesi 4 mm. longis supra basin 1–1.5 mm. latis, maturitate ad 4.5 mm. longis et 1.5–2 mm. latis, sparse hispidulis, apice acutis vel paullo attenuatis; corolla alba, lobis orbicularibus 3–4 mm. diametro; tubo 2.2 mm. longis a basi ca. 1.5 mm. crassa sursum ampliato apice ad 2.8 mm. diametro, appendiculis faucium trapeziformibus prominulis puberulentis, filamentis 0.4 mm. longis medio tubi corollae orientibus, antheris 0.7–0.8 mm. longis oblongis infra medium affixis; stylo maturitate ad 1.3 mm. longo apices nuculorum vix superanti; nuculus 4 tetrahedraeis nigris laevibus subnitidis angulatis, angulo adaxillari ca. 1 mm. longo, faciebus 3 inferioribus subaequalibus planis; facie superiore nuculae convexa triangulari ca. 2 mm. longa et lata, marginibus ciliolatis (pilulis 0.1 mm. longis) eis lateralibus valde acutis, margine abaxillari anguste alato (ala adscendente curvata 0.2–0.3 mm. lata).

DUTCH NEW GUINEA: Angi, creeping on sandy bank along Iray River, Lake Giji, Arfak Mts., 1900 m. alt., fl. white, April 8, 1940, *R. Kanehira & S. Hatusima 13883* (TYPE, Arn. Arb.).

Though very different in fruit, the present plant simulates *T. abata* very closely in gross habit and vegetative characters and is probably most closely related to it. It comes from western Dutch New Guinea about 600 km. northwesterly from the high mountain valleys, near Lake Habbema, where *T. abata* Johnston (1940) has been collected. The completely glabrous nutlets of *T. abata* are bifacial, having a large convex back, a broadly angled adaxial face, and a superbasal attachment. The very angulate nutlets of *T. ciliolata* are tetrahedral and bear their attachment at the peak of the equally three-sided pyramid. Their fourth surface, the uppermost and outer one, is also triangular but differs in being convex. Its abaxial edge bears an up-curving knife-like wing. Its lateral edges are merely sharply acute. All three of its edges are ciliolate, a unique development in the genus. Unlike most of the repent Malaysian species of *Trigonotis, T. ciliolata* has distinctly tetrahedral nutlets generally similar in type to those prevailing in the genus in other regions. Its discovery lends additional support to the belief that the Malaysian species, formerly segregated as *Zoelleria* and *Havilandia,* are, indeed, merely aberrant members of the present genus, cf. Johnston, Jour. Arnold Arb. **21:** 58 (1940).

Trigonotis cupulifera, sp. nov.

Herba 1–2 dm. alta sparse strigosa (pilis rectis 0.1–0.5 mm. longis antrorsis); caulibus gracilibus erectis subsimplicibus 1–1.5 mm. crassis; foliis firmiusculis ovatis vel ellipticis sparse strigosis 1–2.5 cm. longis 8–12 mm. latis, basi saepe rotundis obtusisve in petiolum abrupte contractis, apice rare acutis plerumque rotundis obtusisve et saepe minute apiculatis; petiolo folii inferiori 1–2 cm. longo folii superiori 2–10 mm. longo; cymis solitariis caulem terminatis et axillis foliorum supremis orientibus gracillimis ebracteatis maturitate ad 8 cm. longis laxifloris; sepalis sparse strigosis sub anthesi 1–1.3 mm. longis 0.6–0.7 mm. latis acutis ovato-lanceolatis, maturitate ovatis patentibus 2–2.5 mm. longis ad 1.3 mm. latis, 0–3 mm. longe pedicellatis; corolla caerulea, limbo ca. 4 mm. diametro, lobis rotundis ca. 1 mm. latis, tubo cylindrico 1 mm. longo 1.3 mm. crasso; staminibus medio tubi affixis; nuculis valde angulatis laevibus glabris tetrahedraeis nitidis 0.8–1 mm. longis, basi haud pedicellatis, facie superiori evidenter marginatis, margine opaco erecto crassiusculo 0.3–0.6 mm. alto cupulum formanti.

KIANGSI: Lin-chuan, 105 m. alt., by river, fl. white, June 20, 1932, *Y. Tsiang 9931* (TYPE, Gray Herb.).

HUNAN: Changsha, along Linyang-ho, 35 m. alt., in thickets, April 25, 1918, *Handel-Mazzetti 11687* (G).

The collection from Changsha, cited above, is the basis for recent reports of *T. brevipes* Maxim. from China, cf. Hand.-Mazz. Symb. Sin. **7** [2]: 820 (1936) and Johnston, Jour. Arnold Arb. **18:** 6 (1937). It consists of plants in flowering state which simulate the Japanese plants closely in vegetative characters and general aspect. The resemblance, however, proves to be deceptive. Now that fruit of the Chinese plant is available for study it is obvious that any resemblances between the Chinese and Japanese plants is superficial and inconsequential. The two differ so widely in nutlets that direct relation between them is unbelievable.

The nutlet of *T. cupulifera* has a smooth, lustrous, acutely angled, distinctly tetrahedral body which is 0.8–1 mm. in length along the inner angle. The total nutlet, however, is actually longer, for its upper face is bordered by an upturned erect thickish marginal flange 0.3–0.6 mm. high. The outer faces of this flange are in the same plane as the flat sides of the nutlet body directly beneath and may appear at first sight to be a continuation of them. Nutlet body and flange, however, are readily distinguished by close examination, since the former has a lustrous and the latter an opaque surface. The shallowly cup-shaped superstructure on the nutlet body is a distinctive feature of our present species.

Trigonotis floribunda, sp. nov.

Planta herbacea fortasse rhizomate gracillimo oriens; ramis gracilibus laxe decumbentibus 1–5 dm. longis 1–2.5 mm. crassis saepe laxe longeque ramosis sparse antrorseque strigosis (pilis 0.2–0.8 mm. longis); foliis numerosis caulinis ellipticis vel elliptico-ovatis vel ovato-lanceolatis 2–6 (saepe 3–4) cm. longis 8–27 (saepe 10–20) mm. latis superioribus quam inferioribus saepe duplo vel triplo minoribus, saepe apiculatis costatis sed obscurissime nervatis, apice acutis vel obtusis rotundisve, basi obtusis vel rotundis in petiolum 3–18 mm. longum alatum ca. 1 mm. latum abrupte contractis, facie superiore pilis sparsis 0.3–1.2 mm. longis adpressis vel adscendentibus non rare basi bulbosa vel disciforma orientibus obsitïs, facie inferiore antrorse strigosis; cymis numerosis ebracteatis simplicibus vel furcatis 0–5 cm. longe pedunculatis terminalibus et axillis foliorum superiorum orientibus maturitate 5–15 cm. longis dissitifloris; calyce sub anthesi 1.5 mm. longo 0–1 mm. longe pedicellato, lobis oblongis vel elliptico-obovatis 1–1.2 mm. longis, 0.2–0.4 mm. latis; calyce fructifero 2–3 mm. longo 2–3 mm. longe graciliterque pedicellato basi incrassato plus minusve pallido, tubo cupulato, lobis adscendentibus 1.5–2.5 mm. longis oblanceolatis 0.2–0.6 mm. latis basin versus angustatis apice obtusis; corolla caerulescente 2–2.5 mm. diametro, tubo 1 mm. longo cylindrico 1.2 mm. crasso, limbo ad 2 mm. diametro, lobis rotundis 0.7–0.9 mm. longis; staminibus paullo supra medium tubi corollae affixis; nuculis 4 angulatis tetrahedraeis laevibus glabris nullo modo pedicellatis, angulo adaxillari 1 mm. longis, angulo facies superiorem aliquantulum concavam circumdato acutissimo prominulis, apice nuculis inconspicue producto et sursum curvato.

WESTERN SZECHUAN: Mt. Omei, Fu-hu-sse, roadside, 3 dm. tall, fl. blue, May 14, 1942, *W. P. Fang 18747* (G); Mt. Omei, Tru-dien, May 28, 1941, *Fang 16747* (G); Mt. Omei, Hong-train-ping, 35 cm. tall, May 21, 1940, *C. L. Sun 2124* (G); Mt. Omei, Hong-train-ping, fl. blue, July 8, 1940, *T. C. Lee 2704* (G); Mt. Omei, Hung-chun-ping, roadside, 950 m. alt., June 16, 1938, *H. C. Chow 7532* (G); Mt. Omei, Hung-chun-ping, roadside, May 22, 1944, *H. C. Chow 11851* (G); Mt. Omei, Kuan-hsin-an, ditch, fl. bluish, 1378 m., July 17, 1939, *S. C. Sun & K. Chang 877* (TYPE, Gray Herb.); Mt. Omei, 950 m. alt., about thicket, fl. bluish, July 1, 1931, *F. T. Wang 23129* (G); Mt. Omei, 850 m., hillside, plant 2.5 dm. tall, fl. blue, July 18, 1938, *T. C. Peng 17* (G); without locality, *Faber 598* (NY).

KWANGSI: Nan Kan, Ling Yü Hsien, valley shade, fl. bluish, Apr. 13, 1933, *Steward & Cheo 184* (G).

This plant, and also *T. laxa,* were incorrectly identified as *T. omeiensis* Matsuda (1919), in my synopsis of the *Trigonotis* of southern China, Jour. Arnold Arb. **18:** 6 (1937). Matsuda's species properly belongs in the synonymy of the very different *T. Cavaleriei* (Lev.) Hand.-Mazz. Our present plant is without a name. Its closest relative is *T. laxa.* Among its distinctive features are the up-curving corners of the upper face of the nutlet and the mineralized pallid epidermis developed on the thickened base of old fruiting calyces.

Trigonotis laxa, sp. nov.

Herba ut videtur perennis; caulibus 2–5 dm. longis 1–2.5 mm. crassis simplicibus vel sparse ramosis sparse strigosis; foliis caulinis costatis sed enervatis, lamina elliptica vel ovato-elliptica vel late lanceolata saepe 2–3 cm. longa et 6–15 mm. lata, apice obtusa vel rotunda et apiculata vel rare acuta, basi obtusa rotundave in petiolum 3–10 mm. longum alatum 1–2 mm. latum contracta, supra glabra vel apicem versus sparse strigosa, subtus sparse strigosa (pilis 0.2–0.5 mm. longis non rare basi incrassata disciformave orientibus); inflorescentia terminali et axillis supremis orientibus; cymis gracillimis ad 1 dm. longis furcatis 1–8 mm. longe pedunculatis ebracteatis; corolla subcaerulea vel subalba, limbo 5 mm. diametro, lobis rotundis 1.5 mm. latis, tubo 1–1.5 mm. longo a basi ca. 1 mm. crasso sursum gradatim ampliato apice ad 1.8 mm. diametro; staminibus medio tubi affixis; calyce subanthesi 1.5–2 mm. longo 0.3–1.5 mm. longe pedicellato sparse strigoso, lobis obovatis 1.7 mm. longis 0.3–0.4 mm. latis apice rotundis; calyce fructiferi 2 mm. longo ad 6 mm. longe pedicellato, lobis laxe adscendentibus 0.4–0.6 mm. latis obtusis; nuculis acute angulatis 4 tetrahedraeis haud pedicellatis glabris laevibus, angulo adaxiale ca. 1 mm. longo, facie superiori margine angustissime alato circumdata; stigmate nuculis breviter sed distincte superanti.

SZECHUAN: Nanchuan Hsien, roadside, 8000–9000 ft., fl. white, May 25, 1928, *W. P. Fang 915* (G); Nanchuan Hsien, roadside, 8000–9000, herb 1–1.5 ft. tall, fl. pale blue, May 31, 1928, *W. P. Fang 1159* (G); roadside, 5000–6000 ft., herb 1 ft. tall, fl. pale blue, June 1, 1928, *W. P. Fang 1348* (TYPE, Gray Herb.).

This plant of southeastern Szechuan is most closely related to *T. floribunda* of western Szechuan and western Kwangsi. It differs in having a larger corolla with an ampliate rather than cylindrical tube, a protruding style, broader and shorter calyx-lobes, and different nutlets. The mature calyx, unlike that of *T. floribunda*, does not have a noticeably thickened base covered with mineralized epidermis, nor does it develop a short but distinct cupulate tube. In the fruit the upper faces of the nutlets slope away from one another much less steeply than those of *T. laxa*. In *T. floribunda*, but not in *T. laxa*, the corners of the upper nutlet face are characteristically up-curving. The margin about the upper nutlet face in *T. laxa* tends to become very narrowly winged on the side opposite the nutlet apex. In *T. floribunda* the nutlet angles are acute and with a suggestion of a wing, but the latter is not so pronounced as in *T. laxa*. The relationship between the two species is very clear, but the two are certainly distinct.

Microula blepharolepis (Maxim.), comb. nov.

Omphalodes blepharolepis Maxim. Bull. Acad. St. Petersbourgh ser. 3, **27:** 504 (1881) and Mel. Biol. **11: 269** (1881); Brand, Pflanzenr. Heft **78; 105 (1921)**.

Microula diffusa (Maxim.), comb. nov.

Omphalodes diffusa Maxim. Bull. Acad. St. Petersbourgh ser. 3, **27:** 504 (1881) and Mel. Biol. **11: 270** (1881); Brand, Pflanzenr. **78:** 106 (1921).

I am indebted to Prof. W. Th. Kuprevicz, Director of the Komarov Botanical Institute, Leningrad, for the great privilege of examining the types of *Omphalodes blepharolepis* and *O. diffusa*. These species, based on material from western China, in the region south and southwest of Lake Kokonor, are very definitely members of *Microula*, a genus well developed in the area of Lake Kokonor south into Yunnan. In technical characters and general appearance they are obviously members of *Microula*. Both species are well marked and distinct from any heretofore seen by me.

Cryptantha Weberi, sp. nov.

Planta perennis caespitosa pallida e radice palari oriens caudice denso humili multicipitali proferens; caulibus numerosis erectis foliosis 10–18 cm. longis supra medium floriferis, plus minusve hispidis (pilis patentibus 1–2 mm. longis) et abundanter hispidulo-villulosis (pilulis 0.2–0.3 mm. longis saepe retrorso-adpressis); foliis pallidis numerosis abundanter hispidulo-villulosis (pilulis adpressis 0.1–0.3 mm. longis) et hispidis (pilis 1–2.5 mm. longis basi incrassato orientibus adpressis vel praesertim secus marginem laminae adscendentibus vel rare patentibus) anguste oblanceolatis apicem versus latioribus firmis inconspicue costatis margine vix revolutis apice rotundis obtusisve; foliis basalibus confertis tempore florendi vigentibus 3–8 cm. longis 3–7 mm. latis; foliis caulinis numerosis medionalibus eis basalibus similibus sed minoribus 2–3 cm. longis 2–4 mm. latis; foliis supra medium caulis cymis axillaribus breviter pedunculatis suffultis; inflorescentia cylindrica infra medium bracteis exsertis donata, juventate densa 1.5–2 cm. crassa 4–6 cm. longa, maturitate plus minusve interrupta 2–2.5 cm. crassa 8–10 cm. longa; cymis abundantibus sub anthesi glomeratis 5–8 mm. longis, fructiferis 10–15 mm. longis; calycibus ad anthesim 3–4 mm. longis ,fructiferis 5–6 mm. longis, 0–8 mm. longe pedicellatis, lobis basi 0.7–1 mm. latis sursum angustatis, inconspicue costatis sparse hispidis (pilis ca. 1 mm. longis) et dense hispidulo-villulosis apice rotundis; corolla alba, tubo cylindrico 3 mm. longo ad 2 mm. crasso, lobis suborbicularibus 2–2.5 mm. diametro, limbo 4–6 mm. diametro; staminibus supra medium tubo corollae (0.5–0.7 mm. infra faucem) affixis; stylo cum gynobasi 3.5–4 mm. longo; stylo 1.5–1.8 mm. longo; nuculis 2–2.3 mm. longis 1.3–1.8 mm. latis ovatis fere symmetricis compressis angustissime marginatis, ventre sublaevibus sulcatis (sulco aperto anguste cuneato ad 0.5 mm. infra apicem nuculae attingentibus), dorse tuberculis et rugis brevibus irregularibus plus minusve transversis sparse donatis.

COLORADO (Saguache County): along road to Stone Cellar Ranger Station and Saguache Park, near junction of main highway, 4 miles west of Cochetopa Pass, volcanic ash deposit, 9700 ft., with *Aster coloradensis*, *Senecio Hallii* and *Penstemon secundiflorus*, July 28, 1950, *William A. Weber 5778* (TYPE, Gray Herb.); dry knoll one mile north of Stone Cellar Ranger Station, 9000 ft., July 7, 1936, *Reed C. Rollins 1323* (G); Carnero Ranger Station, Cochetopa Forest, scattered on lower slopes, 10000 ft., June 20, 1922, *C. E. Taylor 573* (G).

A very well marked species of the mountains of south central Colorado for which I can suggest no close relative. In Payson's revision of *Cryptantha* § *Oreocarya*, Ann. Missouri Bot. Gard. **14: 239, 240** (1927), it keys out to *C. virgata*. In Brand's treatment, Pflanzenr. Heft **97: 79** (1931), it keys out to *O. rugulosa*. The caespitose and perennial habit, different indument and smaller nutlets with open scar all readily distinguish it from the very different *C. virgata*. *Cryptantha rugulosa* shows greater similarity with *C. Weberi* but differs in indument, in the cylindric thyrse of short cymes, small nutlets, etc.

Two flowering collections of the species have been known for over ten years. Though recognized as representing what was evidently an unnamed plant, they have not been used in describing the species, since they lack fruit. For at last receiving material of the plant in mature state I am indebted to Professor William A. Weber, of the University of Colorado, who made a special visit to the mountains of Saguache County in search of it. It is with great pleasure that I associate his name with the species.

Craniospermum mongolicum, sp. nov.

Herba humilis multicaulis ut videtur perennis et 5–6 cm. alta; caulibus hornotinis 6 cm. longis infra medium simplicibus supra medium cymas brevipedunculatas axillares dense dispositis proferentibus sparse hispidis (pilis patentibus vel adscendentibus 1–2 mm. longis) et hispidulis (pilulis 0.4–0.8 mm. longis retrorse adpressis); foliis firmis enervatis villuloso-hispidulis (pilulis saepe retrorse adpressis 0.3–0.9 mm. longis vix abundantibus) et sparse hispidulis (pilis rigidis e basibus pallidis incrassatis prominulis erumpentibus facie superiore et praesertim margine laminae folii gestis) foliis basalibus congestis tempore florendi marcidis oblanceolatis 1–2 mm. latis 8–11 mm. longis; foliis caulinis oblanceolatis 15–20 mm. longis 3–4 mm. latis apice acutis obtusisve; calyce 5-partito hispidulo sub anthesi 5 mm. longo mox ad 8 mm. longo, lobis subaequalibus oblongo-lanceolatis apice obtusis pedicello ad 1 mm. longo; corolla ca. 7.5 mm. longa glaberrima, tubo cylindrico 2.5 mm. crasso, faucibus 2 mm. longis apice 4 mm. crassis, lobis caerulescentibus adscendentibus nervatis 1.5 mm. longis a basi ca. 1.5 mm. lato sursum laeviter attenuatis apice rotundis; staminibus basim versus faucis (ca. 4 mm. supra basin corollae) affixis e plicis intrusis extus foveolatis orientibus glaberrimis; filamentis 5–6 mm. longis e fauce corollae 3–4 mm. longe exsertis ligulato-linearibus basin versus aliquantum ampliatis basi imo geniculatis; antheris 0.5–1.2 mm. longis; stylo filiformi glabro longe exserto; nuculis maturis homomorphis 3.5 mm. longis cinereis minute verrucosis sparse tuberculatis, dorse supra medium foveola conspicua donatis.

OUTER MONGOLIA: Daying Gol, dry hills at 5500 ft. alt., 1925, *R. W. Chaney 195* (TYPE, Gray Herb.).

From the other members of the genus this well-marked species differs in having a low compact growth habit, hispid or hispidulous rather than villous indument, and a branched inflorescence. Furthermore, its filaments are not entirely linear nor do they arise directly from the walls of the corolla. They are broadened towards their geniculate base and each arises from a small protuberance situated low in the corolla throat. On the outside of the corolla the location of each filament-bearing protuberance is marked by a small but distinct depression. The plant appears to have a perennial root. From it arise a number of short stems about 6 cm. long. These stems bear not only terminal cymes but also numerous, equally well developed lateral ones from the four to six axils above its middle. The inflorescence is obviously compound. It is dense, 2.5–3.5 cm. long, and the most conspicuous part of the plant. In other species the inflorescence consists of a solitary subcapitate glomerule borne terminal on each stem. These stems are better developed than those in *C. mongolicum* and are more elongate and very much more leafy. In the most recent account of *Craniospermum*, Pflanzenr. Heft **97:** 102–3 (1931), Brand recognizes three members of the genus, *C. canescens* DC., *C. subvillosum* Lehm., and *C. subfloccosum* Krylow. All these are closely related, so closely in fact that they may be no more than forms of a single somewhat variable species. They grow in southern Siberia along the Mongolian border from the west of the Altai east to beyond Lake Baical. The proposed new species is more southerly, occurring along the southern extension of the Altai in western Outer Mongolia. The type was obtained at Daying (or Da-Ying) Gol, a stream heading in the Baga Bogdo Range and flowing north into Tsagan Nor, about long. 101° 30′ and lat. 45° 5′. It was distributed misidentified as "*Arnebia guttata.*"

Trichodesma calycosum Collett & Hemsl., Jour. Linn. Soc. Bot. **28:** 92 (1890); Lacaita, Jour. Linn. Soc. Bot. **43:** 476 (1916) — type from Burma; "Shan hills at 4000 feet."

Lacaitaea calycosa (Coll. & Hemsl.) Brand, in Fedde Repert. **13:** 81 (1914) and Pflanzenr. Heft **87:** 44 (1921).

Trichodesma Hemsleyana Levl. in Fedde, Repert. **9:** 327 (1911) and Fl. Kouy Tcheou 55 (1814); Brand, Pflanzenr. Heft **78:** 43 (1921) — type from "Kouy-Tcheou [Kweichow, China], *J. Esquirol 745.*"

Trichodesma sinicum Brand in Fedde, Repert. **12:** 504 (1913) and Pflanzenr. Heft **78:** 43 (1921) — type from Szemao, southern Yunnan, *Henry 10124 D.*

Trichodesma calcareum Craib, Kew Bull. **1914:** 8 (1914) — type from northern Siam, "Doi Chieng Dao, crevices of limestone rock, 900 m., *Kerr 2856.*"

Trichodesma khasianum var. *calcareum* (Craib) Brand, Pflanzenr. Heft **78:** 33 (1921).

Octosomatium Kerrii Gagnep. Not. Syst. **14:** 23 (1950) — type from Laos, Indo-China; Muong-Khao, Xieng-Khouang dist., ca. lat. 19° 50′ and long. 103° 30′, *Kerr 20978.*

Known from Burma (north of lat. 22°) and from China (western and southern Yunnan; Kweichow) south to about lat. 19° in northern Siam and adjoining Indo-China; also in Sikkim.

BURMA: Kanpetlet, Chin Hills, 7500 ft., hillside, fairly common, shrub 15 ft. tall, trunk 3 in. thick breast-high, fl. white, *F. G. Dickason 8425* (A); Webula (Falam), damp ravines and open mountain slope at 4000 ft., fairly common, shrub 8–10 ft. tall, *Dickason 7347.*

INDO-CHINA: Muong-Khao, Xieng-Khouang, Laos, *Kerr 20978* (Paris, TYPE of *O. Kerrii*; fragment received on loan).

CHINA: Yunnan: Salween Valley, lat. 25° 6′, in open scrub at 4000 ft., shrub 20 ft. tall, *Forrest 13665* (A); Salween Valley, lat. 25° 10′, long. 98° 50′, open dry situations on margin of scrub, half shrubby plant 3–4 ft. tall, *Forrest 19341* (A); Lan-Tsang Hsien, 1100 m. alt., woody plant on mountain slope, *C. W. Wang 73127* (A); Mengtse, 5000 ft. alt., shrub 3 ft. tall, fl.

white, *A. Henry 10124* (A, NY); Lunan, shrub 5 ft. tall, fl. white, *Henry 10124A* (A, NY); Chu-yuan, shrub 3 ft. tall, *Henry 10124B* (A, NY); Red River Valley, Manpan, 4000 ft., shrub 4 ft., fl. white, *Henry 10124C* (A); Szemao, 5000 ft., shrub 10 ft. tall, fl. white, *Henry 10124D* (A, ISOTYPE of *T. sinicum*). Kweichow: Lo fou, Feb. 1909, *J. Cavalerie 3498* (G); without locality, *J. Esquirol 745* (G, photo & frag., TYPE of *T. Hemsleyana*).

A study of the recently published *Octosomatium Kerrii* Gagnep. reveals it to be a synonym of the present plant, which now has accumulated four different trivial names and has twice been made the type of a monotypic genus, i.e. *Lacaitaea* Brand and *Octosomatium* Gagnep. It is a large shrubby plant with broad opposite leaves, which grows 1–6 m. tall and has fruit and flowers characteristic of *Trichodesma* in all details save only for the 8–10 gibbose intrusions developed in the corolla throat. Unlike most congeners it is not a desert or steppe plant but rather an inhabitant of the tropical forest.

The invaginate appendages present in the corolla throat of *T. calycosum* are of special interest. No other member of the genus has similar appendages, and furthermore, no other member of the entire Boraginaceae has them in so large a number. The corolla of *T. calycosum*, though usually pentamerous, is occasionally tetramerous and bears two gibbose appendages in the throat opposite each corolla-lobe. In other Boraginaceae the faucal appendages are traversed medially by the primary vein leading to the corolla-lobe and accordingly occur singly in the throat opposite the middle of the lobe. In *T. calycosum* the two appendages opposite each lobe arise lateral to the vein which courses between them. The condition, though unique in the family, is readily homologized. Many of the Boraginaceae with well-developed faucal invaginations have the invagination more or less strongly retuse at the summit. The vein leading to the corolla-lobe is detoured over the summit of the invaginate appendage. In those appendages that are lobed or emarginate at the summit its course over the summit lies at the bottom of the apical sinus. Should the appendage become strongly bilobed or parted, the vein would have no detour and would pass directly between the halves of the appendage, which would then appear double. The supernumerary appendages of *T. calycosum* probably had some such origin.

It is interesting to speculate why double faucal appendages should have developed only in this species of *Trichodesma*. The genus is a member of the Cynoglosseae, the most highly evolved tribe in the Boraginaceae, in which faucal appendages are usually well developed. Their loss in *Trichodesma* is probably associated with the elaboration of the androecium, in which the large anthers, held together by twisted tips, form a large protruding cone that controls all access to the corolla-tube. Faucal appendages, alternating with the anthers, would hinder rather than guide the proboscis of an insect seeking the slit between the closely juxtaposed anthers. This is obviated by the divided faucal appendages of *T. calycosum*. In that species they probably represent a modification and persistence of an ancestral character. As a general rule, in any large natural group such as *Trichodesma*, ancestral characteristics are more frequently retained by the shrubby or arborescent than by the herbaceous members. The latter, with a short life history and more frequent generations, can be expected to vary more rapidly and so deviate more from the ancestral than do the woody and arborescent congeners. Significantly, *T. calycosum* is the most robust member of the genus, and with the possible exception of *T. khasianum* Clarke, the only large shrub in the genus. The normal single faucal appendages of the Cynoglosseae having no function and being perhaps even disadvantageous in the *Trichodesma* flower, have been eliminated in most species of the genus. In *T. calycosum*, divided and so no longer hindering insects seeking the nectaries at the bottom of the floral cup, the appendages appear to have persisted as non-functional innocuous structures not yet eliminated in the course of evolution.

Brand states frankly that *T. calycosum*, though admittedly otherwise typical of *Trichodesma*, should, because of its faucal appendages, be segregated to form the monotypic genus *Lacaitaea*. Gagnepain, in establishing the synonymous genus *Octosomatium*, gives no intimation that he recognized the obvious affinities of the plant with *Trichodesma*. He considered the plant remarkable because of its opposite leaves, the prominent line on the stem joining the attachments of opposing leaves, the tetramerous flowers (of his specimen), and finally, the double faucal appendages of the corolla. Of the characters mentioned by him only the faucal appendages are notable when the plant is compared with *Trichodesma*. They alone are distinctive of *T. calycosum* and they alone constitute the only character of possible generic value that can possibly justify any proposal that the species be given special recognition as representing a monotypic genus distinct from *Trichodesma*.

In estimating the importance to be placed on the faucal appendages of *T. calycosum*, I am influenced by the remarkable similarity existing between that species and *T. khasianum*. The latter ranges just west of *T. calycosum* and like it is a shrub of monsoonal forests. *Trichodesma khasianum* has absolutely no faucal appendages, has less hairy anthers, and usually has more conspicuously white-dotted upper leaf-surfaces, but except for these differences the two species are extremely alike, so much so that any doubt as to their extremely close relationship is inconceivable. These two species belong together in one and the same genus! To disassociate them generically on the basis of one character is arbitrary and unnatural. I am, accordingly, content to assign *T. calycosum* as well as *T. khasianum* to *Trichodesma* § *Friedrichsthalia*, a section containing several African species which also have ample opposite leaves combined with frutescent habit.

Trichodesma calycosum var. **formosanum** (Matsumura), comb. nov.

Trichodesma formosana Matsumura, Bot. Mag. Tokyo **12:** 108 (1898) — "Hab. Formosa: in montosis ad Taichu (Y. Tashiro, no. 35); Tenkachilaisha, Shu-shu-kai (C. Owatari)."

Trichodesma khasianum sensu auct. Formos.; S. Sasaki [Cat. Govt. Herb.] Dept. Forestry, Taihoku, Formosa, Report **9:** 431 (1930); D. Hou, Taiwania **1:** 212 (1950).

FORMOSA: Kinkwaseki, *T. Ito* (A, photo); South Cape, *A. Henry 286 & 939* (A); Boryo to Kuraru, prov. Koshun, south Formosan common shrub 3–6 ft. tall, fl. blue, *E. H. Wilson 11014* (A); prov. Nanto, low altitudes, common bush, 6–12 ft. tall, *Wilson 9831* (A); [Bankinsing], *Henry 1239* (NY); Taito-cho, Shikano, 1931, *Tanaka 10462* (NY).

This plant of Formosa has been reported numerous times as "Trichodesma khasianum." Actually it is scarcely separable from *T. calycosum*. Indeed, it is distinguishable only by the arrangement of hairs on the back of the anthers. In the plant of Formosa these hairs are appressed and have the appearance of having been combed in different directions, left and right, from the mid-line of the anther. The hairs of the anthers of the continental plant are less appressed and do not have the combed, orderly appearance. The difference is a minor one, and only because it seems to be geographically correlated does it merit nomenclatorial recognition.

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STUDIES IN THE THEACEAE, XXV
THE GENUS ANNESLEA

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The theaceous genus *Anneslea* was first described and illustrated by Wallich in his Pl. As. Rar. **1:** 5, *t. 5.* **1829.** One cannot but be impressed by the manner in which the genus was presented. The details offered in the description, along with the excellent plate, produce a picture hard to duplicate even today.

According to G. Don, the genus was named *Anneslea* "in honor of George Annesley, Lord Mountnorris, F. R. and L. S., who collected many plants on his travels in the north of Africa and the south of Europe, while Viscount Valentia." It is fortunate that the name has been included in the list of *nomina conservanda,* since other genera had been described earlier under the same name. One of these, *Anneslia* Hooker ex Salisbury (1807), belonging to the Leguminosae, has had over a hundred species attributed to it; while *Anneslea* Roxburgh ex Andr. (1810), belonging to the Nymphaeaceae, has had three species described.

Anneslea is one of the three genera of the Theaceae recorded as having an inferior or subinferior ovary. The other two are *Visnea* Linnaeus f. (1781) and *Symplococarpon* Airy-Shaw (1937). The geographical distribution of these three genera is very interesting in that they are so far removed from one another. *Anneslea* grows in tropical and subtropical Asia, extending from southern China through Burma, Indo-China and Malaya, into Sumatra. The islands of Formosa and Hainan have both recorded the genus. The relationship of *Anneslea* is clearly with *Ternstroemia. Symplococarpon* is found in tropical America, and its relationship is with the American species of *Cleyera.* So close are the last two mentioned genera in appearance that when in flower it is difficult to separate them. On the other hand, *Visnea* is confined to the Canary Islands and Madeira and has no immediate generic relative, since it is the only species of Theaceae growing in this area.

Five synonyms have been recorded for *Anneslea* during the past century. In checking the literature, I find that all the synonyms except *Richtera* Reichenbach clearly pertain to this genus. *Richtera* was recorded in a listing of genera by Reichenbach with no description or reference to herbarium material. Both Dalla Torre & Harms (1907) and Melchior (1925) record the name as a synonym of *Anneslea.* I feel that I am correct in assuming that a specimen bearing this name had been seen by these authors and thus associated with the genus. The name *Mountnorrisia,* introduced by Szyszylowicz, refers also to

George Annesley. The name was cleverly used by the author, since at the time (1893) he recognized the priority of the other two *Annesleae* and could not foresee the eventual inclusion of Wallich's genus among the *nomina conservanda*.

In 1948 Gagnepain described a new genus, *Paranneslea*, which he separated from *Anneslea* by the following characters: (1) the anthers not mucronate by a prolongation of the connective, but bi-mucronate by lateral projections of the cells; (2) a five-parted stigma; (3) the cells of the ovary 2-ovulate; and (4) the peduncles solitary in the axils of the leaves.

Gagnepain states that it is difficult to designate the genus to which *Paranneslea* is most closely related. Except for the four differences listed above, the plant described would fall into *Anneslea fragrans* — and after detailed study of the genus (*Anneslea*), some of the characters listed by Gagnepain lose their importance.

Because of Gagnepain's proposed new genus, I made many more dissections of both flowers and fruits than I would otherwise have made. Some interesting results were obtained — results not unexpected in this family, however. Whereas the genus *Anneslea* was originally described as having three cells in the ovary and fruit and a three-parted stigma, I discovered that two-celled ovaries and fruit were more prevalent than three-celled and were found in a ratio of two to one. Also, there is no true relationship between the number of divisions in the stigma and the cells of the ovary. Three-parted stigmas were more prevalent even in flowers with two-celled ovaries.

As to the five-parted stigma of *Paranneslea*, this is not an unusual variation within genera of this family. The genus *Eurya* has dominantly a three-parted style. However, it has been discovered that a five-parted style is not unusual, and occasionally four-parted styles may be found.

The number of ovules in the cells of the ovary varies considerably in *Anneslea fragrans* and cannot be used as a diagnostic character in the separation of species, to say nothing of genera.

The mucronate anther cells are distinct from all the material of *Anneslea* that I have studied. However, it is not unusual to find this character present or absent in members of other genera of the family.

The fourth point, peduncles solitary in the axils of the leaves, is the most distinctive character listed by Gagnepain.

The three characters (1) flowers solitary in the axils of the leaves; (2) five-parted style; and (3) the mucronate anther cells, constitute points worthy of specific, but hardly of generic delimitation. True enough, they contribute a remarkable variation from the so-called other species of *Anneslea*. However, except for *Anneslea donnaiensis* and *A. steenisii* (Sumatra) I feel that all other known material of the genus belongs to the single species *A. fragrans* with five regional varieties.

Anneslea Wallich, Pl. As. Rar. **1:** 5, *t. 5.* **1829.** — G. Don, Gen. Syst. **1:** 565. 1840. — Endlicher, Gen. Pl. 1018. 1840. — Choisy in Mém. Soc. Phys. Hist. Nat. Genève **14:** 129 (Mém, Ternstr. 41). 1855. — Bentham & Hooker, Gen. Pl. **1:** 182. 1862 — Baillon, Hist. Pl. **4:** 258. 1873. — Kurz, For. Fl. Brit. Burma **1:** 98. 1877. — Melchior in Nat. Pflanzenfam. ed. 2, **21:** 143. 1925. — Lemée, Dict. Pl. Phan. **1:** 289. 1929. — Keng in Taiwania **1:** 254. 1950. — Non *Anneslia* Hooker (1807), Leguminosae; nec *Anneslea* Roxburgh (1810), Nymphaeaceae.

Richtera Reichenbach, Repert. Herb. Nomencl. Gen. Pl. 208. 1841, nomen. — Dalla Torre & Harms, Gen. Siphonogamarum Suppl. 622. 1907, as syn. — Melchior in Nat. Pflanzenfam. ed. 2, **21:** 143. 1925, as syn.

Callosmia Presl, Bot. Bemerk. 103. 1844.

Daydonia Britten in Jour. Bot. **26:** 11. 1888.

Mountnorrisia Szyszylowicz in Nat. Pflanzenfam. III. **6:** 189. 1893.

Annesleya Post & Kuntze, Lexic. Gen. Phan. 32. 1903.

Paranneslea Gagnepain in Bull. Soc. Bot. France **95:** 29. 1948.

Calyx persistent, imbricate, bi-bracteate at the base, deeply parted into 5 lobes, the lobes unequal. Petals 5, imbricate, connate at the base, deeply constricted at the middle. Stamens 30–40, distinct, in a single or in double series, the filaments inserted on the torus, the anthers linear, usually longcuspidate. Ovary imbedded in the torus, 2- or 3-celled with a few to several ovules in each cell; ovules suspended from the apex of the placenta, the style entire, persistent, the stigmas usually 3, occasionally 2 or 5. Fruit inferior, subglobose, subligneous, crowned by the persistent calyx, 2- or 3-celled, the cells 1–3-seeded. Seeds pendulous, arillate, the embryo curved.

Trees or shrubs with alternate coriaceous persistent leaves.

Type species: *Anneslea fragrans* Wallich.

KEY TO THE SPECIES

A. Flowers crowded at the apex in a compact spiral arrangement; stigmas 3 or 2; the connective of the anther projected into an apicule usually 1–2 mm. long.
  - B. Petals connate at the base for 4–5 mm., deeply constricted on each side at the middle, appearing in outline like an hourglass . . . . 1. *A. fragrans.*
  - BB. Petals joined only lightly at the very base, the sides entire with no middle constriction . . . . 2. *A. steenisii.*

AA. Flowers solitary in the axils of the leaves; stigmas 5; individual anther cells apiculate, not a single apicule from the projected connective . . . . 3. *A. donnaiensis.*

1. **Anneslea fragrans** Wallich, Pl. Asiat. Rar. **1:** 5, t. 5. 1830. — G. Don, Gen. Syst. **1:** 566. 1840. — Griffith, Icon. Pl. As. *t. 585, fig. 17,* 1854. — Choisy in Mém. Soc. Phys. Hist. Nat. Genève **14:** 129 (Mém. Ternstr. 41). 1855. — Dyer in Hooker f., Fl. Brit. India **1:**

280. 1872. — Kurz, For. Fl. Brit. Burma **1:** 98. 1877. — Mason, Burma People Prod. (Bot.) **2:** 630. 1883. — Pierre, Fl. For. Cochinch. **2:** *pl. 127.* 1887. — Brandis, Ind. Trees 58. 1906. — Pitard in Fl. Gén. Indo-Chine **1:** 335. 1910. — Craib, Fl. Siam Enum. **1:** 123. 1925. — Melchior in Nat. Pflanzenfam. ed. 2, **21:** 143. 1925. — Gagnepain in Fl. Gén. Indo-Chine Suppl. 1: 278. 1943.

Callosmia fragrans (Wallich) Presl, Bot. Bemerk. 103. 1844.
Anneslea fragrans α *typica* Pierre, Fl. For. Cochinch. **2:** *t. 127.* 1887.
Mountnorrisia fragrans (Wallich) Szyszylowicz in Nat. Pflanzenfam. III. **6:** 189. 1893.

Small tree to 15 m. (occasionally shrubs or very large trees); branches terete, glabrous, gray. Leaves coriaceous, few, disposed near the apex of the branchlets, glabrous, lanceolate, oblong-lanceolate, rarely obovate, (4.5–) 10–15 (–18) cm. long, (2–) 3–5 (–8) cm. wide, acute at the apex, occasionally obtuse, rarely rounded, usually cuneate at the base, tapering along and into the petiole (2–3 cm. long), punctate below, the margine entire, subrevolute, with occasional minute glands (seen only with a lens); the midrib canaliculate above, elevated below, the veins 10–12 pairs elevated below, sometimes quite inconspicuous. Inflorescence consisting of several to many individual flowers in a compact spiral arrangement, subapical, terminating the season's growth, subtended by or occasionally intermixed with a few (ca. 3) subverticillately arranged leaves; pedicels glabrous, usually 5–6 cm. long, often 2–3–4 cm. long, narrowest at the base; bracteoles 2, opposite or nearly so, immediately below the calyx, broadly ovate to deltoid, occasionally rounded, 4–4.5 mm. long, ca, 3 mm. wide, often carinate, denticulate; sepals 5, imbricate, unequal, glabrous, ovate or rounded, 1–1.5 cm. long, the outer ones smaller, thicker, with a narrow ciliate membranaceous margin, the inner ones thickened at the center and base, the margin more widely membranaceous, eciliate; petals 5, imbricate, membranaceous, glabrous, ca. 20 mm. long, 5–6 mm. wide, with the over-all form of an hourglass, deeply constricted immediately below the middle to 2 mm. or less in width, the lower portions of the petals connate for 5–7 mm. simulating a tube but often separating at maturity, the uppermost portion of the petals broadly ovate, acute at the apex, appearing decidedly so because of the tendency to curve inward; stamens 30–40, uni- or bi-seriate, 12–15 mm. long, the filaments lightly adnate to the base of the corolla, ca. 5 mm. long, the anthers basifixed, linear, 5–7 cm. long, the connective projected into a conspicuous apicule 2–3 mm. long; ovary subinferior, 2- or 3-celled, with several ovules suspended from the apex of the placenta in each cell, the style tenuous 1.5–2 cm. long, 2- or 3-lobed at the apex, the stigmas 3. Fruit baccate, subinferior, free only at the apex, otherwise joined with the calyx-tube, somewhat leathery, usually pustular-dotted when mature, globular or rounded, ca. 2 cm. diameter (sometimes as much as 4 cm. long and 3 cm. diameter), crowned by persistent sepals, 2– or

3-celled, each cell 1–3-seeded. Seeds with a hard woody testa and reddish arillae, the embryo horseshoe-shaped.

YUNNAN: Kintung Chai, between Keng Hung and Muang Hing, top of dry slopes, alt. 1350–1800 m., *J. F. Rock 2703* (AA), Mar. 1, 1922 (tree). — Between Tengyueh and the Burmese border, en route to Sadom, *J. F. Rock 7314* (AA), Nov. 1922 (tree 30 ft.; flowers white, the pedicels white). — "Ad orientem fluminis Dsolin-ho humidis ad vicum Lodse-Magai," alt. 1900 m., *H. Handel-Mazzetti 6164* (AA), April 29, 1915. — Kien-shuei Hsien, woods, alt. 1900 m., *H. T. Tsai 53142* (AA), April 13, 1933 (tree 20 ft.). — Lung-ling Hsien, in thickets, alt. 1800 m., *H. T. Tsai 55629* (AA), *55768* (AA), 55855 (AA), April 1934 (tree 30 ft., fruit yellow). — Mong-ka, in forest, alt. 1600–1750 m., *H. T. Tsai 56722* (AA), *56840* (AA), *56846* (AA), Jan.–Feb. 1934 (tree 20–30 ft.; flowers yellow). — Yuanchiang, alt. 4000–5000 ft., *A. Henry 11591* (AA). — Szemao, eastern Mt., alt. 4000–5000 ft., *A. Henry 11591A* (AA), *11591C* (AA). — Shun-Ning, Holungtan, among thickets, alt. 1850 m., *T. T. Yü 16195* (AA), June 10, 1938 (rare shrub 4–6 ft.; capsule woody, brownish yellow). — Shun-Ning Hsien, mountain slope, alt. 2800 m., *C. W. Wang 71812* (AA), Feb. 1936. — Chen-Kang Hsien, in woods, alt. 1600 m., *C. W. Wang 72227* (AA), March 1936. — Tsang-Yuan, north slope, alt. 1600 m., *C. W. Wang 73247* (AA), April 1936 (tree 15 m.). — Fo-Hai, alt. 1540 m., *C. W. Wang 73755* (AA), May 1936 (shrub 15 ft.). — Jah-kuang, Che-li Hsien, in thickets, alt. 1300 m., *C. W. Wang 79106* (AA), Sept. 1936. — Kuen-ger, Che-li Hsien. in thickets, alt. 1260 m., *C. W. Wang 79272* (AA), Oct. 1936. — Ban-chiou-chian, Che-li Hsien, thickets, alt. 840 m., *C. W. Wang 79763* (AA), *79770* (AA), Oct. 1936. — Meng-la, Jenn-yeh Hsien, mixed forest, alt. 1000 m., *C. W. Wang 80498* (AA), *80599* (AA), Nov. 1936. — Kuan-yeang, Luh-shuen Hsien, mixed forest, alt. 1180 m., *C. W. Wang 81161* (AA), Nov. 1936. — Without precise locality: *G. Forrest 9615* (AA), *27783* (AA).

KWEICHOW: Tuh-shan, in dense shade, *Y. Tsiang 6980* (AA), Sept. 8, 1930.

KWANGSI: Shang-sze District, southeast of Shang-sze, Kwangtung border, Shap Man Tsai Shan, near Iu Shan village, *W. T. Tsang 22227* (AA), May 7, 1933.

KIANGSI: Lungnan District, Oo Chi Shan, near Lam Uk Village, steep slopes in rocky forest, *S K. Lau 4777* (AA), Oct. 1934 (tree 20 ft.).

UPPER BURMA: Taung-gyi, *F. G. Dickason 5880* (AA), May 5, 1933. — Toungu District, Thandoung, alt. 3200 ft., *F. G. Dickason 6791* (AA), Jan. 1938 (shrub 15 ft.). — Haka, semi-open hillside, alt. 6000 ft., *F. G. Dickason 7587* (AA), *7695* (AA), Apr. 1938 (tree 30 ft.). — Kachin Hills, *Shaik Mokim s.n.* (AA), Jan. 1898. — Ken Tung [Kiangtung] Territory, Muang Len Ridge, *J. F. Rock 2027* (AA), Jan. 24, 1922. — Fort Stedman, *Abdul Huk s.n.* (AA), Jan. 1893 (tree 100–150 ft.). — Madre Hills, *King's Coll. 174* (AA), Feb. 20, 1893 (tree 80 ft.).

LOWER BURMA: Amherst District, Kyain, common in scrub jungle, *F. G. Dickason 6882* (AA), Feb. 1938 (small tree 30 ft.). — South Tenasserim, in Zadi Circle, Jaungbyant forest, *Maung Po In 5611* (AA), Feb. 25, 1906.

SIAM: Phu Krading, Loie (N. E. Siam), common in open forests at summit, alt. 1000 m., *Native Collector DE329* (Roy. For. Dept. 4418) (AA), August 19, 1950.

INDO-CHINA: Laos: Sam-neua, *E. Poilane 2074*, Nov. 14, 1920.

Anneslea fragrans is a very variable species extending from southern China through Burma and Indo-China into Malaya. Several species have been described in the genus since Wallich first introduced the original *A. fragrans*.

After a careful study of material of this genus from all regions, one cannot help conclude that, with the exception of the isolated *A. donnaiensis* and *A. steenisii*, only a single species is represented, with regional variations — and these regional varieties not consistently distinct. A similar situation may be found in the single Asiatic species of *Cleyera*, namely *C. japonica*.

The center of distribution for the genus, as well as the species *A. fragrans*, appears to be Yunnan and Burma. Even in this area considerable variation may be found in leaf size and shape and pedicel length, as well as in number of cells in the ovary and the number of stigmas. It was on these characters that the species had been separated.

On the fringes of the distribution area may be found the regional varieties. On Formosa is var. *lanceolata*. This variety was later given specific status, but in a treatment by Keng in 1950 it was again recorded as a variety. In this variety the leaves are consistently narrower than the species and lanceolate, the peduncle short, and the fruit reportedly smaller. Narrow-lanceolate leaves may be found in the Yunnan material, but only occasionally. The same is true of the pedicel length.

An interesting observation on peduncle length can be found in a series of specimens colected by Tsai in Yunnan. Tsai's numbers *55768*, *55629*, and *53142* were collected on the same day, and the peduncles consistently measure 5.5–6 cm. in length. His numbers *56840*, *56846*, and *56722* were collected in the same locality and in these numbers the peduncles measure 3.5, 3.5, and 3.5–6 cm. in length. *Handel-Mazzetti 6164* has fruiting peduncles measuring 2.5 cm. Study shows that the peduncles of a length of 5 and 6 cm. on the typical material, although outstanding, are actually less frequently found than those of the shorter measurements.

In Malaya the specimens are of a much sturdier appearance throughout. The peduncle is outstanding because of its short, thick character, as it measures as much as 5 mm. in diameter at the apex. This variety is well named *crassipes*.

Two closely allied varieties, *hainanensis* and *ternstroemioides*, are found in Hainan and Tonkin respectively. These are characterized by having smaller flowers on shorter pedicels. However, var. *ternstroemioides* has also much smaller leaves and shorter petioles. Gagnepain considered this variety a distinct species because of the two-celled ovary and two-lobed stigma. These characters are not distinctive. I have seen Gagnepain's type of *A. ternstroemioides* and feel that it is worthy of varietal status only.

The variety *alpina* is not a marginal or regional variety. It was collected in Yunnan and reported by the collector, Yü, as common. In his use of the word "common" Yü was probably referring to material typical of the species. Still only a single specimen of typical material seems to have been collected by him. *Anneslea alpina* was based on a very poor specimen. However, its rounded leaves and short petioles cannot be overlooked. Although specimens from Burma show leaves similar to var. *alpina,* the leaves on the Yü specimen are all rounded, while on the Burmese material the rounded leaves are only occasional.

Three specimens, one each from Kwangsi, Kweichow, and Kiangsi, are cited under the species. These three specimens increase the specific range somewhat along the southern area of China. The Kwangsi specimen, *Tsang 22227,* has lanceolate leaves very similar to those of var. *lanceolata.*

Anneslea fragrans Wallich var. **crassipes** (Hooker ex Choisy) Pierre, Flor. For. Cochinch. **2:** *t. 127.* 1887.

Anneslea crassipes Hooker ex Choisy in Mém. Soc. Phys. Hist. Nat. Genève **14:** 129 (Mém. Ternstr. 41). 1855. — Dyer in Hooker f., Fl. Brit. India **1:** 280. 1872. — Keng, Mater. Fl. Malay Penins. **1:** 127. 1890. — Ridley, Fl. Malay Penins. **1:** 193. 1922. — Melchior in Nat. Pflanzenfam. ed. 2, **21:** 143. 1925.

Anneslea monticola Kurz in Jour. As. Soc. Bengal **42**(2): 59. 1873; For. Fl. Brit. Burma **1:** 98. 1877. — Mason, Burma People Prod. (Bot.) **2:** 630. 1883.

Anneslea fragrans Wallich *β monticola* (Kurz) Pierre, Flor. For. Cochinch. **2:** *t. 127.* 1887.

Daydonia crassipes (Hooker ex Choisy) Britten in Jour. Bot. **26:** 11. 1888.

Anneslea crassipes Hooker ex Choisy var. *obovata* King, Mater. Fl. Malay Penins. **1:** 127. 1890.

Mountnorrisia crassipes (Hooker ex Choisy) Szyszylowicz in Nat. Pflanzenfam. III. **6:** 189. 1893.

MALAYA: Pahang: Cameron Highlands, Rhododendron Hill, alt. ca. 4800 ft., *M. R. Henderson 23321* (AA), April 2, 1930. — Cameron Highlands, alt. ca. 4000 ft., *M. R. Henderson 32671* (AA), April 16, 1937 (48 ft. to first branch). Penang: *Hooker s.n.* (G) in 1851. Perak: summit of Gunong Batu Pateh, alt. 6700 ft., *L. Wray 315* (AA). Without precise locality: *Griffith 741* (G) and *A. C. Maingay 181* (G).

This variety is characterized by an over-all sturdiness and is well named *crassipes.* Most characteristic is the stout sturdy pedicel measuring sometimes only 1.5–2 cm. long. In fruiting specimens these pedicels may measure as much as 5 mm. in diameter (*Wray 315*). In *Henderson 23321* and *32671,* two specimens collected in the same locality, variation in the pedicel character may be found. The earlier number has much thicker pedicels, especially at the apex, than *32671.* The latter number appears more closely related to the species.

Anneslea fragrans Wallich var. **lanceolata** Hayata, Icon. Pl. Formos. **3:** 42, *t. 5.* 1913. — Kanehira, Formos. Trees 55, *fig.* 1917. —

Melchior in Nat. Pflanzenfam. ed. 2, **21:** 143. 1925. — Makino & Nemoto, Fl. Jap. 736. 1931. — Yamamoto in Sylvia **5:** 32. 1934. — Keng in Taiwania **1:** 254. 1950.

Anneslea lanceolata (Hayata) Kanehira, Formos. Trees, ed. rev. 455, *fig. 412.* 1936.

FORMOSA: Hunchuen Peninsula: *Matsuda 16781* (photo, AA); *R. Kanehira 7* (AA); *S. Sasaki W10* (AA), Oct. 31, 1920.

This variety is separated from the species by its smaller fruits (ca. 1 cm. diam.), shorter pedicels, 2.5–3 cm. long, and consistently lanceolate to oblong-lanceolate leaves 10–13 cm. long and ca. 3 cm. wide.

The latest and probably the best treatment of this variety was furnished by Keng in Taiwania **1:** 254. 1950. Unfortunately Keng compared this variety with material from Hainan only, thus dealing with *A. fragrans* var. *hainanensis* rather than with the species. In the latter named variety from Hainan, the fruit is larger, as are the leaves. However, both varieties are characterized by shorter pedicels.

The narrow lanceolate leaves are not distinctive of this variety alone, since material from Yunnan and Kwangsi show the same type of leaf. The leaves of *Forrest 9615* measure ca. 9 × 2.5 cm. and are all similar. However, on *Tsai 53142* there are lanceolate leaves measuring ca. 12 × 3.5 cm., very similar to those of var. *lanceolata.* On the same specimen may be found wider leaves, less acute at the apex and more typical of the species. Both the above specimens were collected in Yunnan. *Tsang 22227,* collected in Kwangsi, bears leaves similar to this variety, measuring 10 × 2.8 cm. and 8.5 × 2.2 cm. Others, however, measure 11 × 4 cm. All are acute at the apex.

VERNACULAR NAME: *Nagaba-mokkoku* (Japanese).

Anneslea fragrans Wallich var. **hainanensis,** var. nov.

A varietate *ternstroemioides* differt foliis maioribus, ad 15 cm. longis et 5–6 cm. latis, obovatis, apice rotundatis vel obtusis rare late acuminatis, petiolis ad 3 cm. longis; filamentis 2–3 mm. longis, antheris 4 mm. longis, acumine ca. 2 mm. longo; ovario 2- vel 3-loculato, stigmatibus 2 vel 3.

HAINAN: Dung Ka to Wen Fa Shi, in thickets, alt. 2000 ft., *N. K. Chun & C. L. Tso 43792* (AA), 1932–33 (tree 20 m.; seeds red). — Po-ting, in forest, alt. 2800 m., *F. C. How 72915* (AA), June 16, 1935 (tree 10 m. with gray bark; leaves dark green above, pale green beneath; fruit yellow-green). — Without precise locality: *H. Y. Liang 64168 & 64223* (AA); *C. Wang 35183* (AA).

KWANGTUNG: Wung Yuen District: Fan Shiu Shen, steep slopes of rocky forest, *S. K. Lau 2743* (AA), Nov. 1933 (tree 10 m.).

This variety is characterized by small lanceolate leaves 4.5–7 cm. long, 2–3 cm. wide, with the petioles ca. 1 cm. long, the pedicels short, 2–3 cm. long, the filaments short, 2–3 mm. long, and the ovary usually two-celled and the stigmas two in number.

Except in the shape and size of the leaves this variety very much resembles var. *ternstroemioides* from Indo-China. Both varieties have smaller flowers on shorter pedicels than those found in typical *A. fragrans* and the other varieties. In the stamens of both varieties the filaments are very short (not over 2–3 mm.) appearing almost bulbous in shape, while in other members of the species the filaments are usually approximately 5 mm. long.

Anneslea fragrans Wallich var. **ternstroemioides** (Gagnepain), comb. nov.

Anneslea ternstroemioides Gagnepain in Notulae Syst. (Paris) **10:** 116. 1941; in Fl. Gén. Indo-Chine Suppl. **1:** 278. 1943.

INDO-CHINA: Tonkin: Massif du Tam-dao, alt. ca. 1400 m., *A. Pételot 3869* (TYPE of *A. ternstroemioides*, Paris), Dec. 1930.

This variety is characterized by lanceolate leaves far smaller than those of the species or any of the other varieties, being 4.5–7 cm. long, 2–3 cm. wide with a petiole seldom measuring over 1 cm. long. The pedicels are short (2 cm. long). The filaments are very short (ca. 1 mm. long) and only one-fifth the length of the anthers. The ovary is two-celled and the stigmas number two.

It is most closely allied to var. *hainanensis*, which differs in having larger leaves (up to 15 cm. × 6 cm.) with petioles as much as 3 cm. long. However, in the inflorescence there is close agreement between the two varieties.

The two-celled ovary and two stigmas of var. *ternstroemioides* may not prove to be consistent characters. Only a single specimen, the type, has been collected to date.

Originally described by Gagnepain as *A. ternstroemioides*, it was separated from *A. fragrans* primarily on the two stigma lobes, the shorter sepals, and the size of the leaf. I find the short bulbous filaments and the short-petioled leaves more distinctive characters, and it is on the basis of these that I separate it from *A. fragrans* as a variety.

VERNACULAR NAMES: *Brol, Cây la chua, Reung, Ko nang na.*

Anneslea fragrans Wallich var. **alpina** (Li), comb. nov.

Anneslea alpina Li in Jour. Arnold Arb. **25:** 307. 1944.

YUNNAN: Mien-ning, Po-shang, common in forest, alt. 2700 m., *T. T. Yü 18031* (TYPE of *A. alpina*, AA), Oct. 11, 1936 (shrub 8–12 ft. high with pinkish red flowers).

This variety can be separated from the species by its smaller ovate to suborbicular leaves (4–6 cm. long, 3–4 cm. wide) with the short petioles only 5 mm. long.

The specimen cited above, Li's type for *A. alpina*, is very poor. No flowers were attached and all pedicels were broken off. The exact measurements could not be given. Li's measurement of 1–1.5 mm. is a mechanical error, of course. He probably meant to say 1–1.5 cm. Even this is not correct, since one pedicel (in packet) measures over 2 cm. long, and this one is broken off at the base.

The small ovate leaves are rather distinct from those of other specimens from this region which have been studied. *Dickason 7587* from Upper Burma has rounded leaves 5 × 2.5 cm. with petioles 1 cm. long. However, on the same specimen are longer leaves, more acute, and typical of the species. On the Dickason specimen the pedicel measures over 5 cm. in length.

2. **Anneslea steenisii,** sp. nov.

Arbor ?; ramulis verticillatis subverticillatisve, brunneis vel griseis, teretibus, glabris; foliis coriaceis, paucis ad apicem ramulorum dispositis, glabris, oblongo-ellipticis vel obovatis, apice acutis vel obtusis, basi attenuatis, subtus punctatis, margine subrevolutis, subintegerrimis, costa supra canaliculata, subtus elevata, venis ca. 8–10 paribus conspicuis vel subconspicuis, supra leviter impressis, subtus elevatis, petiolis 1 cm. minusve. Flores ad apicem ramulorum leviter spiraliterque dispositi; pedicellis crassis, recurvatis, 1.5–2 cm. longis, ca. 4 mm. diametro, glabris, teretibus, rare ancipitibus; bracteolis 2, oppositis suboppositisve, subaequalibus, crasso-coriaceis, subrotundatis vel late deltoideis, 3 × 3 mm., 4 × 4 mm., ad 6 × 6 mm., glabris; sepalis 5, imbricatis, inaequalibus, subrotundatis, glabris, exterioribus duobus crassioribus, 7–12 mm. longis, 9–12 mm. latis, interioribus tribus leviter latioribus, ad 15 × 15 mm., margine plus minusve scariosis; petalis 5, basi leviter connatis, obovatis, 12–13 mm. longis, 7–10 mm. latis, margine integris vel subintegris non constrictis; staminibus ca. 35, 2-seriatis, glabris, apice in apiculum 1 mm. longum projectis, filamentis basi ad corollam adnatis, crassis 3–4 mm. longis, antheris elongatis, ca. 4–5 mm. longis; ovario glabro, subplano, 2–(vel 3-) loculari, stylo glabro, attenuato, ca. 1.3 cm. longo, apice 2–(vel 3-) partito, non recurvato. Fructus globosi, glabri, sublepidotis obtecti, 4–5 cm. longi, ad 3 cm. diametro, apice persistentibus sepalis coronati, 2–(vel 3-) loculares, duobus vel tribus seminibus in quoque loculo; seminibus ca. 1 cm. longo, 3–4 mm. diametro.

SUMATRA: Atjeh: Gajolanden: Poetjoek Angasan, common in the ridge forest above Penosan, alt. 2300 m., *C. G. G. J. van Steenis 8327* (Herb. Bogor.), Jan. 27, 1937. — Mt Losir, on watershed between bivouacs 4 and 5, near stream in the forest, alt. 2700–2800 m., *Van Steenis 8493* (Herb. Bogor.), Jan. 31, 1937. — Mt. Kemiri, in scrub at the summit on east side of Camp at Aloer, alt. 2850–3300 m., *Van Steenis 9685* (Herb. Bogor., TYPE), March 10, 1937. — Near junction of Kapi and Aoenan Rivers near Paja camp, flat forest ridges near sulphur field, *Van Steenis 9964 & 9981* (Herb. Bogor.), March 21, 1937.

Included in a loan of specimens of *Adinandra* and *Ternstroemia* from Herbarium Bogoriense were the five specimens cited above. The arrival of this material considerably upset the rest of this paper, which had already been prepared for publication. Until these specimens came to light the genus was supposed to occur only as far south as the Malay Peninsula. From a general examination it was thought at first that the above Sumatran material would prove to be only an extension of the range of *A. fragrans*, perhaps another variety with very large fruit. However, characters discovered in the flowers, as well as those in the fruit, showed that a new species should be designated.

The petals in *A. steenisii*, like those of *A. donnaiensis*, lack the "hourglass" shape of *A. fragrans* but are obovate without the single constriction along each side. Also the petals are joined only lightly at the base rather than connate for 5–7 mm. as in *A. fragrans*, and measure only approximately one-half the length of those of the mainland species. The stamens measure slightly less in length than those of *A. fragrans*. In *A. steenisii* the partitions of the style, although either two or three in number, are erect rather than spreading as in *A. fragrans*.

The fruit of this species is far larger than any previously seen for the genus, measuring as much as 5 cm. in length and 3 cm. in diameter. The walls of the fruit are very thick, measuring 5 mm. or more. The seeds, one centimeter or more in length, are correspondingly large.

In the mature fruit examined (*Van Steenis 9981*), the bracteoles had disappeared, only the scars remaining. The measurement of the scar showed the bracteoles at full maturity to have measured as much as 9 mm. across at the base. In general the bracteole measurements even in the young flowers were considerably more than those found in *A. fragrans*. The above description of the fruit was drawn from *Van Steenis 9981*.

It is a pleasure to name this species after C. G. G. J. van Steenis, the collector and my close friend.

VERNACULAR NAME: *Kajoe gaboe*.

3. **Anneslea donnaiensis** (Gagnepain), comb. nov.

Paranneslea donnaiensis Gagnepain in Bull. Soc. Bot. France **95:** 29. 1948, as *P. donnalensis*.

Trees 20–30 m.; branchlets terete, subverticillate, glabrous, gray. Leaves coriaceous, glabrous, subverticillate, few, disposed at the apex of the branchlets, obovate to oblanceolate, 7–15 cm. long, 3–5 cm. wide, obtuse at the apex, bluntly acuminate, attenuate at the base, slightly decurrent, the margin entire, the midrib canaliculate above, elevated below, the veins 6–8 pairs inconspicuous on both surfaces, the petiole 2–2.5 cm. long. Flowers solitary, axillary, subverticillate; peduncles terete, glabrous, 3–3.5 cm. long, somewhat thickened at the apex; bracteoles 2, persistent, opposite, immediately below the calyx, unequal, broadly ovate to deltoid, ca. 3 mm. long, 2–3 mm. wide; sepals 5, imbricate, unequal, glabrous, obovate to rounded, the outer ones 5 mm. long, the inner ones 15 mm. long; petals 5 [fide Gagnepain], orbicular, strongly concave, 12 mm. diameter in the bud; stamens very numerous, free, 7 mm. long, glabrous, the anthers basifixed, 5 mm. long, linear, bi-mucronate at the apex, 2-celled, the cells unequal, the filaments short, 2 mm. long, flattened; the ovary immersed at the base in the torus, pyramidal, 5 mm. long, 2-celled, 5-lobed at the apex, the stigmas [5] obtuse, erect, the ovules 2 to each cell, pendulous from the top of the placenta. Fruit baccate, subinferior, free only at the apex, otherwise joined with the calyx-tube, leathery, usually pustular dotted, globular or rounded, 2 cm. diameter, crowned by the persistent sepals, 2-celled, each cell 2-seeded. Seeds with a woody testa, covered with (reddish ?) arillae.

INDO-CHINA: Annam: Prov. Ht. Donnai; between Dang-kie and Yonglé, *E. Poilane 23425* (AA), January 28, 1934. — Braïan, near Djiring, alt. 1200 m., *E. Poilane 24470* (Paris, SYNTYPE of *Paranneslea donnaiensis*), Feb. 22. 1935.

A syntype of *Paranneslea donnaiensis* was borrowed from the herbarium of the Paris Museum in the hope of studying the floral structure. However, since only a single flowering bud was found attached to the specimen, I decided to rely on Gagnepain's notes for the above description of petals, stamens, and ovary, rather than remove the bud.

Gagnepain's description was obviously drawn from the bud rather than from open or mature flowers. The petals may be similar in shape to those of either *A. fragrans* or *A. steenisii*. I assume from the description that "orbicularia . . . in alabastro 12 mm. diam." refers to the shape and size of the bud rather than the individual petals. No reference to a style of any sort was made by Gagnepain. Gagnepain seems dubious about the number of ovules in each cell, citing two. This number may vary, possibly, as it does in *A. fragrans* and *A. steenisii*.

Examining the above cited fruiting specimen (*Poilane 23425*), there is no obvious character to remove it from *A. fragrans* except the solitary arrangement of the fruit in the axils of the leaves. This same specimen was available to Gagnepain in the Paris Herbarium, since he earlier cited it (Fl. Gen. Indochine Suppl. **1: 278. 1943**) as *A. fragrans*.

Up to the present time the fruit has not been described. In the above description, details for the fruit were taken from *Poilane 23425*, a specimen collected close to the type locality.

All the fruits dissected for this study showed two well-developed cells with two mature seeds in each cell measuring ca. 12 mm. in length and 5–7 mm. across. As mentioned earlier in this paper, the bi-mucronate anthers, the five pistils, and the solitary axillary pedicels constitute the principal differences separating this species.

The specific name appeared only once in Gagnepain's publication and was printed "*donnalensis*." Since the name is obviously derived from the Province Ht. Donnai, I presume the spelling *donnalensis* is a mechanical error, and I have here corrected it to *donnaiensis*.

ARNOLD ARBORETUM,
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ERIANDRA, A NEW GENUS OF POLYGALACEAE FROM NEW GUINEA [1]

P. VAN ROYEN AND C. G. G. J. VAN STEENIS

With one plate

AMONG THE UNIQUE COLLECTIONS made by Mr. L. J. Brass on the Archbold Expeditions to New Guinea, we found a most remarkable plant which had been sent to this herbarium under the provisional name *Sideroxylon.* An examination of the characters convinced us that it is closely related to *Diclidanthera*, *Moutabea*, and *Barnhartia*, three genera of the Polygalaceae known only from South America. From a plant-geographical standpoint this is most remarkable, but this type of distribution is by no means unique though still exceptional and interesting.

The group of American genera has a chequered taxonomical history which we need not recall here, since it has been done previously by other authors (O'Donell, Erdtman, Sandwith & Sprague).

In comparing the four genera it appears that they show a reticulate affinity, i.e., their conformity is different when different characters are chosen for comparison.

The four genera are either trees (*Eriandra*) or shrubs, while the leaves are spirally arranged [2] and entire. The inflorescences are either axillary or terminal. In comparison with the other three genera *Eriandra* is pauciflorous.

The leaves of *Eriandra* have a light greenish yellow colour when dried, reminiscent of some species of *Xanthophyllum*, which influenced the senior author in giving as sight determination: "a Xanthophyllum with regular flowers." This yellowish colour is often due to the presence of a certain amount of aluminium, and since according to Chenery (1948) the other three genera belong to the aluminium-containing plants, it is reasonable to assume that *Eriandra* belongs to the same group.

In the absence of glands on the leaves, petioles, bracts, and bracteoles, *Eriandra* differs from the other three genera.

The calyx in *Eriandra* is 4- or 5-merous and 5-merous in the other three genera. The corolla is 5-merous in the four genera, actinomorphic in *Diclidanthera* or subactinomorphic in *Eriandra*, subzygomorphic in *Barnhartia*, and zygomorphic in *Moutabea*. The zygomorphy in

[1] Results of the Richard Archbold Expeditions.

[2] The term "alternate" as used by Sprague & Sandwith to indicate the spiral phyllotaxis in *Barnhartia* seems less preferable in botanical terminology. In all four genera of the Moutabeae the leaves are spirally arranged.

Moutabea is partly due to the boat-shaped lower petal and the zygomorphic androecium. The subzygomorphy in *Barnhartia* is determined by the absence of two or three stamens and to the (very weak) union of four petals in two pairs. Gleason (**1926**) points out that the slight connation of the paired petals is facilitated by their approximation on the margin of the hypanthium away from a normal position alternate with the sepals; thus one might conclude that a slight zygomorphy is also found in this shifting of the petals.

The petals in *Eriandra, Moutabea,* and *Diclidanthera* are united into a tube and are free in the apical parts only, but in *Barnhartia* the five petals are free, four of them cohering in two pairs. In *Moutabea*, however, the tube is deeply incised at the dorsal side.

In *Eriandra, Diclidanthera,* and *Moutabea* the eight or ten stamens are united into a single column which is united with the corolla, but in *Barnhartia* the seven or eight stamens are inserted on the petals but never united into a tube. In *Moutabea* this tube is open at the dorsal side.

In the four genera the anthers dehisce with one tangential slit, a character which is otherwise not found in the Polygalaceae.

On the structure of the pollen we have a report by Dr. G. Erdtman, Director of the Palynological Laboratory at Stockholm, to whom we sent some material and who, in **1944**, examined the pollen of *Diclidanthera.* He pointed out that the pollen closely resembled that of *Xanthophyllum, Salomonia,* and *Polygala.* We investigated the pollen grains of *Barnhartia floribunda* Gleason, and as our drawing shows, it is closely related to *Diclidanthera* and to *Eriandra.* The pollen grains of *Eriandra fragrans* are slightly constricted at their equator, and in the opinion of Dr. Erdtman this character may be seen as an evidence in favour of the distinction of a new polygalaceous genus. His pollen diagnosis, which he kindly put at our disposal, runs: "pollen grains **8–9**-colporate (zonate), prolate spheroidal (**30** x **28**μ) slightly constricted at their equator. Sexine probably thicker than nexine; OL pattern (faint; can be seen at least near the equator)."

The ovary of *Eriandra* is 7- or 8-celled, that of *Diclidanthera* 5-celled (fruit 5–7(!)-celled), *Moutabea* 4- or 5-celled (fruit 2–5-celled), and that of *Barnhartia* 2- or 3-celled. In all cases the cells contain one pendulous ovule.

The styles are densely pubescent in *Eriandra, Barnhartia,* and *Diclidanthera,* but glabrous in *Moutabea.*

The stigmas are capitate, papillate in *Eriandra, Diclidanthera,* and *Barnhartia,* but subquinquelobate to bilabiate and slightly infundibuliform in *Moutabea,* as is clearly shown in Miquel's drawing in the Flora Brasiliensis **7:** *pl. 5, f. 13* and *14.* The authors found a bilabiate stigma.

According to Chodat (**1897**) and Oort (**1932**) a disk seems to be present in *Moutabea.* However, neither in Aublet's description (**1775**) nor in the one given by Miquel (1856) is there a disk represented. We could not find the slightest indication of this character.

Considering the details given above, the proper place of *Eriandra* is in the Polygalaceae in the affinity of *Barnhartia*, *Moutabea*, and *Diclidanthera*, to the last of which it is most closely related. The four genera are best placed together in the tribe Moutabeae. Arranged according to affinity with the tribe Polygaleae *Barnhartia* seems to come first, followed by *Moutabea*, whilst *Eriandra* and *Diclidanthera* show the least relationship. The four genera form a series of genera running from zygomorphic to actinomorphic and from choripetalous to gamopetalous flowers. Related to this last character is the uniting of the stamens, which are free in *Barnhartia* and form a staminal tube in *Diclidanthera* and *Eriandra*. *Moutabea* forms an intermediate stage, as the eight stamens are united into two bundles, though still in one tube which is open at the dorsal side.

As the characters of the Moutabeae given by Chodat (1897) have to be emendated to include the four genera, we propose to give the following definition of this tribe:

Tribe **Moutabeae**

Calyx and corolla united at the base on a torus. Calyx united. Corolla free, cohering or united, quincuncial in bud. Stamens 7, 8 or 10, united into a tube or free and inserted on the free petals, sometimes in two bundles. Anthers dehiscing with one tangential slit. Carpels 2–8, united, with one ovule in each cell. Trees or shrubs with entire, spirally arranged leaves.

Four genera with ten species, in South America and New Guinea.

KEY TO THE GENERA

1. Stamens 8 or 10, connate in a tube.
   2. Calyx 5-merous, quincuncial in bud. Anthers glabrous. Ovary 5-celled. Base of bracts and base of leaf-margin provided with a gland . . . . *Diclidanthera* Martius.
   2. Calyx 4-merous, decussate or 5-merous, quincuncial. Anthers densely pubescent. Ovary 7- or 8-celled. Glandless . . . . *Eriandra* nov. gen.
1. Stamens 7 or 8, either in 2 bundles or not connate in a tube.
   3. Flowers markedly zygomorphic. Corolla tubular, splitting at the dorsal side. Upper 2 stamens absent, the others in two bundles of 4. Anthers transversely ellipsoidal. Ovary 4- or 5- celled, style glabrous, stigma sub-5-lobed and subinfundibuliform or bilabiate. Leaf-blade and petiole glandless . . . . *Moutabea* Aublet.
   3. Flowers subzygomorphic. Petals connivent, not united. Stamens inserted on the petals, not united into a tube. Anthers longitudinally ellipsoidal. Ovary 2- or 3-celled, style densely pubescent, stigma discoid-capitate. Apex of the petiole with a gland on either side. . . . . *Barnhartia* Gleason.

Eriandra gen. nov.

Arbor parva, foliis spiraliter ordinatis petiolatis integris; racemis axillaribus parvis paucifloris; floribus epigynis actinomorphis subzygomorphisve; sepalis 4 vel 5 decussatis vel quincuncialibus, basi connatis; petalis 4 vel 5 pro 3/4 longitudinis connatis in tubum calyci adnatum, apice tantum liberis; partibus liberis decussatis vel imbricatis orbicularibus; staminibus 8 vel 10 coalitis in tubum corollae adnatum, nunc uno latere paululo exsculptum; antheris transverse ellipsoideis, fissura communi transversa dehiscentibus; valvis 2, dense longeque pilosis; pollinis granulis in 8-vel 9-colporatis; ovario globoso glabro, 7-vel 8-loculari; loculis omnibus uniovulatis; stylo dense piloso; stigmate discoideo-capitato, papillato; fructu adhuc ignoto.

TYPUS: *E. fragrans*.

Eriandra fragrans sp. nov.

Arbor parva corona umbrosa instructa; trunco irregulariter et profunde sulcato (truncum spurium Ficorum epiphyticarum nonnullarum in mentem revocante): ramulis glabris; internodiis 0.5–2.5 cm. longis; foliis ellipticis oblongisve basi anguste cuneatis apice acutis 15–20 cm. longis 5–7 cm. latis coriaceis, utraque facie subnitentibus et glabris sed in facie inferiore costae mediae interdum pilis paucis raris conspersis; costa media subtus prominente, in facie superiore basi subcanaliculata, apice prominente; nervis lateralibus utroque latere costae mediae 12–16, subtus distincte prominentibus, supra prominulis; margine revoluta; petiolo supra applanato, parte inferiore rugoso, 1–2.5 cm. longo; floribus albis fragrantibus; racemis circ. 1 cm. longis; pedunculo communi breviter piloso, circ. 6 mm. longo; bracteis bracteolisque cymbiformibus obtusis; bracteis dense pilosis circ. 1 mm. longis; bracteolis subglabris circ. 0.5 mm. longis pedicellis 1–5 mm. longis, glabris; sepalis spathulatis obovatisve, 4–5.5 mm. longis, utrimque glabris, exterioribus margine toto, inferioribus parte apicali tantum fimbriatis; partibus petalorum liberis circ. 3 mm. longis, praeter margines fimbriatos glabris, in sicco rubiginosis; tubi staminei membranacei parte libera extus glabra, intus pilosa; antheris circ. 0.8 mm. latis; pollinis granulis plus minusve 30μ longis, ca. 28μ crassis; ovario plus minusve 2 mm. diametiente; stylo 3–4 mm. longo.

TYPE: *L. J. Brass 7767* in L, duplicate in A.

PAPUA: Western Division, Lake Daviumbu, Middle Fly River, rain forest, *Brass 7767* (TYPE in L; duplicate in A), Sept. 1936 (common small canopy tree; whole length of trunk deeply indented and flanged, like some strangling figs. Flowers white, fragrant).

NETHERLANDS NEW GUINEA: Mt. Arfak, Putat, *Beccari 9928* (in herb. Firenze), anno 1872 (loose flowers).

The name *Eriandra* is chosen on account of the pubescent anthers, while the specific epithet is used because of the fragrant flowers.

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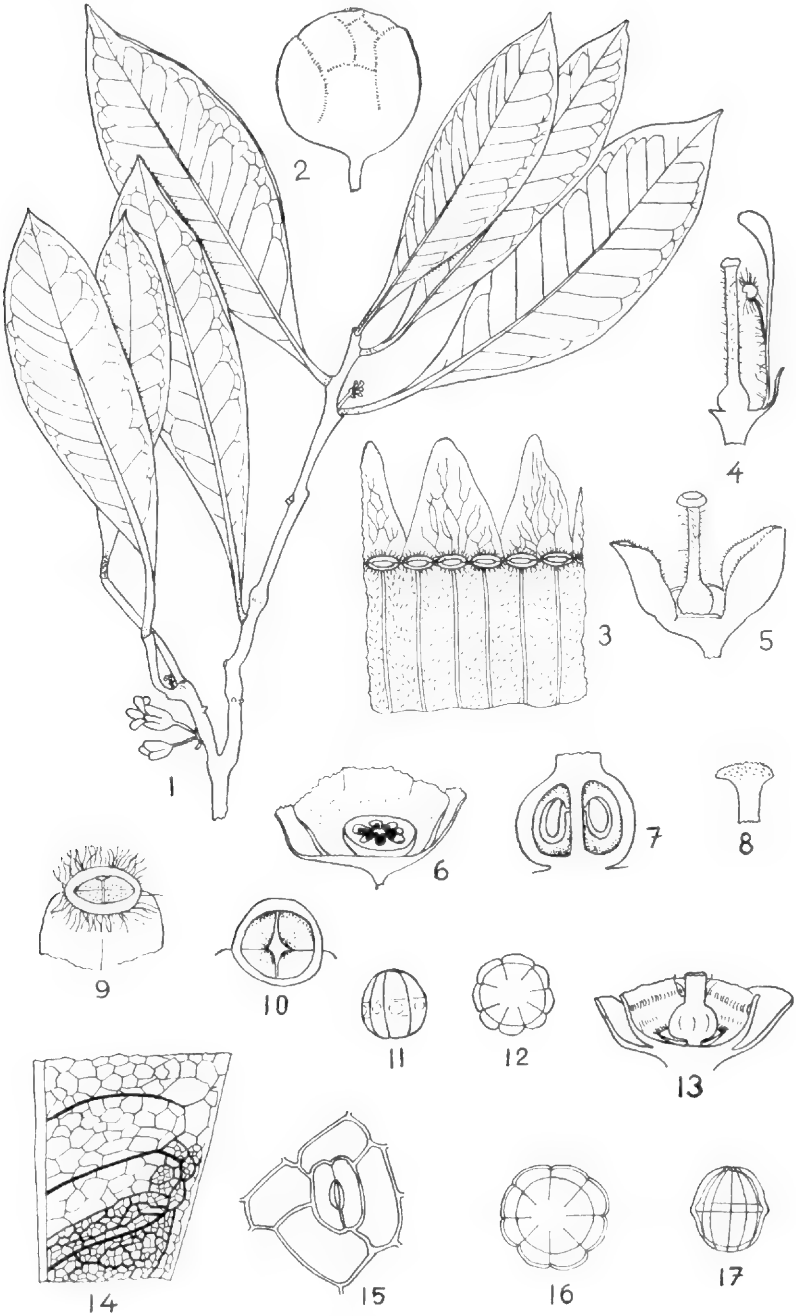
EXPLANATION OF PLATE

PLATE I

Eriandra fragrans Van Royen & Van Steenis (*Brass 7767*): 1. habit, × 1/3; 2. bud; 3. part of corolla from inner side, flattened; 4. longitudinal section of flower (schematic); 5. flower with 2 sepals, corolla and androecium removed; 6. base of flower with cross-section of ovary; 7. longitudinal section of ovary; 8. stigma; 9. anther; 10. ditto, showing the vertical septum; 11–12. pollen grains; 13. basal part of flower in section; 14. detail of leaf-nervation, underside; 15. stomatal apparatus. *Barnhartia floribunda* Gleason: 16–17. pollen grains. Except in fig. 1 all details enlarged.

RIJKSHERBARIUM,
LEIDEN, NETHERLANDS.



ERIANDRA FRAGRANS VAN ROYEN & VAN STEENIS

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STUDIES OF PACIFIC ISLAND PLANTS, XI [1]
FURTHER NOTES ON FIJIAN FLOWERING PLANTS

A. C. Smith

The present paper concludes from No. VII of this series (in Jour. Arnold Arb. 31: 288–319. 1950) a discussion of recently collected noteworthy plants of angiosperm families in Fiji; here are included the families from Rhizophoraceae to Compositae, in the Engler and Prantl sequence. The description of a new species of Theaceae, kindly contributed by Dr. C. E. Kobuski, is also here included. This paper completes the study of the specimens collected by the writer in 1947,[2] with the exception of a few families which are being studied more intensively and which will form the subject matter of further reports in this series. The place of deposit of cited specimens is indicated as follows: Arnold Arboretum (A); British Museum (BM); Gray Herbarium (GH); Royal Botanic Gardens, Kew (K); New York Botanical Garden (NY); and U. S. National Herbarium (US).

THEACEAE

By C. E. Kobuski

Eurya greenwoodii Kobuski, sp. nov.

Frutex 2–3 m. altus; ramis ramulisque glabris, teretibus rubro-brunneis. Folia subcoriacea vel submembranacea, glabra (gemmis basi leviter pubescentibus), ovalia vel ovata, 3–4.5 cm. longa, 1.5–2 cm. lata, apice breviacuminata, leviter retusa, basi rotundata vel cuneata, margine plana basi conspicue revoluta, costa supra canaliculata subtus elevata, venis 7 vel 8

[1] No. X of this series was published as Vol. 30, Part 4, of Contributions from the U. S. National Herbarium (1952).

[2] Under the auspices of the Arnold Arboretum of Harvard University and the John Simon Guggenheim Memorial Foundation, with the aid of grants from the Penrose Fund of the American Philosophical Society and the Bache Fund of the National Academy of Sciences.

paribus ad marginem reticulatis, petiolis teretibus 3–4 mm. longis, glabris. Flores axillares, 2–5-fasciculati erecti vel nonnumquam cernui; ♂ : ignoti; ♀ : pedicellis teretibus 2–2.5 mm. longis, pubescentibus; bracteolis 2, oppositis, persistentibus, pubescentibus rotundatis vel subrotundatis circa 1 mm. longis et 1 mm. latis, apiculatis; sepalis 5, imbricatis, glabris, inaequalibus, 1.5–2 mm. longis, 2–2.5 mm. latis, concavis, margine scariosis; petalis 5, albis, late oblongis, 3.5–4 mm. longis, 2–2.5 mm. latis, apice leviter retusis, basi ½ connatis; staminodiis 0; ovario globoso, glabro 1.5–2 mm. diametro 4-loculato (raro 3-loculato), loculis multiovulatis; stylis 4, liberis, circiter 0.5 mm. longis, maturitate recurvatis. Fructus ignotus.

VITI LEVU: Mba: Immediate vicinity of Nandarivatu, alt. 800–900 m., June 26, 1947, *Smith 4898* (A TYPE, US) ("samu ni mbati"; compact shrub 2–3 m. high, in dry forest; petals white); same locality, *Greenwood 236A* (A) (much branched shrub to 3 m. high; flowers white), *Degener 14799* (A, US) (spreading shrub abeut 1 m. high, in scrub vegetation).

This species is most closely allied to *E. vitiensis* A. Gray, but can be separated from the latter by the smaller glabrous oval or ovate leaves (3–4 cm. long), and by the glabrous branchlets and terminal buds. In *E. vitiensis* the obovate leaves are longer, measuring up to 7.5 cm. long, and with pubescent petioles. The very young branchlets and terminal buds are also pubescent. The three cited specimens of the new species bear only pistillate flowers.

RHIZOPHORACEAE

Crossostylis pedunculata sp. nov.

Arbor gracilis ad 8 m. alta, ramulis validis, juvenilibus complanatis pilis circiter 0.3 mm. longis stramineis copiose pilosis mox glabrescentibus, internodiis 2–2.5 cm. longis; stipulis oblongo-lanceolatis circiter 13 mm. longis et 4 mm. latis dorso basim versus puberulis ceterum glabris caducis; petiolis rugulosis subteretibus 15–25 mm. longis ut ramulis decidue pilosis; laminis in sicco fuscis chartaceis ellipticis, 10–13 cm. longis, 5–8 cm. latis, basi obtusis et in petiolum longe decurrentibus, apice obtuse cuspidatis saepe obscure emarginatis, margine basim versus integris superne crenatis (crenaturis circiter 2 per centimetrum), praeter costam subtus ut petiolum pilosam utrinque glabris, costa supra subplana subtus prominente, nervis secundariis utrinsecus 8 vel 9 arcuato-patentibus utrinque leviter elevatis, rete venularum irregulari utrinque subprominulo vel immerso; inflorescentiis binis in axillis superpositis pedunculatis, pedunculo crasso subtereti 6–9 mm. longo ut petiolo breviter piloso; floribus ut videtur 2 per inflorescentiam primo involucro (bracteis connatis) ovoideo circiter 9 mm. longo parce piloso apice cuspidato unilateraliter fisso inclusis; pedicellis sub anthesi 6–9 mm. longis stramineo-hispidulis; calyce carnoso rotato-cupuliformi 8–10 mm. diametro extus parce strigilloso plerumque 5-lobato, lobis oblongo-deltoideis circiter 4 mm. longis 2.5–3 mm. latis apice subacutis et hispidulis; petalis mox caducis submembranaceis obovatis circiter 5 mm. longis et 2 mm. latis, basim versus angustatis, apice emarginatis et inconspicue glanduloso-erosulis, praeter lineam medianam dorsalem hispidulam glabris; disco carnoso perigyno margine libero et obscure hispidulo; staminibus plerumque 20, filamentis gracilibus teretibus glabris 2–2.5 mm. longis, antheris oblongis circiter 0.8 mm. longis; ovario subcomplanato faciei superiore copiose sed minute hispidulo, stylo crasso circiter 1.5 mm. longo glabro apice radiatim plurilobato, lobis reflexis filiformibus stigmatosis plus minusve coadnatis.

VANUA LEVU: Thakaundrove: Natewa Bay region, hills west of Korotasere, alt. 100–300 m., June 8, 1934, *Smith 1925* (GH, NY, US 1676416 TYPE, etc.) (slender tree 8 m. high, in forest; calyx-lobes and filaments white).

The collection described above was originally identified by me as *C. seemanni* (A. Gray) Schimp., and as such duplicates were distributed. However, it clearly differs from *C. seemanni* in its less copiously pubescent young parts and its glabrous stipules and leaf-blades, by having its flowers borne at the apex of short stout peduncles, and in its larger flowers, which furthermore have the sepals and petals only sparsely pilose and the filaments comparatively long. In foliage the new species is suggestive of *C. biflora* Forst., of the Society Islands (whether or not this includes the Samoan form discussed by A. Gray, Bot. U. S. Expl. Exped. **1**: 610. *pl. 77.* 1854, and Christophersen, in Bishop Mus. Bull. **128**: 155. 1935), and *C. banksiana* Guillaumin, from the New Hebrides. From these, however, *C. pedunculata* differs in the pubescence of its young parts and flowers. It further differs from *C. biflora* in its smaller flowers, with shorter filaments and style and without staminodes or disk-lobes. *Crossostylis banksiana* appears to have flowers smaller than those of *C. pedunculata* and petals pilose within, but it is perhaps the closest ally of the new species.

Crossostylis pachyantha sp. nov.

Arbor parva ubique praeter flores glabra, ramulis subteretibus (juvenilibus subquadrangularibus); stipulis in sicco subcoriaceis lanceolatis 10–15 mm. longis; petiolis gracilibus 10–17 mm. longis margine leviter angulatis; laminis in sicco coriaceis fuscis elliptico-obovatis, 8–12 cm. longis, 3–5 cm. latis, basi attenuatis et in petiolum longe decurrentibus, apice rotundatis vel obscure emarginatis vel obtusis, margine integris, costa supra in sulculam elevata subtus prominente, nervis secundariis utrinsecus 7–9 erecto-patentibus marginem versus curvatis et anastomosantibus supra subplanis subtus leviter elevatis, rete venularum immerso vel subtus laxe subprominulo; inflorescentiis apices ramulorum versus axillaribus breviter pedunculatis, pedunculo crasso haud 3 mm. longo apice ut videtur flores circiter 4 gerente, bracteis non visis; pedicellis validis glabris sub anthesi 5–8 mm. longis in sicco superne leviter angulatis, floribus apice circiter 7–8 mm. diametro; calyce crasso-carnoso rotato-cupuliformi extus glabro, lobis plerumque 5 interdum 4 oblongo-deltoideis 3–4 mm. longis 2–3 mm. latis apice subacutis intus pilis 0.1–0.2 mm. longis fulvis dense sericeo-tomentellis; petalis mox caducis carnosis valde carinatis obovatis circiter 3.5 mm. longis et 2 mm. latis, basi valde angustatis, apice emarginatis, utrinque basim et medium versus puberulis; disco carnoso perigyno glabro margine haud libero; staminibus 21–26, filamentis crassis 0.5–0.7 mm. longis glabris, antheris oblongis circiter 0.7 mm. longis; gynoecio glabro, ovario subcomplanato sub anthesi ad 3 mm. diametro inconspicue 10–12-lobato, ovulis numerosis (ut videtur 20–24) geminatim radiatis; stylo crasso (ad 1 mm. diametro) tereti circiter 1.5 mm. longo apice radiatim plurilobato, lobis filiformibus stigmatosis in peltam carnosam ad 2 mm. diametro coadnatis.

VITI LEVU: Naitasiri: Near Tholo-i-suva, alt. about 200 m., Feb. 23, 1947, *J. H. Vaughan 3370* (BM TYPE) (small tree, with dark, shiny foliage and green flowers); Nasinu, *Gillespie 3650* (GH).

In general appearance and leaf-shape, the species here described could be taken for a form of *C. richii* (A. Gray) A. C. Sm., although it is more robust in vegetative parts than any available specimens of *C. richii*, which now appears to be the most abundant species of the genus in Fiji. In inflorescence characters, however, the two species are quite different, *C. pachyantha* being at once distinguished by the thick texture of its much larger calyx, the dense indument of the inner surface of calyx-lobes, the numerous stamens and ovules, the glabrous ovary with 10–12 radiating sulcae, and the stout style with numerous stigmatic branches.

COMBRETACEAE

Terminalia vitiensis A. C. Sm. in Sargentia 1: 74. 1942.

VANUA LEVU: Mathuata: Southern slopes of Mt. Numbuiloa, east of Lambasa, alt. 350–500 m., *Smith 6441* (A, US) (tree 5 m. high, in thin forest on rocky slope; calyx, filaments, and style pale yellowish green).

The cited specimen, the second known of the species, agrees excellently with the type, from the Province of Serua on Viti Levu. The only points of difference are minor; the Mathuata specimen has the leaf-blades rarely larger, up to 10 × 4.5 cm., the rachis and pedicels sparsely pilose rather than glabrous, the pedicels longer (up to 7 mm. long), and the filaments and style up to 15 mm. in length.

Terminalia luteola sp. nov.

Arbor multiramosa ad 8 m. alta, partibus novellis pilis aureis 0.6–1 mm. longis copiose hispidulo-sericeis, ramulis infra folia apice congesta copiose cicatricosis glabratis demum cinereis apicem versus ad 8 mm. diametro; petiolis semiteretibus 0.7–2 cm. longis ut ramulis juvenilibus copiose patenti-pilosis, laminis chartaceis siccitate fusco-olivaceis late obovatis, 8–12 cm. longis, 5–8 cm. latis, basi obtusis in petiolum breviter decurrentibus, apice rotundatis vel leviter emarginatis, margine integris, utrinque ut petiolo subpersistenter pilosis (pilis pallidis costa nervisque magis copiosis), costa supra paullo subtus valde elevata, nervis lateralibus utrinsecus 8–10 erecto-patentibus marginem versus curvatis utrinque elevatis, rete venularum laxo utrinque prominulo; inflorescentiis axillaribus spicatis sub anthesi 6–11 cm. longis, pedunculo ad 3 cm. longo et rhachi gracilibus pilis mollis 0.3–0.6 mm. longis copiose tomentellis; floribus numerosis congestis sessilibus bracteolatis, bracteolis reflexis oblongo-linearibus 3–5 mm. longis utrinque copiose tomentellis; calyce infundibuliformi 6–8 mm. longo extus pilis 0.3–0.4 mm. longis copiose et molliter tomentello, tubo 2–3.5 mm. longo 2–2.5 mm. diametro basi truncato, limbo tenuiter carnoso 4–5 mm. longo intus pilis 1–1.3 mm. longis pallidis sericeo, lobis deltoideo-lanceolatis circiter 2 mm. longis acutis; lobis disci 5 carnosis copiose hispidulis; staminibus 8–11, filamentis filiformibus sub anthesi 7–9 mm. longis glabris superne angustatis, antheris oblongo-ellipsoideis circiter 1 mm. longis, loculis ad medium liberis; stylo in floribus ☿ tereti carnoso 8–11 mm. longo glabro superne contracto, in floribus ♂ rudimentario; ovulis 2 a funiculis gracilibus pendulis.

Vanua Levu: Mathuata: Southern slopes of Mt. Numbuiloa, east of Lambasa, alt. 350–500 m., Oct. 29, 1947, *Smith 6409* (A type, US) (tree 8 m. high, in transitional zone between reed-covered slopes and forest; filaments and style yellowish green; anthers yellow).

Although the new species was collected in the same locality as *T. vitiensis* A. C. Sm., noted above, it is not closely related to that species, being immediately distinguished by its dense indument, larger leaves, sessile flowers, etc. *Terminalia litoralis* Seem. has leaves somewhat resembling in shape those of the new species, but they are glabrous or essentially so and the inflorescence is also glabrous and has small pedicellate flowers.

MELASTOMATACEAE

Medinilla subviridis sp. nov.

Frutex scandens, partibus novellis et ramulorum apicibus copiosissime tomentosis, pilis pallide ferrugineis 1–2 mm. longis multicellularibus lateraliter brevi-calcaratis, ramulis elongatis gracilibus teretibus vel superne inconspicue sulcatis mox glabratis cinerascentibus, internodiis 2–4 cm. longis; foliis valde disparibus minoribus mox caducis; foliis majoribus: petiolis leviter canaliculatis 5–15 mm. longis ut ramulis juvenilibus tomentosis demum glabratis, laminis chartaceis in sicco fusco-olivaceis oblongo-ellipticis, 10–15 cm. longis, 3.5–7 cm. latis, basi obtusis vel rotundatis raro subattenuatis vel leviter cordatis, apice obtusis vel breviter cuspidatis (apice ipso haud 1 cm. longo), 5- vel 7-nerviis, nervis superioribus cum costa ad 1–2 cm. conjunctis supra planis vel interdum leviter sulcatis subtus valde elevatis, nervis aliis debilioribus, venulis transversis subtus prominulis aliis immersis, primo ut ramulis pilosis demum supra glabratis subtus certe nervis subpersistenter tomentellis; foliis minoribus: petiolis subnullis, laminis suborbicularibus vel ellipticis, 1–2.5 cm. longis latisque, basi rotundatis saepe amplexicaulibus, apice rotundatis vel obtusis, inconspicue 3- vel 5-nerviis, demum glabratis; inflorescentiis axillaribus vel e ramulis infra folia orientibus solitariis cymoso-racemosis, 2–5 cm. longis paucifloris (floribus in verticillis 1–3 dispositis); pedunculo brevi (haud 1 cm. longo) et rhachi teretibus gracilibus pilis pallide brunneis circiter 1 mm. longis copiose tomentosis demum subglabratis; bracteis 3 vel 4 e nodis papyraceis oblongis, 3–7 mm. longis, 1.5–3 mm. latis, basi et apice obtusis, primo ut rhachi pilosis demum glabratis; floribus 3 vel 4 e nodis, pedicellis gracilibus 3–5 mm. longis sub anthesi ut rhachi copiose pilosis; bracteolis apice pedicellorum binis florem obtegentibus submembranaceis deltoideo-ovatis, 12–20 mm. longis, 9–15 mm. latis, basi et apice rotundatis, utrinque molliter pilosis (pilis patentibus 0.3–0.7 mm. longis breviter calcaratis) demum subglabratis; calyce sub anthesi circiter 5 mm. longo et apice diametro carnoso, tubo cupuliformi 2.5–3 mm. longo basi rotundato et supra bracteolas minute stipitato ut bracteolis dense tomentoso (pilis ad 1 mm. longis), limbo suberecto membranaceo subintegro vel minute 4-dentato; petalis 4 membranaceis glabris oblongo-obovatis, 7.5–8.5 mm. longis, 6–7 mm. latis, basi angustatis, apice rotundatis et paullo retusis, obscure nervatis; staminibus 8, filamentis gracilibus glabris circiter 3 mm. longis, antheris oblongis 1.7–2 mm. longis, basi trilobulatis (lobis 2 anterioribus haud projectis, lobo posteriore circiter 0.4 mm. diametro), apice obtusis, poris confluentibus; stylo carnoso tereti circiter 5 mm. longo, stigmate minuto; fructibus subglobosis demum glabratis, calycis limbo persistente, pericarpio tenui, seminibus numerosis.

VITI LEVU: Naitasiri: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi [Mt. Victoria] and Nasonggo, alt. 870–970 m., Sept. 18, 1947, *Smith 6112* (A TYPE, US) (liana, in dense forest; bracts and bracteoles pale greenish white or very faintly pink-tinged; calyx white with pale brown pubescence; petals, filaments, and style pure white; anthers rich blue with bright yellow basal lobes; fruit rich purple); same locality, Aug. 21, 1947, *Smith 5793* (A, US) (high-climbing liana, in dense forest; bracts and bracteoles thin, very pale green, with brown puberulence; calyx white, similarly puberulent; corolla pure white; filaments and style white; anthers rich purple with bright yellow basal lobes; young fruit white to pale green, then blue-tinged).

The species here described, observed at only one locality, in central Viti Levu, is without close relatives, at least in Fiji and the adjacent archipelagos. In general type of indument and in bracteole-size the new species approaches *M. longicymosa* Gibbs, but differences in foliage, length of trichomes, color of inflorescence-parts, size and shape of bracts, shape of bracteoles, and dimensions of petals and stamens are so great that comparison of the two species is superfluous. A closer ally of *M. subviridis* may be *M. rhodochlaena* A. Gray, which suggests it in leaf-shape, type of trichomes, proportions of bracts and bracteoles, and flower-size, but *M. rhodochlaena* has rich pink bracts and bracteoles, the latter being only 4–11 mm. in diameter.

Astronidium degeneri A. C. Sm. in Sargentia 1: 93. 1942.

VITI LEVU: Mba: Northern portion of Mt. Evans Range, between Mt. Vatuyanitu and Mt. Natondra, alt. 700–900 m., *Smith 4359* (A, US) (tree 13 m. high, on edge of forest); mountains near Lautoka, alt. about 550 m., *Greenwood 931* (A).

The second and third known collections of this species agree very closely with the type, which was obtained at lower elevation near the south coast of Viti Levu.

ARALIACEAE

Plerandra pickeringii A. Gray, Bot. U. S. Expl. Exped. 1: 729. *pl 95.* 1854.

This striking species is the common *sole* or *sole ndina* (i. e. the true *sole*) of the Fijians. It is readily recognized by its very large leaves (with petioles up to 1 meter long, the 9–12 leaflets up to 40 × 18 cm. or more) and robust compound umbels (with 10–15 rays, each as much as 30 cm. long and with 30–60 flowers). Gray's original description of the staminate flowers is more or less correct, except for the reference to "stamens . . . as many as 60 or 70." Actually the stamens, in both staminate and perfect flowers, are between 200 and 300, crowded in 5–7 series; the type specimen (*U. S. Expl. Exped.*, US 62359) also bears this out. In both staminate and perfect flowers the ovary seems well developed, with 13–16 locules, but in the former case the ovules are abortive and the stylopodium is inconspicuous, truncate, and depressed at the center; in perfect flowers the stylopodium is elongate (up to 1 cm. long in fully developed fruits) and composed of styles firmly connate to the apex. Among my recent collections the species is represented by nos. 4021 and 5803 (staminate flowers) and 6896 (perfect flowers and fruits). I do not find that this species has the petals connate into a calyptra, a character emphasized by Seemann (Fl. Vit. 117. 1865); in most specimens the petals tend to separate before falling, but I do not believe the degree of coherence to be a reliable character.

Plerandra insolita sp. nov.

Arbor gracilis ad 9 m. alta pauciramosa ubique glabra, ramulis crassis teretibus fistulosis, foliis apices ramulorum versus aggregatis magnis; petiolis crassis subteretibus interdum copiose verrucoso-lenticellatis 40–50 cm. longis, basi in vaginam coriaceam 2–4 cm. latam dilatatis, ligula oblonga 1.5–2 cm. longa; foliolis 7–12 (plerumque 9–11), petiolulis crassis semiteretibus vel leviter canaliculatis 3.5–5.5 cm. longis, laminis in sicco subcoriaceis et fusco-olivaceis oblongo- vel anguste obovato-ellipticis, 20–35 cm. longis, 5–9 cm. latis, basi acutis vel attenuatis, apice obtusis vel rotundatis, margine integris et anguste recurvatis, costa valida utrinque prominente, nervis secundariis utrinsecus 15–25 erecto-patentibus curvatis utrinque elevatis, rete venularum immerso vel subtus prominulo;

inflorescentia pro genere compacta e ramulis infra folia oriente composito-pseudoumbellata, radiis 5–7 (4–7 cm. longis) apice pedunculi brevis (1–5 cm. longi) dispositis, pedunculo et radiis inflorescentiae crassis (saepe 1 cm. diametro) conspicue verrucosis vel lenticellatis, radiis infra apicem incrassatis et ibi fructiferis vel copiose cicatricosis apice vel in centimetrum distale floriferis, umbellulis sub anthesi circiter 5 cm. diametro, floribus circiter 15–20 (♂ solis visis) bracteis subtentis, bracteis subcoriaceis oblongis ad 15×7 mm. apice rotundatis scarioso-marginatis longe persistentibus; floribus ♂ sub anthesi subsessilibus vel pedicellis (paullo post anthesin) ad 12 mm. longis crassis; calyce sub anthesi 7–9 mm. longo obconico-cupuliformi, tubo tereti vel leviter angulato, limbo subcoriaceo erecto-patente lobis 5 vel 6 late deltoideis circiter 1 mm. longis obtusis inclusis circiter 2 mm. longo; petalis 5 vel 6 (raro 4) in calyptram conicam subacutam videtur subconnatis crasso-carnosis deltoideis, 7–8 mm. longis, 4–6 mm. latis, apice valde incrassatis et subacutis; staminibus numerosis (circiter 75) disco carnoso annulari 2- vel 3-seriatis, filamentis paullo ante anthesin ligulatis superne angustatis gracilibus 2–3.5 mm. longis, antheris oblongis 2–2.5 mm. longis utroque obtusis; stylopodio breviter conico vel umbonato obtuso carnoso 4–5 mm. diametro margine lobato sulculis 9–12 radiatis ornato; ovario sterili 7–8 mm. diametro, muro valde incrassato fistulis numerosis longitudinalibus copiose notato, loculis 9–12 magnis, ovulis nullis vel sterilibus; fructibus e radiis inflorescentiae 2–3 cm. infra apicem enatis, pedicellis sub fructu crassis ad 15 mm. longis, fructibus coriaceis obovoideo-ellipsoideis ad 2.5 cm. longis et 1.8 cm. diametro conspicue 9–12-sulcatis, calycis limbo persistente et stylopodio coronatis, stylopodio oblongo-umbraculiformi circiter 1 mm. longo et 3 mm. diametro, stylis firme connatis apice radiatis sed haud liberis, pyrenis 9–12 coriaceis falcato-obovoideis valde complanatis ad 20 mm. longis et 7 mm. latis, semine forma simili circiter 13×5 mm.

VITI LEVU: Mba: Southern slopes of Mt. Ndelainathovu, on the escarpment west of Nandarivatu, alt. 870–970 m., June 26, 1947, *Smith 4922* (A TYPE, US) ("sole lailai"; slender tree 3–4 m. high, in dense forest; leaves terminal, with 9–11 leaflets; inflorescence arising just below leaves, composed of 5–7 umbels; petals deep purple without, pale green within; filaments white; anthers yellow; fruit black); Serua: Mbuyombuyo, near Namboutini, *Tabualewa 15584* (A, US, etc.) ("sole"; sparingly branched tree 9 m. high, in forest); Vatuvilakia, vicinity of Ngaloa, alt. 0–150 m., *Degener 15172* (A, US, etc.) ("sole"; unbranched tree 1–2 m. high, in open forest; petals purplish black without, greenish within).

The species described above is readily distinguished from the other Fijian *Plerandrae* by its compact inflorescence, of which the rays are not strictly umbelliform, the flowers being crowded upon the distal portion of each ray instead of arising from its actual apex. The three available collections are essentially identical in floral characters, all the available flowers being staminate. Fruits are borne from a swollen portion of the inflorescence-ray somewhat below the apex, indicating the polygamomonoecious character of the species; other species of the genus, in my observation, are polygamo-dioecious. In its large number of ovary-locules *P. insolita* suggests *P. pickeringii* A. Gray and *P. grayi* Seem., from both of which it differs in the characters mentioned above, the short-pedicellate and comparatively small flowers, the very thick ovary-walls traversed by copious longitudinal canals, etc.

EPACRIDACEAE

Leucopogon cymbulae Labill. Sert. Austro-Caled. 36. *pl. 39.* 1824; Seem. in Bonplandia **10**: 36. 1862, Fl. Vit. 147. 1866; Guillaumin in Bull. Soc. Bot. Fr. **74**: 699. 1927, in Jour. Arnold Arb. **13**: 11. 1932, in Bull. Soc. Bot. Fr. **82**: 350. 1935.

Leucopogon vitiensis A. Gray ex Seem. in Bonplandia **10**: 36, nomen. 1862.

VITI LEVU: Mba: Upper slopes of Mt. Koromba [Pickering Peak], alt. 800–1075 m., *Smith 4700* (A, US) (tree 5 m. high, on forested crest; fruit orange). KANDAVU: *Seemann 285* (GH). VANUA LEVU: Mbua: *H. B. R. Parham*, Jan. 7, 1937 (BM); Mathuata: Wainikoro, *Greenwood 703* (A) (shrub about 3 m. high, on dry open hillsides; flowers white; fruit yellow and finally red); between Ndreketi and Nasorowangga, *B. E. Parham 1094* (A); Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, alt. 100–200 m., *Smith 6667* (A, US) ("seruserumasala"; shrub or tree 2–4 m. high, frequent in open rolling country; corolla white; fruit dull orange; wood used in making small hand-drums); summit ridge of Mt. Numbuiloa, east of Lambasa, alt. 500–590 m., *Smith 6493* (A, US) (tree 3–5 m. high, in dense forest, locally abundant; corolla white; fruit at length orange). Fiji, without definite locality: *U. S. Expl. Exped.* (GH, US, source of the name *L. vitiensis*), *Horne 654* (GH), *H. B. R. Parham 14* (A).

The only previously published records of the occurrence of this genus in Fiji appear to be those of Seemann, cited above; Guillaumin has reported it from several islands in the New Hebrides, and it is frequently mentioned in literature pertaining to New Caledonia, the type locality. In the sense of Brongniart & Gris (in Ann. Sci. Nat. Bot. V. 2: 153. 1864), *L. cymbulae* is a variable species in New Caledonia. In general, the material from Fiji and the New Hebrides has the leaves longer and proportionately narrower than that from New Caledonia, but I find no inflorescence differences of note. Possibly the Fijian and New Hebrides specimens should receive varietal recognition, but at present this seems inadvisable and I am willing to follow Seemann and Guillaumin in their identifications.

As the above citations show, the species is rare in Fiji except in northern Vanua Levu; in Mathuata it is a very frequent component of the "talasinga" vegetation, but curiously there appear to be no collections of it from the similar zone of northern and western Viti Levu. The cited specimen from Mt. Koromba was obtained in a forested highland which interrupts the "talasinga" of western Viti Levu.

MYRSINACEAE

Maesa stenophylla sp. nov.

Frutex ad 4 m. altus ubique glaber, ramulis gracilibus teretibus fuscis lenticellis pallidis copiose verrucosis; petiolis gracilibus canaliculatis 8–12 mm. longis, foliorum laminis papyraceis siccitate fusco-viridibus lanceolatis, 7–12 cm. longis, 1.7–2.5 cm. latis, basi attenuatis et in petiolum decurrentibus, apice obtusis, margine integris vel undulatis et anguste revolutis, costa supra elevata subtus prominente, nervis lateralibus utrinsecus 4–6 valde adscendentibus elongatis supra planis vel prominulis subtus leviter elevatis, lineis nervilliformibus numerosis irregularibus subtus manifestis supra obscuris; inflorescentiis axillaribus racemosis vel anguste paniculatis sub anthesi 2.5–4 cm. longis, pedunculo subnullo et rhachi gracilibus, bracteis lanceolatis acutis 0.5–1 mm. longis, pedicellis gracilibus 1.5–2 mm. longis; floribus 5-meris circiter 2 mm. longis et apice 2.5 mm. diametro; prophyllis liberis deltoideo-lanceolatis 0.5–0.8 mm. longis dorso parce lepidotis; calyce circiter 1.5 mm. longo, tubo obconico minute lepidoto, lobis deltoideis circiter 0.7 mm. longis subacutis non glanduloso-lineatis; corolla campanulata circiter 1.5 mm. longa inconspicue glanduloso-lineolata, lobis ovatis circiter 0.9 mm. longis latisque apice rotundatis margine erosulis; staminibus basim corollae versus insertis, filamentis gracilibus 0.1–0.2 mm. longis, antheris deltoideo-ovoideis 0.3–0.4 mm. longis; ovario levi semigloboso-conico, stylo brevi crasso tereti 0.2–0.3 mm. longo, stigmate obscure bilobato, ovulis circiter 10 biseriatis; fructibus immaturis ovoideo-ellipsoideis inconspicue luteo-glanduloso-lineolatis circiter 2.5 mm. diametro, calycis lobis et stigmatibus persistentibus.

VANUA LEVU: Mathuata: Northwestern slopes of Mt. Numbuiloa, east of Lambasa, alt. 350 m., Nov. 6, 1947, *Smith 6490* (A TYPE US) ("kolonimbeka"; shrub 4 m. high, locally frequent in hillside thickets; corolla pale yellow with salmon-pink markings; filaments pale green; anthers yellow).

From its closest ally, *M. persicaefolia* A. Gray, the new species differs in its narrower leaves with sharply ascending secondaries, its simpler and less obviously lepidote inflorescence, and its slightly larger flowers with less prominent glandular markings. *Maesa neriifolia* Gillespie seems very close to *M. persicaefolia* but has even more conspicuously glandular-lineolate floral parts.

Tapeinosperma chloranthum sp. nov.

Arbor ad 12 m. alta inflorescentiis exceptis glabra, partibus novellis minute puberulis mox glabratis, ramulis cinereis plerumque teretibus ad nodos incrassatis robustis superne cicatricosis, ramulis foliiferis saepe gracilibus; petiolis sat robustis semiteretibus 10–15 mm. longis, laminis chartaceis in sicco fusco-viridibus immerso-glandulosis anguste oblongo-ellipticis, 10–20 cm. longis, 4–7.5 cm. latis, basi in petiolum attenuatis et longe decurrentibus, apice obtusis vel anguste rotundatis, margine integris anguste recurvatis, costa valida supra subplana subtus prominente, nervis lateralibus primariis utrinsecus circiter 18–22 patentibus utrinque cum rete venularum prominulis; inflorescentiis apices ramulorum versus axillaribus paniculatis sub anthesi ad 6 cm. longis latisque, pedunculo brevi et rhachi ramulisque validis subteretibus copiose tomentellis (pilis cinnamomeis 0.2–0.4 mm. longis multicellularibus saepe irregulariter ramulosis eglandulosis), bracteis oblongis 2–3 mm. longis subacutis intus glabris; pedicellis crassis teretibus 2.5–5 mm. longis ut inflorescentiae ramulis cum calyce dense tomentellis superne incrassatis; calyce cupuliformi 3.5–4.5 mm. longo et apice circiter 5 mm. diametro textura subcarnoso immerso-nigro-glanduloso intus glabro profunde lobato, lobis 5 (raro 6) ovatis subacutis circiter 2 mm. longis latisque; corolla crasso-carnosa infundibulari-rotata sub anthesi circiter 6 mm. longa et apice diametro, tubo 1–2 mm. longo, lobis 5 immerso-nigro-glandulosis late imbricatis ovatis circiter 4 $\times$ 3 mm. obtusis; staminibus corollae faucibus insertis, filamentis carnosis ad 0.4 mm. longis, antheris deltoideo-ovoideis circiter 1.2 mm. longis obtusis dorso glandulis inconspicuis ornatis; gynoecio sub anthesi circiter 3 mm. longo, ovario ovoideo minutissime et pallide glanduloso-puberulo in stylum gracilem attenuato, stigmate subpeltato circiter 0.5 mm. diametro, placenta ovoidea apice subacuta, ovulis 3; inflorescentiis sub fructu majoribus ad 20 cm. longis, pedunculo ad 3.5 cm. longo et ramulis pedicellisque subpersistenter tomentellis, pedicellis superne valde incrassatis, calyce demum rotato ad 7 mm. diametro extus persistenter tomentello; fructibus subglobosis ad 7 mm. diametro stylo coronatis, pericarpio coriaceo circiter 1 mm. crasso glandulis magnis atris ovalibus copiose ornato, semine 1 subgloboso.

VITI LEVU: Mba: Hills between Nggaliwana and Nandala Creeks, south of Nauwanga, alt. 725–850 m., Aug. 26, 1947, *Smith 5820* (A TYPE, US) (tree 10 m. high, in dense forest; calyx brown; corolla dull green with purplish glands; mature fruit red); slopes of Mt. Nairosa, eastern flank of Mt. Evans Range, alt. 700–1050 m., *Smith 4023* ("kutumirase"; tree 12 m. high, in dense forest); eastern slopes of Mt. Koroyanitu, Mt. Evans Range, alt. 950–1050 m., *Smith 4133* (A, US) (tree 10 m. high, in dense low forest).

From its closest ally, *T. clavatum* Mez, the new species is readily distinguished by the much more copious and persistent indument of its inflorescence-branches and calyces and by its larger flowers with thick-carnose infundibuliform corollas. *Tapeinosperma greenwoodii* A. C. Sm., known only from the Mt. Evans Range, where the new species also occurs, has similar foliage but a more delicate and small-flowered inflorescence, the indument being composed of very minute (less than 0.1 mm. long) simple glandular hairs.

Tapeinosperma ligulifolium sp. nov.

Frutex ad 2 m. altus partibus novellis et inflorescentiis glanduloso-puberulis exceptis ubique glaber, ramulis cinereis teretibus subvalidis; foliis apices ramulorum versus confertis, petiolis crassis rugulosis 2–5 mm.

longis, laminis in sicco coriaceis olivaceis elongato-ligulatis, 20–32 cm. longis, 1–1.5 cm. latis, basi obtusis, apice obtusis vel anguste rotundatis, margine integris plerumque valde revolutis, utrinque inconspicue glandulosis, costa supra valde impressa subtus prominente, nervis lateralibus primariis numerosis circiter 1 cm. distantibus brevibus patentibus intra marginem anastomosantibus cum rete venularum inconspicue prominulis; inflorescentia (unica visa) prope apicem ramuli axillari gracili multiflora anguste paniculata circiter 12 cm. longa et 6 cm. lata, pedunculo circiter 5 cm. longo et rhachi ramulisque gracilibus subteretibus pilis haud 0.1 mm. longis parce glanduloso-puberulis, bracteis oblongo-ligulatis 1–1.5 mm. longis obtusis extus glandulosis intus glabris; pedicellis sub anthesi 2–3 mm. longis ut inflorescentiae ramulis cum calyce glandulosis; calyce rotato circiter 3 mm. diametro intus glabro profunde 5-lobato, lobis lanceolatis 1–1.2 mm. longis et circiter 0.7 mm. latis subacutis minute glanduloso-ciliolatis; corolla tenuiter carnosa paullo ante anthesin circiter 3.5 mm. diametro glanduloso-punctata, lobis 5 fere ad basim liberis ovatis circiter 2.5 mm. longis latisque apice obtusis; staminibus prope basim corollae insertis, filamentis circiter 0.5 mm. longis, antheris oblongo-deltoideis circiter 1.2 mm. longis acutis obscure glandulosis; gynoecio sub anthesi circiter 2 mm. longo, ovario oblongo minute glanduloso in stylum crassum attenuato, stigmate minute subpeltato, ovulis ut videtur 2.

VANUA LEVU: Mathuata: Summit ridge of Mt. Numbuiloa, east of Lambasa, alt. 500–590 m., Nov. 6, 1947, *Smith 6522* (A TYPE) (shrub 2 m. high, in dense forest; inflorescence-branches and perianth-parts rich pink).

This extraordinarily distinct species, represented by a single though reasonably ample specimen, is at once distinguished by its remarkably long and narrow leaf-blades, which are conspicuously revolute and essentially sessile; its inflorescence is comparatively delicate, with slender pedicels and narrow calyx-lobes. The relationship of *T. ligulifolium* is probably with such species as *T. grande* (Seem.) Mez and *T. megaphyllum* (Hemsl.) Mez, both with large narrow leaves, which, however, do not approach in proportions those of the new species.

Discocalyx obtecta sp. nov.

Arbor vel frutex ad 6 m. altus, partibus novellis copiose ferrugineo-puberulis, ramulis teretibus gracilibus cinereis mox glabratis ad nodos incrassatis; petiolis subvalidis supra canaliculatis ad 1 cm. longis saepe fere ad basim anguste alatis mox glabratis; laminis foliorum in sicco chartaceo-subcoriaceis fuscis oblanceolatis, (5–) 7–12 cm. longis, (2–) 3–4.5 cm. latis, basi attenuatis et in petiolum longe decurrentibus, apice obtusis, margine integris et leviter recurvatis, supra glabris, subtus copiose glanduloso-punctatis et costa saepe pilosis, costa valida supra subplana vel elevata subtus prominente, nervis lateralibus utrinsecus circiter 8–10 erecto-patentibus subtus prominulis vel interdum utrinque immersis, rete venularum subimmerso; inflorescentiis apices ramulorum versus axillaribus amplis paniculatis 6–11 cm. longis multifloris, pedunculo (ad 3.5 cm. longo) rhachi ramulisque subteretibus striatis copiose puberulis (pilis brunneo-ferrugineis glandulosis) demum subglabratis, bracteis oblongo-lanceolatis 2–3 mm. longis caducis, bracteolis minoribus; floribus paullo ante anthesin subsessilibus (pedicello ad 1 mm. longo), calyce et pedicello pilis brunneo-ferrugineis ad 0.1–0.2 mm. longis densissime glanduloso-tomentello-puberulis; calyce obconico-pyriformi circiter 2.5 mm. longo et diametro intus glabro, lobis 5 ovatis 1–1.3 mm. longis latisque acutis ciliis circiter 0.3 mm. longis copiose ornatis; corolla carnosa submatura videtur rotata 3–3.5 mm. diametro profunde 5-lobata, lobis oblongis circiter 1.5 mm. longis apice rotundatis immerso-glandulosis dorso parce pilosis alibi glabris; staminibus immaturis, filamentis gracilibus haud 0.1 mm. longis, antheris deltoideo-oblongis circiter 0.5 mm. longis apice obtusis; gynoecio glabro in stylum gracilem circiter 0.6 mm. longum et stigmatem parvum peltatum attenuato, ovulis ut videtur paucis; calyce sub fructu rotato circiter 3 mm. diametro persistenter ciliolato et saltem inconspicue glanduloso-tomentello. fructu subgloboso 5–6 mm. diametro stylo minuto coronato.

VITI LEVU: M b a : Hills east of Nandala Creek, about 3 miles south of Nandarivatu, alt. 870–970 m., Sept. 25, 1947, *Smith 6217* (A TYPE, US) (tree 4 m. high, in dense forest; flower-buds brown); hills between Nggaliwana and Tumbeindreketi Creeks, east of the sawmill at Navai, alt. 725–800 m., *Smith 6007* (A, US) (tree 6 m. high, in dense forest; young flowers cinnamon-brown); southern slope of Mt. Ndelainathovu, on the escarpment west of Nandarivatu, alt. 870–970 m., *Smith 4921* (A, US) ("sila"; simple-stemmed shrub 2 m. high, in dense forest; fruit red, at length purplish); Mt. Evans Range, alt. about 970 m., *Greenwood 1149* (A) (tree 5–6 m. high, in dense forest; flower-buds brown).

Of the four available collections, my no. *4921* bears fruits and the others immature flowers. The species is readily distinguished by the close and copious glandular-tomentellous indument of the inflorescence-branches and calyces. Among the described Fijian species, only *D. divaricata* Gillespie has an obviously pilose inflorescence, and from that the new species differs in its short petioles, its thick obovate leaf-blades narrowed at base, and its flowers with shorter pedicels and pyriform calyces. *Discocalyx divaricata*, a very graceful and attractive species, is quite frequent in upland Viti Levu, being represented by my nos. *4250*, *4526*, *4823*, and *6216*. In foliage *D. obtecta* more nearly resembles *D. fusca* Gibbs, but that species is essentially glabrous throughout.

Discocalyx gillespieana sp. nov.

Arbor gracilis ad 4 m. alta partibus novellis et inflorescentiis obscure glanduloso-puberulis exceptis ubique glabra, ramulis teretibus gracilibus fuscis ad nodos incrassatis; petiolis semiteretibus rugulosis 10–17 mm. longis, laminis foliorum in sicco subcoriaceis fusco-olivaceis elliptico-obovatis, 7–11.5 cm. longis, 3–4.5 cm. latis, basi acutis et in petiolum decurrentibus, apice rotundatis vel late obtusis, margine integris anguste recurvatis, subtus parce glanduloso-punctatis, costa supra subplana subtus prominente, nervis lateralibus utrinsecus 10–12 subpatentibus utrinque prominulis vel interdum cum rete venularum obscuris; inflorescentiis apices ramulorum versus congestis compacte paniculatis ad 3.5 cm. longis latisque, pedunculo brevi rhachi ramulisque paucis gracilibus teretibus parce glanduloso-puberulis mox glabratis, bracteis oblongo-lanceolatis circiter 2 mm. longis caducis; pedicellis gracilibus sub anthesi 1.5–2 mm. longis subglabris; calyce rotato sub anthesi 2–2.5 mm. diametro extus obscure glanduloso-puberulo, lobis 5 (raro 6) deltoideo-oblongis circiter 0.7 mm. longis obtusis margine ciliis glandulosis circiter 0.2 mm. longis copiose ornatis; corolla carnosa rotata circiter 5 mm. diametro profunde 5-lobata, lobis oblongis circiter 1.5 mm. longis latisque rotundatis immerso-glandulosis; antheris subsessilibus oblongo-ovoideis 0.7–0.8 mm. longis obscure glandulosis apice obtusis; ovario sub anthesi conico 0.5–0.8 mm. diametro inconspicue glanduloso, stigmate subsessili peltato circiter 0.7 mm. diametro eroso-marginato, ovulis 3 vel 4.

VITI LEVU: Nandronga & Navosa: Northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, alt. 725–825 m., Aug. 7, 1947, *Smith 5546* (A TYPE, US) ("vutuvutu"; slender tree 4 m. high, in dense forest; calyx and corolla deep purplish red; anthers and stigma pale yellow).

Discocalyx gillespieana is related to *D. multiflora* Gillespie and *D. sylvestris* A. C. Sm., but both of these have obvious styles, whereas in the new species the stigma is essentially sessile. From *D. multiflora* the present plant also differs in its longer-petiolate and proportionately broader leaves, more compact inflorescence, smaller and less conspicuously glandular corolla, and smaller anthers; from *D. sylvestris* it is further distinguished by its differently proportioned leaves with more numerous secondaries. The three species are certainly close relatives, but I believe that combinations of characters and especially the stylar differences amply differentiate them.

EBENACEAE

Diospyros foliosa (Rich. ex Gray) Bakh. in Bull. Jard. Bot. Buitenzorg III. 15: 447. 1941.

Maba foliosa Rich ex A. Gray in Proc. Amer. Acad. 5: 326. 1862; Seem. Fl. Vit. 152. 1866; Hiern in Trans. Cambr. Phil. Soc. 12: 113. 1873; Drake, Ill. Fl. Ins. Mar. Pac. 230. 1892.

VANUA LEVU: Mathuata: Southern slopes of Mt. Numbuiloa, east of Lambasa, alt. 350–500 m., *Smith 6439* (A, US) ("ulalo"; tree 8 m. high, in rocky forest on steep hillside, the trunk 20 cm. diam.; fruit yellow, at length red; seed edible), *6443* (A, US) (tree 10 m. high, in thin forest on rocky slope; fruit yellow, at length red). Fiji, without definite locality except "Muthuata and Ovolau" [i.e. Mathuata coast of Vanua Levu and island of Ovalau], *U. S. Expl. Exped.* (GH, US 65907 TYPE).

The three available Fijian collections agree in fundamental characters, my no. *6439* being especially similar to the type. Number *6443*, however, differs in having its slightly narrower leaves copiously brown-tomentellous beneath and its fruits shorter in proportion, nearly subglobose rather than narrowly ellipsoid and about twice as long as broad (as in no. *6439* and the type). These characters, which in the field I took to be significant, probably merely indicate some of the variability to be expected in the species. A few of the older leaves of no. *6443* have become merely canescent-puberulent or nearly glabrous beneath, and some of the fruits vary in shape toward ovoid-ellipsoid.

SYMPLOCACEAE

Symplocos turrilliana sp. nov.

Arbor ad 10 m. alta, partibus novellis et ramulis apices versus pilis stramineis 0.5–0.8 mm. longis hispidulo-pilosis, ramulis teretibus rugulosis brunneis demum glabratis; petiolis gracilibus leviter canaliculatis 1–3 cm. longis ut ramulis juvenilibus pilosis, laminis foliorum in sicco chartaceis flavo-viridibus oblongo- vel ovato-ellipticis, 6–11 cm. longis, 3–6 cm. latis, basi rotundatis vel obtusis et in petiolum breviter decurrentibus, apice breviter cuspidatis, margine inconspicue crenulatis, supra praecipue costa pilosis mox glabratis, subtus pilis patentibus castaneis 0.3–0.7 mm. longis praesertim costa nervisque subpersistenter hispiduloso-pilosis, costa supra leviter canaliculata subtus prominente, nervis secundariis utrinsecus 5–8 erecto-patentibus curvatis anastomosantibus supra prominulis vel planis subtus elevatis, rete venularum utrinque prominulo vel supra immerso; inflorescentiis axillaribus compactis racemosis vel e basi 2- vel 3-ramosis paucifloris, floribus inclusis haud 1.5 cm. longis, pedunculo brevi ramulisque pilis stramineis 0.2–0.4 mm. longis dense sericeis, bracteis oblongo-semiorbicularibus circiter 1 mm. longis et 1.5 mm. latis rotundatis extus copiose sericeis intus glabris; floribus subsessilibus, pedicello (haud 1 mm. longo) et calyce ut inflorescentiae ramulis sericeis; calyce sub anthesi circiter 2.5 mm. longo et apice 4 mm. diametro, tubo cupuliformi circiter 1 mm. longo, lobis 5 imbricatis, 3 exterioribus papyraceis oblongo-ovatis obtusis 1.5–2 mm. longis latisque intus apicem versus saepe sericeo-puberulis alibi glabris, lobis interioribus submembranaceis ad 2.5 mm. longis extus marginem versus glabris; corolla membranacea sub anthesi rotata 7–8 mm. diametro glabra vel lobis extus obscure puberula, fere ad basim 5-lobata, lobis oblongo-ovatis 3–3.5 mm. longis, 2–2.5 mm. latis apice rotundatis interdum obscure eroso-ciliolatis; staminibus circiter 40–45, 2- vel 3-seriatis, filamentis ligulatis glabris sub anthesi 3–4 mm. longis, antheris subglobosis 0.3–0.4 mm. diametro; stylo tereti circiter 3 mm. longo, stigmate obscure lobato; ovario infero; fructibus ovoideo-ellipsoideis immaturis ad 12 mm. longis puberulis vel glabratis, superne contractis, calycis lobis persistentibus.

VITI LEVU: Mba: Summit of Mt. Nanggaranambuluta [Lomalangi], east of Nandarivatu, alt. 1100–1120 m., June 23, 1947, ***Smith 4845*** (A TYPE, US) ("kai namo"; tree 5 m. high, in dense forest; petals and filaments white; anthers yellow); summit of Mt. Koroyanitu, high point of Mt. Evans Range, alt. 1165–

1195 m., in dense ridge forest and thickets, *Smith 4206* (A, US) (tree 10 m. high; young petals white), *4222* (A, US) (tree 8 m. high; flower-buds white; fruit green).

Turrill (in Jour. Linn. Soc. Bot. **43**: 30. 1915), in describing the only Fijian species of *Symplocos* as *S. leptophylla* (designated as a new species but actually to be construed as a new combination based on *S. stawelii* var. *leptophylla* Brand, both concepts being typified by *Seemann 294*, from Kandavu), points out its variable nature. My 1947 collection contains 16 numbers, from Viti Levu and Vanua Levu, which may be referred to this broad concept. Obvious variations are to be seen in the indument of the calyx, which ranges from essentially glabrous to copiously sericeous, and in the size and shape of leaves. I am inclined to consider this specific concept too broad, but perhaps it should not be subdivided without careful consideration of species from island groups to the west. Turrill has indicated as forma *compacta* a plant from Nandarivatu with a reduced inflorescence and coriaceous leaves, and probably some of my collections from upland Viti Levu are referable to this form, although the value of the mentioned characters is questionable. All the specimens thus far referred to *S. leptophylla* have the leaves glabrous or merely minutely strigillose on the costa beneath. The new species here proposed differs from *S. leptophylla* in the obvious and persistent indument of its lower leaf-surfaces and in the densely sericeous inflorescence-branches and calyx. As a rule in *S. leptophylla* these inflorescence-parts are merely puberulent or minutely strigillose and glabrescent, but occasionally the pubescence, in type and persistence, approaches that of *S. turrilliana*.

OLEACEAE

Linociera vitiensis A. C. Sm. in Bull. Torrey Club **70**: 549. 1943.

Fagraea vitiensis Seem. in Bonplandia **9**: 257, nomen. 1861; non Gilg & Benedict (1921).

Olea vitiensis Seem. Fl. Vit. 155. 1866.

VITI LEVU: *Seemann 307* (GH, type coll. of *Olea vitiensis*); Nandronga & Navosa: Northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, alt. 725–825 m., *Smith 5632* (A, US). VANUA LEVU: Mathuata: Southern slopes of Mt. Numbuiloa, east of Lambasa, alt. 100–500 m., *Smith 6374* (A, US), *6580* (A, US).

The cited material agrees very well with the type of the species, *Smith 864*, from Taveuni. It had previously escaped my notice that Seemann's *Olea vitiensis* is actually a species of *Linociera*, and my inadvertent selection of the same specific epithet makes impossible a combination based on Seemann's earlier one. My more recent collections are from trees 8–20 m. high, growing in dense or open forest; all have the fruit immature and orange or dull orange-tinged. The local name *teinivia* was noted for no. *5632*.

Linociera gillespiei A. C. Sm. in Bull. Torrey Club **70**: 548. 1943.

VITI LEVU: Naitasiri: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi [Mt. Victoria] and Nasonggo, alt. 870–970 m., *Smith 5794* (A, US), *6135* (A, US).

The cited specimens, the second and third of the species known to me, were collected in dense forest from trees 15–20 m. high, with green but apparently nearly mature fruit; a local name recorded for no. *6135* is *thaunilawa*. These two collections agree very well with the type, *Gillespie 4289*, from the vicinity of Nandarivatu.

It is curious that all eight collections of *Linociera* now available from Fiji are in fruit, no flowering material having been obtained; this fact makes adequate consideration of the two species impossible. It may be seriously doubted that more than one species of *Linociera* occurs in Fiji, but I cannot make the implied reduction at this time. In general, the leaves of *L. vitiensis* are broader (about twice as long as broad) and thicker, with often immersed veins; the leaves of *L. gillespiei* incline toward lanceolate in shape (about three times as long as broad), have more obvious venation, and dry somewhat darker in color. The recent collections tend to break down the distinctions between the species and, unless future collections indicate the existence of stronger characters, the two entities may be better combined.

LOGANIACEAE

Fagraea gracilipes A. Gray in Proc. Amer. Acad. **4**: 323. 1860; Seem. Fl. Vit. 165. 1866.

Fagraea viridiflora Seem. in Bonplandia **9**: 257, nomen. 1861.

VITI LEVU: Serua: Vicinity of Ngaloa, *Degener 15101* (A, US, etc.) ("makamakandora"; tree 5 m. high, on inner edge of mangrove swamp; tea from bark and leaves used medicinally; timber considered durable and valuable). OVALAU: *Seemann 306* (source of the name *F. viridiflora*, GH, K). VANUA LEVU: Mathuata: Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, alt. 100–200 m., *Smith 6665* (A, US) ("mbuambua"; spreading tree to 10 m. high, in patches of forest in open rolling country, locally frequent but seldom flowering; corolla and filaments cream-white or pale yellow; fruit waxy ivory-white; trunks used as houseposts). Fiji, without definite locality: *U. S. Expl. Exped.* (GH, US 62265 TYPE), *Horne 1124* (GH).

The distribution and habitat of this beautiful endemic tree are more fully indicated above than by the Exploring Expedition and Seemann collections from which it has previously been understood. It is a rare plant in Fiji and was observed by me only once, although in that locality, cited above, it was a frequent component of the low dry forest that occurs on certain reddish clay areas of northern Vanua Levu. The type specimen is accompanied by a detached fruit which obviously represents the other, and more abundant, species of *Fagraea* in Fiji, presumable *F. berteriana* A. Gray (including *F. vitiensis* Gilg & Benedict). The mature fruit of *F. gracilipes* is waxy white, ellipsoid, not much exceeding 2 by 1.5 cm.

APOCYNACEAE

Pagiantha thurstonii (Baker) comb. nov.

Tabernaemontana thurstoni Horne, A Year in Fiji, 268, nomen. 1881; Horne ex Baker in Jour. Linn. Soc. Bot. **20**: 368. 1883; Burkill in Jour. Linn. Soc. Bot. **35**: 46. 1901; Gillespie in Bishop Mus. Bull. **74**: 19. *fig. 24.* 1930.

VITI LEVU: Mba: Western and southern slopes of Mt. Tomanivi [Mt. Victoria], alt. 850–1150 m., *Smith 5089* (A, US) ("nda'alu"; tree 10 m. high, with abundant white latex, on edge of forest; flowers fragrant; corolla-tube greenish, the lobes pure white); Nandronga & Navosa: Northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, alt. 725–825 m., *Smith 5638* (A, US) ("kau ndrenga"; tree 15 m. high, with abundant white latex, in dense forest; pericarp yellow within, the seeds red); Naitasiri: Nanduna, alt. about 30 m., *B. E. Parham 1049* (A) ("tandalo"; tree 30 m. high, with large white flowers).

The proposed combination (with a change to the termination *-ii* as recommended by the International Rules) is necessary if one follows Markgraf's revision (in Notizbl. Bot. Gart. Berlin **12**: 540–552. 1935) of the Asiatic genera allied to *Tabernaemontana*. *Pagiantha koroana* Markgraf (in op. cit. 549. 1935, in Bishop Mus. Bull. **141**: 129. *fig. 65, h-k.* 1936) is almost certainly the same species. Markgraf apparently overlooked the binomial *Tabernaemontana thurstoni*, as indicated by his remark that: "The present specimen is the first collection of a thick-flowered species of *Tabernaemontana* from Fiji." Gillespie's description and plate of *T. thurstoni* are very adequate; he cites several collections from Viti Levu and Taveuni, which, added to previously collected material, indicate that the species is fairly frequent on the large islands of Fiji.

Alyxia linearifolia A. C. Sm. in Sargentia 1: 107. *fig. 5.* 1942, in Jour. Arnold Arb. **27**: 321. 1946.

VITI LEVU: Mba: Vicinity of Nalotawa, eastern base of Mt. Evans Range, alt. 550–600 m., *Smith 4471* (A, US) (shrub 2–3 m. high, the upper branches becoming scandent, in forest along stream; flowers and fruits very scarce; corolla-lobes white; fruit black). VANUA LEVU: Mathuata: Southern slopes of Mt. Numbuiloa, east of Lambasa, alt. 350–500 m., *Smith 6563* (A, US) (shrub 1–2 m. high, becoming scandent, in dense crest forest on summit of southwestern ridge; fruit at length black).

The cited collections agree excellently with the two already known for the species, both from Viti Levu. It is noteworthy that the species is found in Mathuata in the same locality as the following, which is described as a closely allied novelty. The small-leaved *Alyxiae* in Fiji are very puzzling, for which reason I collected all those seen during my 1947 trip. These are too few to permit an accurate picture of the range of variability, but for the time being it seems best to limit *A. linearifolia* to the form with leaves approximately 10–20 times as long as broad (not more than 3.5 mm. in breadth) and parallel-margined.

Alyxia amoena sp. nov.

Frutex scandens copiose ramosus ubique partibus florum exceptis glaber, ramulis gracilibus subteretibus fusco-cinereis; foliis oppositis vel ternatis raro quaternatis, petiolis minutis canaliculatis ad 2 mm. longis, laminis in sicco viridibus chartaceis anguste oblongo-ellipticis, (2–) 3–5 cm. longis, (4–) 5–12 mm. latis, basi obtusis vel acutis et in petiolum decurrentibus, apice obtusis, margine integris et leviter revolutis, costa supra paullo impressa subtus elevata, nervis lateralibus numerosis immersis in nervulum marginalem terminantibus; inflorescentiis axillaribus cymosis 3–5-floris, pedunculo gracili 1–4 cm. longo, bracteis anguste oblongis 1–2 mm. longis obtusis, pedicellis gracilibus (2–) 3–9 mm. longis, bracteolis nullis; calyce sub anthesi 1.6–1.7 mm. longo, lobis erectis membranaceis oblongo-deltoideis subacutis, 1.2–1.3 mm. longis, 0.6–0.7 mm. latis, obscure ciliolatis; corolla submembranacea, tubo urceolato-cylindrico circiter 3.5 mm. longo, superne circiter 1.5 mm. diametro, basi et apice contracto, intus superne molliter retrorso-piloso, lobis oblongo-ovatis circiter 2 $\times$ 1.8 mm. apice rotundatis superne obscure ciliolatis; staminibus circiter 1 mm. infra apicem tubi insertis, filamentis ligulatis circiter 0.3 mm. longis, antheris oblongo-deltoideis acutis circiter 0.8 mm. longis; disco minuto glabro; carpellis ovoideis distinctis glabris, stylo gracili circiter 1 mm. longo, stigmate parvo capitato, ovulis in quoque carpello plerumque 4; fructibus saepe persistenter binis, calyce subpersistente, stipite 2–2.5 mm. longo; drupa ellipsoidea maturitate 7–11 mm. longa et 6–7 mm. diametro, basi et apice obtusa, stylo persistente, pericarpio tenui (haud 0.2 mm. crasso) extus levi vel obscure longitudinaliter sulcato intus ruguloso, semine unico ellipsoideo rugoso.

VANUA LEVU: Mbua: Ramasa Hill, *H. B. R. Parham VIII* (A) (small shrub; flowers white); Mathuata: Southern slopes of Mt. Numbuiloa, east of Lambasa, alt. 100–350 m., Oct. 27, 1947, *Smith 6375* (A TYPE, US) ("vono"; liana, in open forest; corolla-lobes white; fruit at length black); summit ridge of Mt. Numbuiloa, alt. 500–590 m., *Smith 6498* (A, US) ("vono"; shrub 2 m. high, with subscandent branches, in dense forest; fruit becoming black). OVALAU: Vicinity of Levuka, alt. 125 m., *Gillespie 4568* (GH). Fiji, without definite locality: *U. S. Expl. Exped.* (GH in part, US 65908), *Horne 671* (GH).

The new species is apparently most closely related to *A. linearifolia* A. C. Sm., like which it has, for the genus, narrow leaves and comparatively small flowers and fruits. In foliage *A. amoena* tends to be intermediate between *A. linearifolia* and *A. stellata* (Forst.) R. & S.; in the former the leaves are essentially linear, not more than 3.5 mm. broad, and with parallel margins, while in the latter they are elliptic and usually substantially more than 1 cm. in breadth. The new species also differs from *A. linearifolia* in its usually longer peduncles and pedicels, its larger calyx-lobes, and its glabrous disk. From *A. stellata* (for informative discussions of which see Christophersen, in Bishop Mus. Bull. **128**: 184. 1935, and F. B. H. Brown, in op. cit. **130**: 230. 1935) the new species differs not only in its smaller leaves, but also in its shorter corollas and smaller fruits. Some of the Fijian specimens referred to *A. stellata* (e. g. *Degener 14825, 14841*, and *15255*) have leaves nearly as small as those of *A. amoena*, but their fruits are approximately twice as large. A revision of the Pacific *Alyxiae* is much needed, as entities like *A. stellata* have been so widely interpreted in herbaria that their actual limits are uncertain.

Fijian specimens intermediate in foliage between *A. amoena* and *A. linearifolia* are: Viti Levu: Mba: Northern slopes of Mt. Namendre, east of Mt. Koromba [Pickering Peak], alt. 750–900 m., *Smith 4513* (A, US) (liana, in crest forest on wind-swept ridge; ripe fruit deep purple); Nandronga & Navosa: Southern slopes of Nausori Highlands, above Tumbenasolo, alt. about 450 m., *Greenwood 1065A* (A) (shrub 1 m. high with long twining shoots, in forest; flowers white). These two specimens, from adjacent localities in western Viti Levu, have the leaves shorter and proportionately broader than those of *A. linearifolia* but yet averaging smaller than those of *A. amoena*. The flowers of *Greenwood 1065A* show the large calyx-lobes of *A. amoena*, and I believe this to be the better position for the two collections, although they are not typical.

BORAGINACEAE

Cynoglossum amabile Stapf & Drummond in Kew Bull. **1906**: 202. 1906.

VITI LEVU: Mba: Western slopes of Mt. Nanggaranambuluta [Lomalangi], east of Nandarivatu, alt. 1000–1100 m., *Smith 4809* (A, US) (naturalized along track in dense forest; corolla bright blue).

Originally described from western Chinese specimens, this species is the "Chinese forget-me-not" of gardens. In Fiji it was naturalized in the indicated locality, probably as an escape from a European garden at Nandarivatu, where, however, it no longer appears to be grown. I am indebted to Dr. I. M. Johnston for the identification; the genus is not otherwise recorded from Fiji.

LABIATAE

Salvia splendens Sellow ex Roem. & Schultes, Syst. Mant. **1**: 185. 1822; Epling in Rep. Sp. Nov. Beih. **85**: 94. 1935.

VITI LEVU: Nandronga & Navosa: Northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, alt. 725–825 m., *Smith 5398* (A, US) (shrub 1–2 m. high, along trail in forest-grassland transition; calyx bright red).

This frequently cultivated species appeared to be naturalized in the cited locality, which is far from any European settlement; it has not previously been noted from Fiji.

ACANTHACEAE

Graptophyllum sessilifolium sp. nov.

Frutex ad 2 m. altus calycis lobis exceptis ubique glaber, ramulis elongatis gracilibus novellis subcomplanatis demum teretibus cinerascentibus; foliis subsessilibus interdum subamplexicaulibus, petiolis crassis canaliculatis 0.5–2 mm. longis, laminis chartaceis vel subcoriaceis in sicco olivaceo-viridibus oblongis vel anguste ovato-oblongis, (3.5–) 6–9 cm. longis, 2–4 cm. latis, basi leviter cordatis, apice rotundatis vel obtusis, margine integris et leviter revolutis, utrinque cystolithis linearibus 0.2–0.4 mm. longis manifeste ornatis, costa supra leviter subtus valde elevata, nervis secundariis utrinsecus 4–6 arcuato-adscendentibus utrinque prominulis vel subimmersis, rete venularum obscuro; inflorescentiis apices ramulorum versus axillaribus cymosis plurifloris ad 5 cm. longis, pedunculo (circiter 1 cm. longo) et ramulis gracilibus subteretibus, bracteis papyraceis lanceolato-deltoideis acutis 1.5–2 mm. longis subpersistentibus, bracteolis similibus 0.5–1 mm. longis; pedicellis gracilibus sub anthesi et fructu 7–12 mm. longis superne in calycis tubum gradatim incrassatis; calycis lobis 5 erectis lanceolatis, 1.7–2 mm. longis, 1–1.3 mm. latis, acuminatis, extus glabris, intus minute puberulis, inconspicue 3- vel 5-nerviis; corolla membranacea 25–30 mm. longa curvata, tubo circiter 13 mm. longo et 2–2.5 mm. diametro superne in faucem ventricosum sensim ampliato, lobis 5 subaequalibus, 8–9 mm. longis, 3.5–4 mm. latis, apice rotundatis et obscure puberulis, 2 posticis paullo minoribus et altius connatis; staminibus 2 non exsertis, filamentis gracilibus circiter 7 mm. longis, antheris oblongis 3–3.5 mm. longis obtusis; disco carnoso integro ovario haud latiore; ovario oblongo sub anthesi circiter 3 mm. longo in stylum filiformem quam corollam breviorem attenuato, stigmate minuto, ovulis in quoque loculo 2 superpositis; capsula anguste obovoidea circiter 2 cm. longa, basi stipitata, apice acuta, seminibus 2 compresso-suborbicularibus conspicue rugulosis.

VANUA LEVU: Mathuata: Southern slopes of Mt. Numbuiloa, east of Lambasa, alt. 350–500 m., Nov. 10, 1947, *Smith 6566* (A TYPE, US) (shrub 1–2 m. high, with elongate branches, in steep open forest; corolla rich pink).

The closest relative of the new species seems to be *G. insularum* (A. Gray) A. C. Sm., fairly abundant in Fiji (for distributional notes see Sargentia 1: 118. 1942), which, however, has distinctly petiolate leaves, of which the blades are thinner, more obviously nerved, and obtuse to acute at base. Although the flowers of the two species are essentially similar, *G. insularum* often has the inflorescence-branches and pedicels (as well as young vegetative parts) closely puberulent, and the inflorescence comparatively contracted and fewer-flowered.

COMPOSITAE

Centipeda minima (L.) A. Br. & Aschers. Ind. Sem. Hort. Berol. App. 6. 1867.

VANUA LEVU: Mathuata: Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, alt. 100–200 m., *Smith 6885* (A, US) (on edge of pond in open rolling country; corolla-lobes pale green).

Although I find no previous published record of the occurrence of this plant in Fiji, Mr. William Greenwood has indicated its presence by including it in an unpublished list. In the cited locality in Mathuata the small plants were quite common, although very inconspicuous, growing on moist savanna with *Cyperus polystachyos* Rottb., *Fimbristylis annua* var. *diphylla* (Retz.) Kükenth., *Echinochloa colonum* (L.) Link, *Paspalum orbiculare* Forst., *Jussiaea suffruticosa* var. *ligustrifolia* (H. B. K.) Griseb., *Limnophila fragrans* (Forst.) Seem., and *Erechtites valerianae-folia* DC. Although this would seem to be an association of widespread weeds, I have not seen the *Centipeda* elsewhere in Fiji.

DEPARTMENT OF BOTANY,
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STUDIES OF PACIFIC ISLAND PLANTS, XII
THE CUNONIACEAE OF FIJI AND SAMOA

A. C. Smith

Although the Cunoniaceae, a family of considerable size and diversity in New Guinea and New Caledonia, are represented eastward in the Pacific by a sharply decreasing number of members, they are nevertheless a puzzling group in the area under consideration, to judge from the uncertainty of herbarium identifications and the difficulty of analyzing specific criteria. While attempting to place the specimens of the family which I collected in 1947 [1], it seemed desirable to assemble earlier material, to prepare keys, and to redescribe the species, the original descriptions having been based upon too few specimens to show their variability. The place of deposit of specimens cited in this paper is shown as follows: Arnold Aboretum (A); Bernice P. Bishop Museum (Bish); British Museum (BM); Gray Herbarium (GH); New York Botanical Garden (NY); and U. S. National Herbarium (US). The kindness of the authorities of these institutions in permitting study of their material is greatly appreciated.

The Cunoniaceae do not occur in Tonga, on the basis of available records, but in Fiji the family is represented by 14 species and in Samoa by three species, all being endemic to one or the other archipelago. Of the four genera occurring in this area, only *Weinmannia* is widespread, with an extensive distribution mostly in the Southern Hemisphere. *Spiraeanthemum* is found from New Guinea and Australia eastward to Samoa, where its range is terminated by a single species; *Geissois* is more limited, occurring in New Caledonia, Australia, and the New Hebrides, with four species terminating its range in Fiji. Of special interest is the occurrence in Fiji of a species of *Pullea*, a genus previously believed limited to New Guinea.

In this paper three species and three varieties are described as new. Criteria for the demarcation of species in the Cunoniaceae are often neither obvious nor constant, but the genera are well marked. The following key to genera utilizes only characters found in the species of our region:

Infloresccense racemose, the racemes solitary or 2–4 at apex of a short common peduncle or arising from inconspicuous glomerules; ovary 2-carpellate, the capsule septicidally 2-valved; leaves compound or sometimes simple.

Flowers large, the calyx and filaments red, the stamens 8–26, with filaments 11–20 mm. long; petals none; disk pulvinate, entire; ovules numerous,

[1] Under the auspices of the Arnold Arboretum of Harvard University and the John Simon Guggenheim Memorial Foundation, with the aid of grants from the Penrose Fund of the American Philosophical Society and the Bache Fund of the National Academy of Sciences.

20–42 per locule, 2-seriate; seeds distally winged; plants with hermaphrodite flowers and 3-foliolate leaves .... 1. *Geissois.*

Flowers small, the petals and filaments white or greenish, the stamens 8, with filaments up to 4 mm. long; petals 4; disk divided into 8 free lobes; ovules 3–12 per locule; seeds comate at both ends, not winged; plants polygamo-dioecious, the leaves pinnate or 3-foliolate or simple .... 2. *Weinmannia.*

Inflorescence paniculate; flowers small, the calyx and filaments white to yellowish or greenish, the petals none, the stamens (6 –) 8–12; the disk divided into lobes; leaves simple.

Plants dioecious or possibly polygamo-dioecious; inflorescences solitary; ♂ flowers with (3 –) 4–6 free or loosely connate disk-lobes and no carpels; ♀ flowers with (6 –) 8–12 disk-lobes and 4 or 5 (rarely 3 or 6) free carpels, each 1- or 2-ovulate; follicles ventrally dehiscent, the seeds distally winged and usually with a basal wing as well. 3. *Spiraeanthemum.*

Plants with hermaphrodite flowers; inflorescences paired or ternate, superposed; disk-lobes 10 or 12, often coherent in pairs; ovary 2-carpellate, the ovules 4 per locule. .... 4. *Pullea.*

1. GEISSOIS Labill.

Geissois, originally based on a species from New Caledonia, is now considered to include about 17 species; its range centers in New Caledonia, but species also occur in Australia and the New Hebrides and eastward to Fiji, beyond which the genus does not extend.

In Fiji the local names *vure* and *vota* are usually applicable to *Geissois*, and in some localities *G. ternata* is a frequent and striking component of the vegetation, conspicuous for its beautiful red-flowered inflorescences. Criteria for the recognition of species, insofar as they refer to the size and indument of vegetative parts, are satisfactory within limits. The stipules in particular provide reliable characters, and in the case of *G. superba* the extreme length of the raceme is very obvious. Floral characters are usually too uniform to be of much taxonomic value, although the indument of the ovary, on the contrary, is too variable. In both *G. imthurnii* and *G. ternata* the ovary may vary from glabrous to strigillose or even densely sericeous, and as this variation seems uncorrelated with other characters I have not emphasized it.

In Fiji four species can be discerned, of which one is described as new. By far the greater part of the Fijian population of the genus represents *G. ternata*, which I here divide into four varieties, three of them new.

KEY TO THE SPECIES

Inflorescence robust, 22–45 cm. long, the stamens 14–26; leaves comparatively large, the petiole 1.5–8 cm. long, the petiolules 1.5–8 cm. long, the leaflet-blades usually 24–50 × 10–19 cm., with 13–20 secondary nerves per side; stipules large, ovate-oblong, comparatively persistent, up to 60 × 45 mm., proximally laterally connate. .... 1. *G. superba.*

Inflorescence much smaller, not exceeding 10.5 cm. in length, the stamens 8–15; leaves smaller, the petiole not exceeding 5 cm. and the petiolules 6 cm. (usually less than 2.5 cm.) in length, the leaflet-blades not more than

23 × 10.5 cm., usually much smaller, with not more than 15 secondary nerves per side; stipules usually not persistent after attaining a length of about 7 mm., if persistent oblong or elliptic, not more than 20 mm. broad, and laterally free.

Leaflets nearly sessile, the blades rounded to subacute at base, the petiolules of lateral ones up to 2 mm. (rarely to 3 mm.) and of terminal one up to 3 mm. (rarely to 6 mm.) long; leaflet-blades hispidulous on both surfaces, the hairs usually persistent, densest on costa and secondaries; branchlets, petioles, and petiolules copiously setulose or strigillose, rarely subglabrate; inflorescence-rachis and pedicels hispidulous, the calyx-lobes sparsely strigillose on both sides. .... 2. *G. imthurnii.*

Leaflets obviously petiolulate, the petiolules usually 4 mm. or more long (if shorter, the leaflet-base attenuate and long-decurrent); leaflet-blades glabrous or faintly strigillose on costa.

Stipules subpersistent, at length ligulate-oblong, up to 10 × 2 cm., copiously hispid without with hairs 1.5–2.5 mm. long, glabrous within; branchlets robust, distally conspicuously flattened, the petioles similarly flattened, copiously hispidulous or strigillose, the petiolules 1.5–6 cm. long, the leaflet-blades 11–23 × 6.5–10.5 cm.; calyx-lobes 6.5–7 mm. long. .... 3. *G. stipularis.*

Stipules usually early caducous, if subpersistent apparently not exceeding a size of about 3 × 1 cm., variously pilose or glabrous on both sides; branchlets subterete or distally slightly flattened, the petioles semiterete, sparsely strigillose and glabrate, the petiolules up to 2.5 cm. long, the leaflet-blades usually 2–17 × 1.5–9 cm.; calyx-lobes 4.5–6 mm. long. .... 4. *G. ternata.*

1. **Geissois superba** Gillespie in Bishop Mus. Bull **83**: 9. *fig. 9.* 1931.

Tree 10–13 m. or more in height, the branchlets stout (0.8–1.5 cm. in diameter toward apex and there subquadrate or slightly flattened), distally hispidulous or puberulent (hairs 0.1–0.5 mm. long), the older parts glabrate and lenticellate; stipules subcoriaceous, ovate-oblong, rapidly enlarging to about 6 cm. long and 4.5 cm. broad before falling, laterally connate at base, forming a bilobed cupule, recurved at margin, very densely velutinous-hispidulous on both sides (hairs 0.3–0.5 mm. long), rarely glabrate, the scars forming a conspicuous continuous ring; leaves opposite, 3-foliolate, the petioles semiterete, stout, 1.5–8 cm. long, hispidulous like branchlets, sometimes glabrate, the petiolules stout, shallowly canaliculate or subterete, 1.5–8 cm. long (terminal slightly the longest), pilose like petioles; leaflet-blades chartaceous to subcoriaceous, elliptic or obovate-elliptic, (15–) 24–50 cm. long, (6–) 10–19 cm. broad, acute to obtuse at base and decurrent on the petiolules, rounded at apex, entire and narrowly recurved at margin, glabrous above or sparsely strigillose on costa and secondaries, beneath strigillose on principal nerves and sometimes on surface, the costa elevated or prominent above, very prominent beneath, the secondary nerves 13–20 per side, erecto-patent, nearly straight, plane or slightly elevated above, prominent beneath, the veinlet-reticulation intricate, prominulous on both surfaces; racemes axillary and borne within the stipule-cupule or lateral below leaves, solitary or paired, pendent, 22–45 cm. long, the peduncle 3–12 cm. long, stout, terete, curved, with the conspicuously striate rachis sparsely hispidulous; flower-subtending bracts lanceolate, 2–2.5 mm. long, dorsally strigillose, soon caducous, the pedicels strigillose, 7–12 mm. long, articulate near or slightly below middle; calyx-lobes 4, carnose, becoming subcoriaceous, narrowly deltoid or lanceolate, 5–6 × 1.8–2.5 mm., acute, sparsely strigillose without and more densely hispidulous-tomentellous within (hairs 0.2–0.5 mm. long); stamens 14–26, the filaments 15–20 mm. long, the anthers oblong, about 1 mm. long; disk pulvinate, inconspicuously grooved, 0.5–1 mm. high and about 2 mm. in diameter; ovary copiously hispidulous-tomentellous or merely sparsely strigillose (hairs 0.8–1.3 mm. long), the styles 10–12 mm. long, the ovules about 40 per locule, imbricate, biseriate; receptacle swollen in fruit, the calyx-lobes soon caducous; capsule cylindric, falcate, 15–22 mm. long, persistently strigillose-hispidulous but the hairs often sparse, the pericarp coriaceous, the seeds about 3 mm. long.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu, at elevations up to 900 m. The species is a tree up to 13 m. high or perhaps larger, occurring in forest; the calyx and filaments are crimson and the anthers yellow. *Vure* is a reported local name. The type is *Gillespie 4274*, cited below.

FIJI: VITI LEVU: Mba: Between Nandarivatu and Vatuthere, *Gillespie 3178* (Bish, GH), *4274* (Bish TYPE, GH, K); Nandronga & Navosa: Northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, *Smith 5434* (A, US); Serua: Korovisilou, *B. E. Parham 1434* (A); Rewa or Naitasiri: "Central Road, Suva," *Tothill 471* (K); Viti Levu, without further locality, *Tothill 189c* (K).

The very distinct *G. superba* is readily distinguished from its congeners in Fiji by its robust leaves and elongate inflorescence, and by its characteristically large stipules, which are comparatively persistent and connate into a bilobed cupule.

2. **Geissois imthurnii** Turrill in Jour. Linn. Soc. Bot. 43: 19. 1915, in Hook. Ic. Pl. 31: *pl. 3053.* 1916.

Tree, to 20 m. high, the branchlets stout, lenticellate, terete or distally flattened, copiously setulose or strigillose with dull yellow hairs 0.3–1 mm. long, rarely subglabrate; stipules elliptic-oblong, usually caducous when very small, very densely setulose on both sides, rarely persisting to a size of about 5 × 1.5 cm., free to base, the scars elongate, straight or slightly curved; leaves opposite, 3-foliolate, the petioles subterete or slightly flattened above, (1–) 1.5–3 cm. long, copiously setulose like young branchlets, rarely glabrate, the petiolules comparatively inconspicuous, copiously setulose, of lateral leaflets 0–2 (–3) mm. long, of terminal leaflet 1–3 (–6) mm. long; leaflet-blades chartaceous to subcoriaceous, oblong- or obovate-elliptic, 6–11.5 (–18.5) cm. long, (2.5–) 3.5–6 (–8.5) cm. broad, broadly obtuse or rounded and inequilateral (lateral leaflets) or subacute (terminal leaflet) at base, obtusely cuspidate to broadly obtuse at apex, entire and slightly recurved at margin, hispidulous on both surfaces with spreading hairs 0.3–0.8 mm. long, rarely subglabrate but usually with persistent indument at least on costa and secondaries, the costa plane or slightly elevated above, prominent beneath, the secondary nerves 9–15 per side, subspreading, curved, prominulous or plane above, strongly elevated beneath, the veinlet-reticulation intricate, slightly prominulous or plane on both surfaces; racemes borne on defoliate branchlets, axillary to leaf-scars, solitary or 2 or 3 arising from an inconspicuous glomerule, 3–10 cm. long, the peduncle 0.5–3.5 cm. long, with the rachis sparsely hispidulous (hairs 0.2–0.4 mm. long); flower-subtending bracts deltoid or lanceolate, 0.8–1.6 mm. long, sparsely setulose without, soon caducous, the pedicels pilose like rachis, 3.5–8 mm. long, articulate slightly below middle; calyx-lobes 4, papyraceous, deltoid-lanceolate, 4.5–6 × 2–2.5 mm., acute, sparsely strigillose on both sides; stamens 9–12, the filaments 13–16 mm. long, the anthers oblong, 1–1.2 mm. long; disk pulvinate, 0.8–1 mm. high, 2–2.5 mm. in diameter; ovary glabrous or with a few stiff hairs or setulose-strigose with hairs 0.5–1 mm. long (sometimes variable on same individual), the styles 9–15 mm. long, the ovules about 40 per locule, biseriate; capsule linear-oblong, falcate, 18–28 mm. long, 3–5 mm. in diameter, glabrous or persistently strigillose, the seeds 4–5 mm. long, the nucellus ellipsoid, about 2.5 mm. long, the wing distal, rounded at apex.

DISTRIBUTION: Endemic to Fiji and thus far obtained only from a limited area near Nandarivatu, Viti Levu, at elevations of 750 to 900 m. It is a tree, recorded as 10–20 m. in height and with a trunk diameter up to 1 m., occurring in forest and on hillsides, mentioned by some collectors as locally common. The calyx and filaments are bright red to deep rose-pink. The local name, as for other species of *Geissois*, is *vure*; im Thurn mentions the name *vunga*, which is usually applicable to *Metrosideros*.

FIJI: VITI LEVU: Mba: Nandarivatu and immediate vicinity, *im Thurn 137* (Bm, K TYPE), *Parks 20671* (Bish), *Greenwood 886* (A, K), *Degener 14265* (A, Bish, K, NY, US), *Reay 17* (A, K, US), *Vaughan 3432* (BM); Nukunuku Creek, *Vaughan 3401* (BM).

The nearly sessile leaflets and the general pubescence of this plant, which usually persists on the leaflet-blades, differentiate it without difficulty from *G. ternata*. However, transitional forms, in which the petiolules are comparatively obvious (e. g. *Reay 17*), indicate that *G. imthurnii* is not as isolated a taxon as might be inferred from the type specimen alone.

3. **Geissois stipularis** sp. nov.

Arbor, ramulis crassis apices versus conspicue complanatis et pilis 0.2–0.5 mm. longis parce strigilloso-puberulis, demum glabratis cinereisque inconspicue lenticellatis; stipulis papyraceis juventute in gemma compacta subglobosa cohaerentibus, mox accrescentibus subpersistentibus, demum ligulato-oblongis 6–10 cm. longis 1.2–2 cm. latis ad basim liberis apice rotundatis, extus pilis 1.5–2.5 mm. longis copiose hispidis ac etiam minute puberulis, margine puberulo-tomentellis, intus glabris, cicatricibus conspicuis leviter curvatis; foliis oppositis 3-foliolatis, petiolis crassis valde complanatis 1.5–5 cm. longis pilis 0.4–0.7 mm. longis copiose hispidulis vel strigillosis, petiolulis canaliculatis vel semiteretibus 1.5–6 cm. longis ut petiolis pilosis vel subglabratis; foliolorum laminis coriaceis in sicco brunnescentibus elliptico- vel obovato-oblongis, 11–23 cm. longis, 6.5–10.5 cm. latis, basi obtusis vel subacutis et in petiolulum decurrentibus, apice obtuse cuspidatis, margine integris anguste recurvatis, utrinque glabris vel costa parce strigillosis, costa valida supra leviter elevata subtus prominente, nervis secundariis utrinsecus 8–12 erecto-patentibus supra subplanis subtus prominentibus, rete venularum conspicuo intricato utrinque prominulo vel supra subimmerso; racemis infra folia enatis solitariis 4–8 cm. longis, pedunculo brevi tereti et rhachi striata gracilibus strigilloso-puberulis; bracteis caducis, pedicellis sub anthesi 5–7 mm. longis medium versus articulatis, infra articulationem ut rhachi pilosis superne glabris; calycis lobis 4 carnosis deltoideo-lanceolatis, 6.5–7 mm. longis, 2.5–3 mm. latis, extus glabris, intus pilis pallidis 0.4–0.7 mm. longis hispidulis; staminibus 12 vel 13, filamentis ligulatis sub anthesi 12–15 mm. longis, antheris oblongis 1.2–1.4 mm. longis utroque emarginatis; disco carnoso pulvinato 0.8–1 mm. alto circiter 2.5 mm. diametro; ovario oblongo-conico glabro, stylis 10–12 mm. longis, ovulis biseriatis circiter 30 in quoque loculo.

DISTRIBUTION: Known only from the two collections cited below and perhaps limited to southeastern Viti Levu, Fiji.

FIJI: VITI LEVU: Naitasiri: Tamavua woods, 7 miles from Suva, alt. 150 m., Aug. 9, 1927, *Gillespie 2118* (Bish TYPE, GH, US); Viti Levu, without further data, *Parks 20940* (Bish).

Although the number cited as the type collection is sterile, it bears locality data and shows the foliar and stipular characters that are diagnostic for the species. The Parks specimen is accompanied by inflorescences but is without data; some of his plants were also obtained in southeastern Viti Levu.

Superficially the new species, in its large and long-petiolulate leaflets, suggests *G. superba*, but its leaflets are actually considerably smaller and fewer-nerved than in that species, and its stipules are entirely different. In inflorescence it seems closer to *G. ternata*, but characters pertaining to the stipules and branchlets differentiate it, while the predominantly larger leaves and calyx-lobes of *G. stipularis* are also characteristic.

4. **Geissois ternata** A. Gray, Bot. U. S. Expl. Exped. 1: 679. *pl. 86.* 1854.

Shrub or tree, up to 25 m. high, the branchlets subterete or distally flattened, sparsely strigillose with hairs 0.2–0.3 mm. long, soon glabrate, lenticellate; stipules ovate to oblong or elliptic, usually caducous when small, copiously setulose or strigillose to glabrous, rarely persisting to a size of 3 cm. long, free to base, the scars elongate, callose-thickened; leaves opposite, 3-foliolate, the petioles semiterete, 7–35 (–50) mm. long, sparsely strigillose when young, glabrate, the petiolules slender, shallowly canaliculate, strigillose like petioles and soon glabrate, of lateral leaflets 1–20 mm. long, of terminal leaflet to 25 mm. long; leaflet-blades subcoriaceous or chartaceous, elliptic or obovate-elliptic, 3–17 (–19) cm. long, (1.2–) 1.5–9 (–10.5) cm. broad, obtuse to attenuate at base and decurrent on the petiolule, rounded to obtusely cuspidate or acuminate at apex, entire at margin and plane or narrowly recurved (rarely denticulate-serrulate), glabrous on both surfaces or faintly strigillose on costa beneath, the costa plane or slightly elevated above, prominent beneath, the secondary nerves 5–13 per side, spreading or ascending, slightly curved, plane or prominulous above, slightly elevated beneath, the veinlet-reticulation intricate, prominulous on both surfaces or immersed above; racemes borne on defoliate branchlets, solitary or 2 or 3 arising from a small glomerule, 2.5–10.5 cm. long, the peduncle subterete, 0.5–2 cm. long, with the slightly angled rachis glabrous or faintly strigillose-puberulent; flower-subtending bracts lanceolate, 1.2–1.5 mm. long, glabrous or very sparsely strigillose dorsally, soon caducous, the pedicels 4–10 mm. long, articulate near middle or slightly above middle or sometimes near base, glabrous; calyx-lobes 4, papyraceous or carnose, lanceolate or narrowly deltoid, 4.5–6 × 1.4–3 mm., glabrous on both sides or sparsely strigose to crispate-pilose within; stamens 8–15, the filaments 11–18 mm. long, the anthers ellipsoid or oblong, 0.8–1.2 mm. long; disk pulvinate, 0.5–1.2 mm. high, 1.5–2 mm. in diameter; ovary glabrous or sparsely strigillose with hairs 0.3–0.7 mm. long (rarely densely strigose-sericeous), the styles 8–13 mm. long, the ovules 20–42 per locule, biseriate; capsule cylindric, falcate, 12–27 mm. long, 3–5 mm. in diameter, glabrous or strigillose to setulose-puberulent, the seeds about 5 mm. long, the nucellus ellipsoid, the wing distal, rounded at apex.

Distribution: Throughout Fiji, endemic, at elevations up to 1050 m. The species is a shrub or tree, up to 25 m. in height, occurring in a variety of habitats, including forest, hillside thickets, open places, etc. The calyx, filaments, and styles are deep red or bright red, the anthers, disk, and ovary yellow, and the fruit dull yellow or red-tinged, becoming brown. Local names for this common species are *vure* and *vota*, sometimes *vurevure*, and rarely *vunga*.

The residual population of *Geissois* in Fiji, when reasonably well characterized taxa like *G. superba*, *G. imthurnii*, and *G. stipularis* have been segregated, may be designated as *G. ternata*. Superficial acquaintance with this population shows that it is fairly heterogeneous, but detailed examination does not disclose obvious lines of differentiation. Nevertheless the available material seems too diverse to be left in a single taxon, and one is able to discern in it various morphological tendencies that seem usable for the establishment of infraspecific groups. The four groups here proposed as varieties are far from satisfactory, but I believe that their recognition permits a better understanding of *G. ternata*.

Of the proposed varieties, the best marked is characterized by a reduction in size of leaves and number of floral parts; the leaflet-blades tend to be blunter at apex and more attenuate at base, and concomitantly the stamens are reduced in number (8–12), the disk is shorter, and the ovules are comparatively few (20–34 per locule). The latter character, although impracticable for general use, suggests that the tendencies here recognized are not entirely superficial. This variety (var. *minor*) usually occurs at high elevations or in exposed places.

A proposed variety (var. *serrata*) known only from the Yasawa Group differs from the typical form in its comparatively large leaflets with serrulate margins (the species otherwise having entire leaflets), and also in the longer indument of its stipules. The value of this variety can scarcely be assessed without more material, but it seems inadvisable to include a form with toothed leaflets with typical material.

The remaining specimens are more homogeneous, although there is still a great deal of variation in leaf-size. Two types of stipule-indument are discernible; these organs may be copiously setulose with spreading hairs or they may be essentially glabrous (with hairs, when present, of a closely appressed type). This character may not be very consequential, but it is readily observed and is fairly constant, the apical stipules being present even on specimens in advanced fruiting stages. The type of the species falls into the first group, with setulose stipules (var. *ternata*), and the other group I propose as var. *glabrior*. Elsewhere in the Cunoniaceae the type of stipule-indument is a reliable character and is correlated with other criteria; in the present case it seems to be supported by no other consistent characters.

KEY TO THE VARIETIES

Leaves comparatively large, the petiolules (2–) 4–25 mm. long, the leaflet-blades usually 5–17 × 3–9 cm., obtuse to acute at base, obtusely cuspidate to acuminate at apex; inflorescence 4–10.5 cm. long, the stamens 12–15, the disk 0.8–1.2 mm. high, the ovules 36–42 per locule.

Leaflet-blades entire, usually 5–15 × 3–7.5 cm., the secondary nerves 5–11 per side.

Stipules copiously setulose with spreading hairs 0.2–1 mm. long. . . . . 4a. var. *ternata*.

Stipules glabrous on both sides or strigillose with appressed hairs 0.1–0.4 mm. long, sometimes puberulent-tomentellous at margin. . . . . 4b. var. *glabrior*.

Leaflet-blades obviously denticulate-serrulate at margin, large, usually 9–17 × 4–9 cm., the secondary nerves 9–13 per side; stipules copiously setulose with hairs 1.5–2 mm. long. . . . . 4c. var. *serrata*.

Leaves comparatively small, the petiolules 1–11 mm. long, the leaflet-blades usually 3–9.5 × 1.5–5 cm., attenuate at base, obtuse to rounded at apex, entire; stipules copiously setulose; inflorescence 2.5–8 cm. long, the stamens 8–12, the disk 0.5–0.6 mm. high, the ovules 20–34 per locule. 4d. var. *minor*.

4a. Geissois ternata var. ternata.

Geissois ternata A. Gray, Bot. U. S. Expl. Exped. **1**: 679. *pl. 86*. 1854; Seem. Fl. Vit. 109. 1865; Pampan. in Ann. di Bot. **2**: 58. 1905; Gibbs in Jour. Linn. Soc. Bot. **39**: 144. 1909.

The typical variety, characterized by having stipules copiously setulose with spreading hairs 0.2–1 mm. long; petiolules (2–) 4–25 mm. long; leaflet-blades (4–) 5–15 (–19) cm. long, (2–) 3–7.5 (–10.5) cm. broad, acute to obtuse at base, obtusely cuspidate at apex, entire at margin, the secondary nerves 5–11 per side; racemes 4–10.5 cm. long, the stamens 12–15, the disk 0.8–1.2 mm. high, the ovules 36–42 per locule.

DISTRIBUTION: Known from several of the islands, at elevations from near sea-level up to 900 m., and apparently the most abundant variety on Viti Levu. The type material, obtained by the U. S. Exploring Expedition, comes from at least two plants, obtained on Ovalau and in the Province of Mathuata, Vanua Levu.

FIJI: VITI LEVU: *Graeffe* (K), *27* (BM); Mba: Northern portion of Mt. Evans Range, between Mt. Vatuyanitu and Mt. Natondra, *Smith 4271* (A, US); vicinity of Nandarivatu, *Gibbs 591* (BM), *Smith 5969* (A, US); Nandronga & Navosa: Southern slopes of Nausori Highlands, in drainage of Namosi Creek above Tumbenasolo, *Smith 4605* (A, US); vicinity of Mbelo, near Vatukarasa, *Degener 15274* (A, Bish, K, NY, US); Serua: Mbuyombuyo, near Namboutini, *Tabualewa 15609* (A, Bish, K, NY, US); Thulanuku, near Ngaloa, *Degener 15120* (A, Bish, K, NY, US). KANDAVU: *Seemann 201* (BM, GH, K); hills above Namalata and Ngaloa Bays, *Smith 76* (Bish, GH, K, NY, US). OVALAU and VANUA LEVU: *U. S. Expl. Exped.* (GH, K, NY, US 47817 and 47818 TYPE). Fiji, without definite locality: *Horne* (GH).

4b. **Geissois ternata** var. **glabrior** var. nov.

Frutex vel arbor grandis a var. *ternata* stipulis utrinque glabris vel pilis adpressis 0.1–0.4 mm. longis strigillosis interdum margine puberulo-tomentellis differt.

DISTRIBUTION: Recorded from several islands in Fiji, at elevations from near sea-level up to 500 m.; it seems to have a more easterly distribution within the group than var. *ternata*. As type I designate *Smith 1590*, from Vanua Levu, a collection with flowers and fruits which also shows the diagnostic stipule character.

FIJI: VITI LEVU: Namosi: Between Namuamua and Laselase, *Gillespie 3213* (Bish, GH, K, NY). VANUA LEVU: Mbua: Upper Ndama River Valley, Apr. 24, 1934, in dense forest at 100–300 m., *Smith 1590* (Bish, GH, K, NY TYPE, US); Thakaundrove: Hills south of Nakula Valley, *Smith 343* (Bish, GH, K, NY, US); Valanga, Savu Savu Bay region, *Degener & Ordonez 14034* (A). TAVEUNI: Vicinity of Waiyevo, *Gillespie 4699* (Bish, K, NY, US); western slope, between Somosomo and Wairiki, *Smith 847* (Bish, GH, K, NY, US). KORO: Western slope, *Smith 1085* (Bish, GH, K, NY, US). VANUA MBALAVU: Slopes of highest peak, *Bryan 583* (Bish); near Lomaloma, *Smith 1424* (Bish, K, NY). LAKEMBA: *Harvey* (GH, K).

4c. **Geissois ternata** var. **serrata** var. nov.

Arbor ad 15 m. alta, stipulis pilis 1.5–2 mm. longis dense setosis, petiolis (10–) 17–25 mm. longis, petiolulis (5–) 12–25 mm. longis, foliolorum laminis ovatis vel ellipticis, (6–) 9–17 × (2.5–) 4–9 cm., apice obtuse cuspidatis vel acuminatis, margine saltem supra medium denticulato-serrulatis (dentibus 1–3 per centimetrum parvis superne calloso-apiculatis), nervis secundariis utrinsecus 9–13; a var. *ternata* foliolorum laminis manifeste serrulatis, magnis, apice saepe acuminatis, nervis secundariis numerosis, stipularum pilis longioribus differt.

DISTRIBUTION: Known only from the type collection, from Waya Island in the Yasawa Group, northwest of Viti Levu.

FIJI: WAYA, Yasawa Group: North of Yalombi, woods along Olo Creek, alt. 120–240 m., July 19, 1937, *St. John 18128* (Bish TYPE, US) ("vunga"; tree 15 m. high, common, the trunk 8–10 cm. in diameter; flowers red; wood used for houses; birds visit the flowers).

4d. Geissois ternata var. minor var. nov.

Frutex vel arbor ad 4 m. alta, stipulis eis var. *ternatae* similibus; petiolis 7–25 mm. longis, petiolulis 1–11 mm. longis, foliolorum laminis anguste ellipticis vel lanceolato-ellipticis, 3–9.5 × (1.2–) 1.5–5 cm., basi attenuatis, apice obtusis vel rotundatis, nervis secundariis utrinsecus 5–8; racemis 2.5–8 cm. longis, staminibus 8–12, disco 0.5–0.6 mm. alto, ovulis 20–34 in quoque loculo; a var. *ternata* foliis minoribus, foliolorum laminis basi attenuatis apice saepe rotundatis, inflorescentia minore, staminibus et ovulis paucis, disco breviore differt.

DISTRIBUTION: Known from the two large islands of Fiji, often at comparatively high elevations (500–1050 m.), where it occurs in forest, dense thickets, or in exposed places. It is a comparatively small plant, noted as a gnarled shrub or a tree 2–4 m. high. The type, a specimen with flowers, young fruits, and characteristically small leaves, is *Smith 679*, from Vanua Levu.

FIJI: VITI LEVU: Mba: Mt. Evans Range, *Greenwood 119* (K); Tholo-i-Nandarivatu, *Gillespie 3898* (Bish); Namosi: Summit of Mt. Voma, *Gillespie 2730* (Bish). VANUA LEVU: Mathuata: Summit ridge of Mt. Numbuiloa, east of Lambasa, *Smith 6514* (A, US); Thakaundrove: Summit of Mt. Mbatini, alt. 1030 m., Nov. 29, 1933, *Smith 679* (Bish, GH, K, NY TYPE, US).

2. WEINMANNIA L.

The genus *Weinmannia*, as here considered, is represented by five species in Fiji and two in Samoa, being absent from Tonga as far as known. The Fijian and Samoan species appear to be endemic, records of their occurrence in more than one archipelago being discussed below. The genus is not a common component of the vegetation in either group. Criteria for specific delimitation in *Weinmannia* are not satisfactory, such characters as simple vs. pinnate leaves and degree of indument being highly variable. To a certain extent more dependable characters are found in the shape of stipules, the persistent or caducous nature of the calyx, and the number of ovules. In my observation, the Fijian species have the ovules 3–6 per locule as opposed to 8–12 in the Samoan species. Leaflet-shape is a usuable character only within very broad limits; one species, here described as new, is characterized by very small leaves and compact inflorescences. All the species of our region are probably polygamo-dioecious; staminate flowers have comparatively long filaments, short styles, and sterile carpels, while hermaphrodite flowers have shorter filaments, longer styles, and readily observed ovules in the carpels. Superficially the two types of flower are not easily distinguished. It may be noted that the Fijians seem to have no common name for *Weinmannia* which is generic in nature, as they do for *Spiraeanthemum* and *Geissois*.

Key to the species

Leaves simple, rarely 2- or 3-foliolate, the blades up to 11 × 6 cm.; stipules ovate to elliptic or suborbicular-obovate, entire, often nearly as broad as long; perianth (at least in no. 1) comparatively large, the sepals 1.2–1.5 mm. long, the petals 1.6–1.8 mm. long; perianth caducous in fruit.

  Stipules comparatively large, 13–25 × 10–15 mm., conspicuously barbellate in axils, the tufts of hairs often subpersistent; leaves nearly always simple, very rarely 2-foliolate, the blades oblong-elliptic, usually 7–11 × 2.5–6 cm., the marginal crenations usually 1 or 2 per centimeter; ovules usually 4 per locule; seeds copiously comate at both ends, the hairs 0.7–1 mm. long, with obvious cross-walls; Fiji ....1. *W. affinis*.

  Stipules smaller, 6–12 × 2–9 mm., not barbellate in axils or very inconspicuously so; leaves simple or 3-foliolate, the blades predominantly lanceolate, usually 4–10 × 1.3–4 cm., the marginal crenations usually 3 or 4 per centimeter; ovules 10–12 per locule; seeds more sparsely comate at both ends, the hairs 0.4–0.5 mm. long, the cross-walls inconspicuous; Samoa ....2. *W. manuana*.

Leaves compound, 3–9-foliolate, rarely 1-foliolate; perianth (not known for no. 3) comparatively small, the sepals less than 1.2 mm. long, the petals less than 1.6 mm. long.

  Leaflets comparatively large, only rarely less than 2 × 1 cm., usually much larger, the marginal crenations only rarely as few as 8 per side; racemes more than 4 cm. long, often up to 12 cm. or longer.

    Leaves with the petiole, rachis, and lower leaflet-surfaces hispidulous (hairs 0.5–1 mm. long); stipules suborbicular or ovate-oblong, about 10 × 7–10 mm., conspicuously dentate; known only in sterile condition; Fiji ....3. *W. spiraeoides*.

    Leaves glabrous or with the petiole, rachis, and costa of lower leaflet-surfaces puberulent (hairs up to 0.2 mm. long), or in the Samoan species the petiole and costa sometimes strigose (hairs 0.5–1 mm. long); stipules entire.

      Stipules suborbicular, very variable in size but usually slightly broader than long; leaves variable, with (1–) 3–9 leaflets, these predominantly elliptic or oblong-elliptic; sepals 0.5–0.7 mm. long; petals 1–1.3 mm. long; ovules 4–6 per locule; perianth persistent in fruit; Fiji ....4. *W. richii*.

      Stipules oblong or ovate to lanceolate, longer than broad; leaflets predominantly lanceolate or lanceolate-elliptic; sepals 0.7–1.2 mm. long; petals 1.1–1.6 mm. long; perianth caducous in fruit.

        Ovules usually 4 per locule; leaves (as far as known) 3-foliolate, all of the leaflet-blades attenuate at base; Fiji. .....5. *W. vitiensis*.

        Ovules 8–12 per locule; lateral leaflet-blades with the lower basal margins obtuse or rounded; Samoa.

Leaves 3–9-foliolate (very rarely simple), the leaflet-blades 1–2.5 cm. broad. ....6. *W. samoensis.*

Leaves sometimes 3-foliolate, usually simple, the blades 1.3–4 cm. broad. ....2. *W. manuana.*

Leaflets small, 8–16 mm. long, 3–6 mm. broad, with 3–6 marginal crenations per side; stipules suborbicular, 2–4 mm. in diameter, strongly revolute; racemes 2–3 cm. long; Fiji. ....7. *W. exigua.*

1. **Weinmannia affinis** A. Gray, Bot. U. S. Expl. Exped. 1: 674. 1854; C. Muell. in Walp. Ann. Bot. Syst. **5**: 30. 1858; Seem. Fl. Vit. 110. 1865; Engl. in Linnaea **36**: 648. 1870; Pampan. in Ann. di Bot. **2**: 92. 1905; Gibbs in Jour. Linn. Soc. Bot. **39**: 145. 1909.

Shrub or small tree, the branchlets glabrous or inconspicuously puberulent distally; stipules chartaceous or subcoriaceous, elliptic or suborbicular-obovate, entire, 13–25 × 10–15 mm., obtuse at apex, conspicuously barbellate in axils, the hairs (pale, stiff, 1–1.5 mm. long) often subpersistent; leaves glabrous, simple, rarely 2-foliolate, the petioles (4–) 8–17 mm. long (20–25 mm. long in compound leaves, then the leaflets sessile), the blades subcoriaceous, oblong-elliptic, (3.5–) 7–11 cm. long, (1.5–) 2.5–6 cm. broad, acute to obtuse at base and decurrent, obtuse or obtusely cuspidate at apex, conspicuously crenate-serrate with 1 or 2 crenations per centimeter, the venation obvious, the secondary nerves 7–14 per side, the veinlet-reticulation usually prominulous on both surfaces; racemes usually paired or ternate at apices of peduncles (1.5–4 cm. long), 4–9 cm. long, the peduncle, rachis, and pedicels puberulent (hairs 0.1–0.2 mm. long), sometimes glabrate; flowers crowded, sometimes pseudoverticillate, the pedicels 1.3–2 mm. long or slightly shorter at anthesis; sepals essentially glabrous, oblong, 1.2–1.5 × 0.7–1 mm., rounded at apex; petals membranaceous, oblong, 1.6–1.8 × 0.9–1.2 mm., rounded at apex; disk-lobes oblong-clavate, 0.5–0.7 mm. long; stamens with filiform filaments up to 4 mm. long (in ♂ flowers) and anthers 0.3–0.4 mm. in diameter; carpels ovoid, minutely hispidulous-puberulent, the styles less than 1 mm. long at anthesis, the ovules usually 4 per locule (in ☿ flowers, none or undeveloped in ♂ flowers); perianth soon caducous; capsule ellipsoid, 2.5–4 mm. long, usually persistently puberulent, the styles up to 1.5 mm. long; seeds 0.5–0.8 mm. long, copiously and persistently comate at both ends, the hairs 0.7–1 mm. long, many-celled, crispate.

DISTRIBUTION: Endemic to Fiji, thus far known from Viti Levu, Ovalau, and Taveuni but doubtless to be expected from other high islands, at elevations of 350–1200 m. (as far as recorded). It is a shrub or small tree, up to 7 m. in height, usually occurring in dry forest or ridge forest or on dry open ridges, occasionally in wetter localities. The petals and filaments are white and the capsules red. Recorded local names are *vure* (*Gillespie 2736*) and *katakata* (*Smith 4905*), names usually referred to the genera *Geissois* and *Spiraeanthemum* respectively. The type, cited below, is an Exploring Expedition specimen from Ovalau.

FIJI: VITI LEVU: *Seemann 197* (BM, GH, K); Mba: Mountains near Lautoka, *Greenwood 247* (K); vicinity of Nandarivatu, *Gibbs 642* (BM, K), *733* (BM), *881* (BM, K), *Greenwood 864* (A, K, US), *Smith 4905* (A, US), *Vaughan 3405* (BM); Nandronga & Navosa: Southern slopes of Nausori Highlands, above Tumbenasolo, *Greenwood 1188* (A); Namosi: Mt. Korombasambasanga, *B. E. Parham 2201* (A); Mt. Voma, *Gillespie 2736* (Bish), *B. E. Parham 602* (A), *2598* (A). OVALAU: *U. S. Expl. Exped.* (GH, K, NY, US 48070 TYPE), *Graeffe* (K). TAVEUNI: Borders of lake east of Somosomo, *Smith 878* (Bish, K, NY); Vuna, *Seemann 200* (BM, GH, K). Fiji, without definite locality: *Horne 916* (GH, K), *Gillespie 2730* (Bish).

The cited specimens probably give a fair picture of the variation to be expected in *W. affinis*, which is without difficulty recognized by its simple (only very rarely 2-foliolate) leaves with proportionately broad and coarsely crenate blades. Its flowers are slightly larger than those of other species of our region, and in general the indument is negligible. The type material is among the larger in foliage-dimensions, and from it there is a series of specimens toward such small-leaved forms as that found on Taveuni (e. g. *Smith 878*, which also has the inflorescence strictly glabrous). Gray's var. *β*, with 3-foliolate leaves, may be referred to *W. vitiensis*, as suggested by Seemann. The closest ally of *W. affinis* seems to be the Samoan *W. manuana*, as noted below.

2. **Weinmannia manuana** Christophersen in Bishop Mus. Bull. **154**: 10. *fig. 2.* 1938.

Weinmannia affinis sensu Reinecke in Bot. Jahrb. **25**: 635. 1898; Christophersen in Bishop Mus. Bull. **154**: 9. 1938; non A. Gray.

Shrub or small tree, rarely epiphytic, the branchlets in distal internodes strigose with hairs up to 1 mm. long or glabrous; stipules ovate or elliptic, entire, 6–12 × 2–9 mm., obtuse or subacute at apex, soon glabrate, not (or very obscurely) barbellate in axils; leaves simple or 3-foliolate, the petioles 3–30 mm. long, often strigose like young branchlets but soon glabrate, the blades (sessile in lateral leaflets of compound leaves, with petiolules 5–10 mm. long and winged in terminal leaflets) chartaceous, lanceolate, (3–) 4–10 cm. long, (1–) 1.3–4 cm. broad, acute to attenuate at base and decurrent (or lateral leaflets of compound leaves with the lower edge of base rounded), obtusely cuspidate or short-acuminate at apex, crenate with (2–) 3 or 4 crenations per centimeter, the costa often hirtellous beneath but soon glabrate, the secondary nerves 8–14 per side, prominulous or nearly plane, the veinlet-reticulation copious, essentially plane; racemes usually ternate at apices of peduncles (0.8–1.5 cm. long), 4–8 cm. long, the peduncle, rachis, and pedicels pale-puberulent, subglabrate, the subtending bracts lanceolate, about 1 mm. long, caducous; pedicels 1.5–2 mm. long (or slightly shorter at anthesis); sepals ovate-oblong, 0.7–1.1 × 0.7–0.9 mm., rounded at apex; petals membranaceous, oblong, 1.3–1.6 × 0.8–1 mm., rounded at apex; disk-lobes 0.4–0.5 mm. long; stamens with filiform filaments 1–1.5 mm. long (in ☿ flowers) or up to 3 mm. long (in ♂ flowers), the anthers 0.3–0.4 mm. in diameter; carpels ovoid, strigose in bud, the ovules 10–12 (in ☿ flowers, undeveloped in ♂ flowers); perianth soon caducous; capsules ellipsoid, 3.5–4 mm. long, obscurely puberulent or glabrate, the styles 1–1.5 mm. long; seeds 0.6–0.8 mm. long, comate at both ends, the hairs comparatively sparse, 0.4–0.5 mm. long and with inconspicuous cross-walls.

DISTRIBUTION: Limited to Samoa and apparently to be expected throughout the group, at elevations of 480–1500 m. It has been recorded as a shrub or tree 1–7 m. in height, occurring in forest, in wet scrub-forest, on high ridges, and on open old lava fields. The type is *Garber 1031*, from Olosenga, cited below.

SAMOA: SAVAII: Above Aopo, *Christophersen 889* (Bish, NY); Aopo-Gagamalae, *Christophersen 3446* (Bish); Matavanu crater, *828* (Bish, US), *2222* (Bish). TUTUILA: Le Pioa, at top, *Christophersen 1201* (Bish, NY), *3565* (Bish). OLOSENGA: Piumafua Mt., at top, *Garber 1027* (Bish), *1031* (Bish TYPE); Piumafua ridge, *Garber 1066* (Bish). TAU: Trail to peak, *Garber 720* (Bish, US). Samoa, without definite locality: *U. S. Expl. Exped.* (US 66032).

The specimens which Christophersen referred to *W. affinis* have been carefully compared with the type and other Fijian specimens, and also with *W. manuana*, and it appears to me that they represent the latter and that true *W. affinis* does not occur in Samoa. In proposing *W. manuana*, Christophersen separated it from *W. affinis* on the basis of its densely hirtellous young branches and inflorescences and the more prominent crenation of the leaves. While these characters are valid as far as the two type collections are concerned, examination of other material of this relationship shows that the indument is too variable to be very useful; in the Fijian material the young branchlets and inflorescence vary from copiously puberulent to glabrous, and in the Samoan material from somewhat strigose or merely puberulent to glabrous. Characters pertaining to leaf-shape and marginal crenations are apparent but are also very variable, while the flowers (sepals, petals, and disk-lobes) of *W. affinis* are slightly larger than the corresponding parts in *W. manuana*. More dependable characters in differentiating these species pertain to the stipules, number of ovules, and seed-indument, but these characters are either minute or transitory. Nevertheless it seems reasonable to separate the Fijian and Samoan populations as indicated in my key.

3. **Weinmannia spiraeoides** A. Gray, Bot. U. S. Expl. Exped. **1**: 677. 1854; C. Muell. in Walp. Ann. Bot. Syst. **5**: 30. 1858; Seem. Fl. Vit. 110. 1865; Engl. in Linnaea **36**: 644. 1870.

Small tree, the branchlets, at least distally, copiously setulose with pale hairs 0.5–0.8 mm. long; stipules suborbicular or ovate-oblong, about 10 × 7–10 mm., conspicuously dentate with 7–9 teeth, sparsely setulose on both surfaces; leaves 5-foliolate (as far as known), the petioles 13–27 mm. long, like the rachis and petiolules very slender, copiously hispidulous with hairs 0.5–1 mm. long, the petiolules (of lateral leaflets) 1 mm. long or less, of terminal leaflet 5–10 mm. long, the leaflet-blades chartaceous, lanceolate-elliptic, (2.5–) 3–6 cm. long, 1–2.5 cm. broad, acute to attenuate at base, acute or obtusely cuspidate at apex, conspicuously serrate with 3 or 4 teeth per centimeter, copiously hispidulous beneath especially on nerves, often subglabrate above except on costa, the secondary nerves 5–9 per side, prominulous or nearly plane like the veinlet-reticulation; inflorescences unknown.

DISTRIBUTION: Known only from the type collection, from the island of Ovalau, Fiji, at about 150 m.

FIJI: OVALAU: *U. S. Expl. Exped.* (US 48073 TYPE).

The sterile specimen so optimistically described by Gray as a new species has not yet been matched among more recent collections, and it may conceivably represent a distinct species. However, the possibility cannot be ignored that this specimen may be merely a juvenile form of some other taxon, perhaps of *W. richii*. Nevertheless, juvenile forms of *W. richii* so far available do not show the dentate stipules or the type of leaf-indument described for *W. spiraeoides*, which for the time being is accepted as a separate, if quite unsatisfactory, entity.

4. **Weinmannia richii** A. Gray, Bot. U. S. Expl. Exped. **1**: 675. *pl. 85, B.* 1854; C. Muell. in Walp. Ann. Bot. Syst. **5**: 30. 1858; Seem. Fl. Vit. 110. 1865; Engl. in Linnaea **36**: 643. 1870.

Weinmannia rhodogyne Gibbs in Jour. Linn. Soc. Bot. **39**: 145. 1909; Turrill in Jour. Linn. Soc. Bot. **43**: 20. 1915.

Shrub or small tree, often compact, up to 7 m. high, the branchlets sparsely to copiously puberulent distally with hairs 0.1–0.2 mm. long, often glabrate; stipules chartaceous, suborbicular, 1.5–12 × 1.5–16 mm., rounded at apex, entire, sericeous-puberulent on both sides but usually glabrate, strigose-tufted in axils; leaves 3–9-foliolate (very rarely simple), the petioles 0.7–3 cm. long, puberulent like young branchlets or glabrous, the rachis similar, narrowly winged or flattened above in distal internode, the lateral petiolules up to 2 mm. long or essentially none, the terminal petiolule 3–15 mm. long, distally winged, often puberulent, the blades subcoriaceous or chartaceous, elliptic or oblong-elliptic, (1.5–) 3–7 cm. long, (1–) 1.2–3.8 cm. broad (terminal rarely to 9.5 × 4.5 cm.), acute to attenuate at base and decurrent, obtusely cuspidate at apex, crenulate with 2 or 3 crenations per centimeter, glabrous (or puberulent beneath on costa and rarely on lower part of blades), the secondary nerves 7–9 per side, with the veinlet-reticulation prominulous on both surfaces, or the veinlets subimmersed; racemes 2–4 (often ternate) at apices of peduncles (1–10 mm. long) or sometimes solitary, the peduncle, rachis, and pedicels puberulent like young branchlets, rarely glabrate, the racemes 4–12 (–14.5) cm. long, the flowers crowded, subfasciculate in groups of 2–8; pedicels at anthesis 0.7–1.5 mm. long, in fruit up to 2 mm. long; sepals oblong-ovate, 0.5–0.7 × 0.4–0.6 mm., obtuse at apex, essentially glabrous but sometimes sparsely pilose distally or ciliolate; petals membranaceous, obovate-oblong, 1–1.3 × 0.6–0.8 mm., rounded or obscurely retuse at apex; disk-lobes 0.2–0.4 mm. long; stamens with filiform filaments up to 2.5 mm. long, the anthers about 0.3 mm. in diameter; carpels ovoid, crispate-pilose with pale hairs 0.2–0.4 mm. long, the styles up to 1.5 mm. long, the ovules 4–6 per locule in ☿ flowers; calyx and often petals usually persistent, even after carpel has shattered; capsules narrowly ellipsoid, up to 3.5 mm. long, sparsely soft-pilose, eventually subglabrate, the styles persistent; seeds about 0.7 mm. long, comate at both ends, the hairs 0.7–1.5 mm. long, with obscure cross-walls.

DISTRIBUTION: Limited to Fiji, thus far known from Viti Levu, Vanua Levu, and Taveuni but doubtless occurring on other islands. Elevations of 100 to 1100 m. have been recorded, as well as a variety of habitats, such as open forest, thickets, scrub, dry slopes, open country, etc. The species is a shrub or small tree up to 7 m. in height, with pinkish to dark red peduncles, rachises, and pedicels, white or greenish white petals and stamens, and white carpels which become deep red during development and in fruit. A recorded local name is *vota* (*Smith 6813*). The type is an Exploring Expedition specimen from Mbua Bay [Sandalwood Bay], Vanua Levu, cited below.

FIJI: VITI LEVU: Mba: Mountains near Lautoka, *Greenwood 230* (K), *384* (A, K), *401* (K); vicinity of Nandarivatu, *Gibbs 594* (BM type of *W. rhodogyne*, K), *im Thurn 73* (BM, K), *Mead 1989* (K), *Gillespie 4035* (Bish, GH, K, NY), *4233* (Bish, GH, K), *Degener & Ordonez 13599* (A, Bish, K, NY), *Degener 14379* (A, Bish, K, NY, US), *Smith 5052* (A, US), *Vaughan 3228* (BM); slopes and ridges of Mt. Nanggaranambuluta [Lomalangi], east of Nandarivatu, *Gillespie 4333* (Bish, GH, NY), *4071.1* (Bish), *Smith 5739* (A, US); Nandronga & Navosa: Southern slopes of Nausori Highlands, in drainage of Namosi Creek above Tumbenasolo, *Smith 4710* (A, US). VANUA LEVU: Mbua: *H. B. R. Parham*, Jan. 3, 1937 (A, BM); Mbua Bay, *U. S. Expl. Exped.* (GH, K, NY, US 48071 TYPE); Ndama, *B. E. Parham & M. Sealolo 2277* (A); Wairiki, *B. E. Parham 1122* (A); Mathuata: Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, *Smith 6813* (A, US). TAVEUNI: Above Somosomo, *Gillespie 4837* (Bish, GH). Fiji, without definite locality: *Storck*, June 1883 (BM, K), *25* (GH), *Horne 1097* (K).

Although *W. richii* is the most abundant species of the genus in Fiji, it does not seem widely dispersed throughout the group, and in my observation it is nowhere abundant; even at Nandarivatu, where many collectors have obtained it, it is not a conspicuous element of the vegetation. As here delimited, *W. richii* is readily distinguished from its closest relative, *W. vitiensis*, by its suborbicular stipules, proportionately broader leaflets, somewhat smaller flowers, and persistent perianth.

The characters utilized by Gibbs to separate *W. rhodogyne* from *W. richii* are seen to be inconsequential when a series of specimens is examined. It is true that the branchlets and leaves of the type of *W. rhodogyne* are glabrous, whereas in the type of *W. richii* the young branchlets, as well as the petiole, leaf-rachis, and costae of the leaflets beneath are setulose-puberulent. However, every stage between these conditions is to be found, even among plants from the vicinity of Nandarivatu, the type locality of *W. rhodogyne.* Stipules of the two type specimens are similar in shape, those of *W. rhodogyne* being much the smaller, but this appears to be a matter of stage of development, as on other specimens stipules are to be seen varying in diameter from about 2 to 15 mm., often on the same plant. Differences in size of sepals and petals are inconsequential, and filament-length seems to be a matter of state of development of the flower. The ovary is similarly pilose in both concepts. Number of leaflets cannot be utilized to divide the series of specimens cited above. In the type of *W. richii* the leaflets vary between 3 and 9, whereas they seem to be always 3 on Gibbs' type. Other material shows the entire range in this character, and occasionally even unifoliolate leaves are found. In general, it can only be stated that the type of *W. rhodogyne* and much of the other material from the Nandarivatu region is comparatively delicate and inclines to be less pubescent than typical specimens of *W. richii* from the drier regions of leeward Vanua Levu. No reasonable means has been found to separate *W. rhodogyne* from the older concept, even varietally.

5. **Weinmannia vitiensis** Seem. Fl. Vit. 110. 1865; Pampan. in Ann. di Bot. 2: 93. 1905.

Weinmannia affinis var. β A. Gray, Bot. U. S. Expl. Exped. 1: 674. 1854; C. Muell. in Walp. Ann. Bot. Syst. 5: 30. 1858; Engl. in Linnaea 36: 649. 1870.

Shrub or small tree, the young parts and branchlets strigose-puberulent or strigillose with whitish hairs 0.1–0.5 mm. long, soon glabrate; stipules chartaceous, oblong or narrowly elliptic, 3–10 × 1.5–5 mm., rounded or obtuse at apex, sparsely puberulent without or glabrate, strigose-tufted in axils; leaves 3-foliolate (as far as seen), the petioles 4–18 mm. long, glabrous, often narrowly winged distally, the petiolules winged nearly to base (in lateral leaflets essentially none or up to 7 mm. long, slightly longer in terminal leaflets), the blades subcoriaceous, lanceolate or lanceolate-elliptic, (2.5–) 3–5.5 cm. long, 1–2 cm. broad (terminal sometimes up to 7.5 × 2.8 cm.), attenuate at base and decurrent, obtuse or obtusely cuspidate at apex, crenulate with about 3 crenations per centimeter, glabrous on both sides, the secondary nerves 6–12 per side, with the veinlet-reticulation sharply prominulous on both sides, or the veinlets nearly plane; racemes ternate at apices of peduncles (these very short and insignificant or up to 2 cm. long) or perhaps sometimes solitary, the peduncle, rachis, and pedicels strigose-puberulent like young branchlets, at length glabrate, the racemes 4–7 cm. long; flowers scattered or subfasciculate in groups of 2–4, subtended by caducous oblong bracts up to 1 mm. long, the pedicels slender, about 1 mm. long at anthesis and up to 2 mm. long in fruit; sepals oblong, 1–1.2 × 0.7–0.8 mm., rounded at apex, glabrous; petals oblong, 1.4–1.6 × 0.8–1 mm., rounded at apex; disk-lobes 0.5–0.6 mm. long; stamens with filiform filaments up to 1.7 mm. long, the anthers about 0.3 mm. in diameter; carpels ovoid, sparsely strigose, the styles at anthesis less than 1 mm. long, the ovules 4 per locule in ☿

flowers; calyx and petals caducous in fruit, leaving a flattened receptacle; capsules narrowly ellipsoid, 3–3.5 mm. long, sparsely puberulent or soon glabrate, the styles up to 1 mm. long; seeds narrowly ellipsoid, about 0.8 mm. long, comate at both ends, the hairs 0.5–1 mm. long, with obscure cross-walls.

DISTRIBUTION: Endemic to Fiji, thus far known from three of the smaller islands but to be expected elsewhere in the group. The species occurs at elevations up to 400 m., from the scanty data thus far available, in dense forest or in open places as a compact shrub or tree up to 8 m. in height. The petals and filaments are white and the mature capsules brown. On Moala I recorded the local name as *molau ndamu.*

FIJI: KANDAVU: *Seemann 199* (GH, K TYPE). OVALAU: *U. S. Expl. Exped.* (source of the reference to *W. affinis* var. β, GH, NY). MOALA: Summit ridge, *Bryan 317* (Bish); Ndelaimoala, *Smith 1354* (Bish, GH, K, NY, US). Fiji, without definite locality: *Harvey* (GH, K).

This apparently uncommon species is distinguished from *W. richii* by characters pertaining to stipules, foliage, and perianth, as noted above. The species is one of the conspicuous elements in the rather dry, low forest and open scrub on the island of Moala, but I have not personally observed it elsewhere.

6. **Weinmannia samoensis** A. Gray, Bot. U. S. Expl. Exped. **1**: 677. 1854; C. Muell. in Walp. Ann. Bot. Syst. **5**: 30. 1858; Engl. in Linnaea **36**: 647. 1870; Reinecke in Bot. Jahrb. **25**: 634. 1898; Pampan. in Ann. di Bot. **2**: 92. 1905; Rechinger in Denkschr. Akad. Wiss. Wien **85**: 286. 1910; Setchell in Carnegie Inst. Publ. **341**: 92. 1924; Christophersen in Bishop Mus. Bull. **154**: 11. 1938.

Weinmannia samoensis f. *glabrescens* Pampan. in Ann. di Bot. **2**: 92. 1905.

Shrub or small tree, the branchlets hispidulous-puberulent with hairs 0.1–0.7 mm. long, at length glabrate; stipules elliptic or lanceolate-elliptic, 5–15 × 3.5–10 mm., entire, rounded or obtuse at apex, sparsely puberulent and glabrate; leaves 3–7-foliolate (rarely 9-foliolate, very rarely simple), the petioles (1–) 1.5–4 (rarely to 6) cm. long, at first hispidulous, soon glabrate, the rachis similar, usually narrowly winged in distal internode, the petiolules essentially none in lateral leaflets, 3–8 (–13) mm. long in terminal leaflets, winged nearly to base and sometimes hispidulous; leaflet-blades chartaceous, lanceolate, (3–) 4–9 (–12) cm. long, (0.7–) 1–2.5 cm. broad, attenuate at base and decurrent (lateral leaflets with lower basal margin obtuse or narrowly rounded), narrowed to an acuminate or obtusely cuspidate apex, crenulate with 2 or 3 crenations per centimeter, glabrous except the costa sometimes hispidulous like petiole, the secondary nerves 8–14 per side, short, prominulous on both surfaces, the veinlet-reticulation immersed or faintly prominulous; racemes usually ternate (sometimes paired) at apex of peduncles, a subsidiary pair sometimes arising from a lower node of inflorescence-rachis, the peduncle 1.5–2.5 cm. long, like the rachis and pedicels puberulent, eventually glabrate, the racemes 5–8 cm. long; flowers mostly single on the rachis, on pedicels 1.5–2.3 mm. long; sepals deltoid-oblong, 0.8–1 × 0.5–0.7 mm., subacute, sometimes faintly puberulent without; petals membranaceous, oblong-ovate, 1.1–1.5 × 0.7–1 mm., rounded at apex; disk-lobes elongate, 0.4–0.7 mm. long; stamens with filiform filaments 2–3 mm. long (in ♂ flowers) or up to 1.5 mm. long (in ☿ flowers), the anthers about 0.4 mm. in diameter; carpels ovoid, faintly hispidulous-puberulent, glabrate, the styles up to 1.2 mm. long (in ☿ flowers) or shorter (in ♂ flowers), the ovules 8–10 per locule in ☿ flowers, undeveloped in ♂ flowers; calyx and petals caducous in fruit, the receptacle flattened; capsule ellipsoid, 2.5–3 mm. long, puberulent like rachis but soon glabrate; seeds narrowly ellipsoid, 0.6–0.7 mm. long, comate at both ends, the hairs usually about 0.7 mm. long.

DISTRIBUTION: Samoa, recorded from the three large islands at elevations of 300–1000 m. The species is said to be a shrub or tree 2–6 m. in height; habitat data are sparse, but Christophersen describes it as growing on lava fields and on river-banks. The type is an Exploring Expedition specimen from Tutuila, cited below. Additional collections were cited by Reinecke and Rechinger.

SAMOA: SAVAII: Central region, *Reinecke 538* (BM, K, US); Asana, back of Sologa, *Vaupel 373* (Bish, K, NY, US); Matavanu lava field, *Christophersen & Hume 1943* (Bish); above Sili, *Christophersen 3163* (Bish, US). UPOLU: Above Vailele, *Reinecke 567* (Bish). TUTUILA: *U. S. Expl. Exped.* (GH, K, US 48072 TYPE). Samoa, without definite locality: *Whitmee 218* (K), *Powell* (GH), *323* (K).

Weinmannia samoensis, a species characterized by its narrow lanceolate leaflet-blades, is distinguished from the preceding, *W. vitiensis*, by the greater number of ovules. This character, being observable only in pistillate flowers, is not very practical but nevertheless seems dependable in the material at hand. The difference in the base of the lateral leaflets, utilized in my key, also seems fairly constant. It is not always easy to separate specimens of *W. samoensis* and *W. manuana*, the only other described Samoan species, when the latter has 3-foliolate leaves. In general the leaves of *W. samoensis* are 5–7-foliolate and those of *W. manuana* are simple; when 3-foliolate leaves occur on Samoan plants they are also accompanied by one or the other more characteristic type, in my observation. Nevertheless this character is not entirely satisfactory and must be supplemented by the shape of the leaflet-blades, which are somewhat broader in *W. manuana*. I find no consistent differences between the two species in indument or inflorescence.

Pampanini's forma *glabrescens* is based upon *Reinecke 502*, *538*, and *567*. Two of these numbers have been examined and I do not observe any reason to separate them from the population as a whole.

7. **Weinmannia exigua** sp. nov.

Frutex, partibus novellis copiose cinereo-strigoso-puberulis, ramulis superne subcomplanatis et puberulis demum teretibus glabratis; stipulis chartaceis suborbicularibus 2–4 mm. diametro, dorso copiose strigosis, margine valde revolutis, caducis, basi intus strigoso-barbellatis; foliis apices ramulorum versus congestis 3- vel 5-foliolatis raro simplicibus vel 7-foliolatis, petiolis 4–9 mm. longis (vel 2–4 mm. in foliis simplicibus) superne anguste alatis, rhachi etiam anguste alata ut petiolulis puberula, petiolulis lateralibus subnullis terminalibus 1–4 mm. longis alatis, laminis chartaceis in sicco fuscis anguste ellipticis, (5–) 8–16 mm. longis, 3–6 mm. latis, basi (lateralibus) obtusis vel (terminalibus) attenuatis, apice obtusis vel obtuse cuspidatis, margine dentibus utrinsecus 3–6 crenatis, supra glabris, subtus praecipue costa pilis 0.2–0.3 mm. longis strigoso-puberulis demum subglabratis, costa supra subplana subtus elevata, nervis secundariis utrinsecus 3–6 inconspicuis subtus prominulis, rete venularum saepe immerso; racemis summo pedicelli brevis (ad 5 mm. longi) 2 vel 3 vel videtur solitariis 2–3 cm. longis, pedunculo ut rhachi pedicellisque minute puberulo; pedicellis sub anthesi 1–1.5 mm. longis; sepalis 4 subliberis papyraceis oblongis, 0.7–0.8 mm. longis, 0.4–0.5 mm. latis, apice obtusis, superne obscure ciliolatis; petalis 4 membranaceis obovatis, 1.2–1.3 mm. longis, 0.6–0.7 mm. latis, apice rotundatis, basi angustatis; disci lobis 8 oblongis 0.3–0.4 mm. longis apice truncatis; staminibus 8, in floribus ☿ filamentis filiformibus 1.2–1.5 mm. longis, antheris circiter 0.3 mm. diametro; carpellis ovoideis sub anthesi 1–1.5 mm. longis, pilis pallidis 0.2–0.3 mm. longis copiose hirtellis, stylis erectis circiter 1.5 mm. longis, ovulis 3–6 per loculo; perianthio videtur caduco; capsulis ellipsoideis circiter 3 mm. longis glabratis, seminibus ellipsoideis 0.6–0.7 mm. longis utroque conspicue comatis, pilis stramineis circiter 1.5 mm. longis.

DISTRIBUTION: Fiji, known only from the type collection.

FIJI: VANUA LEVU: Thakaundrove or Mathuata: Between Waiwai and Lomaloma, May 1878, *Horne 632* (K TYPE) (large shrub about 3 m. high, on top of the mountains).

The very distinct entity here described differs from other species of the region in its very small leaves and compact inflorescences.

Weinmannia sp.

Weinmannia richii (?) sensu Christophersen in Bishop Mus. Bull. **154**: 11. 1938; non A. Gray.

SAMOA: SAVAII: Tuisivi Range, alt. 1600–1700 m., *Christophersen 787* (Bish, NY); above Matavanu, alt. about 1600 m., *Christophersen 2561* (Bish); rim of Papafu crater, alt. 1500 m., *Christophersen 2735* (Bish).

Although the cited specimens are sterile, they apparently do not represent either known Samoan species, *W. samoensis* or *W. manuana*, unless juvenile forms in this alliance are extremely variable. Although these specimens bear a general resemblance to *W. richii*, I see no reason to refer them here on the basis of present material; the sterile Samoan specimens are inclined to have crenulate stipules and longer petiole-indument, although they do not agree too well among themselves. These collections suggest that an undescribed species is present on Savaii, unless they are extreme juvenile variants.

A sterile specimen from Upolu (above Saluafata, ridge to Maunga Tele, alt. 830 m., *Christophersen 534* [Bish, US]) cannot be placed at present; it is neither precisely like the Savaii specimens mentioned above nor does it seem to represent either *W. samoensis* or *W. manuana.*

3. Spiraeanthemum A. Gray

Spiraeanthemum was described by Gray (Bot. U. S. Expl. Exped. 1: 666. 1854) on the basis of two species, one Samoan and one Fijian. Although these two species have been taken as congeneric by subsequent students, and although in my opinion this is a reasonable interpretation, it is possible they will eventually be placed in at least different sections or perhaps subgenera. I do not find that anyone has made the selection of a genotype, and therefore I should like so to designate *S. samoense*, Gray's first species and the one which in basic characters seems best to agree with the greater number of subsequently described species of *Spiraeanthemum.*

Approximately 27 binomials have thus far been proposed in *Spiraeanthemum*, which has a range from New Guinea, Australia, and New Caledonia to Samoa; it is evidently lacking in Tonga. Like so many of the genera first described from Fiji or Polynesia, *Spiraeanthemum* proves to have its center of distribution in New Guinea and New Caledonia; from the former island eight species are discussed by L. M. Perry (in Jour. Arnold Arb. **30**: 139–143. 1949). In our area five species are discernible, four from Fiji and one from Samoa. Although individuals of the genus are seen fairly frequently in Fiji and Samoa, for the most part they occur singly and do not form a striking feature of the vegetation. A common name for the genus in Fiji is *katakata.*

Spiraeanthemum vitiense differs markedly from the other species of our region in its verticillate leaves, short stipule-scars, solitary ovules, and seeds with a distal wing only; the remaining species have opposite leaves, elongate and curved stipule-scars, paired ovules, and seeds winged at both ends. Usable characters to differentiate the species are found in the type of indument, leaf-margins, stipule-shape and indument, etc. In general these characters are not strong, but they seem more adequate than those one is forced to utilize in *Weinmannia.* All of our species are probably dioecious, the staminate flowers lacking carpels and the pistillate flowers having probably sterile anthers; it is possible, however, that these anthers are sometimes fertile and the species thus occasionally polygamo-dioecious.

Key to the species

Leaves verticillate; stipules leaving inconspicuous, transversely elliptic, nearly straight scars; leaf-blades obovate-elliptic, rounded or broadly obtuse at apex, the secondary nerves 4–6 per side; inflorescence 2–6 cm. long, the branches usually ternate; carpels 1-ovulate, the seed with a distal wing only, the nucellus basal; Fiji. . . . . 1. *S. vitiense.*

Leaves opposite; stipules leaving curved, elongate scars; leaf-blades lanceolate to ovate- or elliptic-oblong, acuminate or cuspidate or callose-apiculate at apex, the secondary nerves 5–11 per side; inflorescence 5–17 cm. long, the branches opposite or subopposite; carpels 2-ovulate, the seeds with distal and basal wings, the nucellus median.

Branchlets and petioles glabrous or distally evanescently strigose-puberulent, the leaf-blades glabrous on both surfaces (rarely sparsely puberulent on costa when young); Fijian species.

Leaf-blades usually less than twice as long as broad, obtuse at base and abruptly decurrent on the petiole, entire or inconspicuously serrulate at margin, the teeth obsolete or 1 or 2 per centimeter; peduncle of inflorescence usually more than 4 cm. long. . . . . 2. *S. graeffei.*

Leaf-blades usually more than twice as long as broad, attenuate to acute at base and long-decurrent on the petiole, conspicuously serrate at margin with 3 or 4 teeth per centimeter; peduncle of inflorescence less than 4 cm. long. . . . . 3. *S. serratum.*

Branchlets and petioles copiously velutinous-puberulent or hispidulous, tardily glabrate, the leaf-blades puberulent or strigillose at least on costa and secondaries beneath, the indument persistent.

Indument of branchlets and petioles velutinous-puberulent (hairs 0.1–0.15 mm. long, very dense, long-persistent); stipules oblong-ovate, up to 15 × 10 mm., velutinous-puberulent or sericeous on both surfaces; leaf-blades entire or inconspicuously denticulate, the costa and secondaries minutely puberulent beneath (hairs scarcely 0.1 mm. long); ultimate branchlets of inflorescence (below pedicel-articulation) insignificant or to 0.6 mm. long; disk-lobes usually obviously setulose at apex; Fiji. . . . . 4. *S. katakata.*

Indument of branchlets and petioles hispidulous (hairs 0.3–1 mm. long); stipules lanceolate-oblong, comparatively narrow, up to 35 × 10 mm., sericeous or hispidulous without, glabrous within; leaf-blades conspicuously serrulate with 2–4 teeth per centimeter, the costa and secondaries strigose-puberulent beneath (hairs 0.2–0.7 mm. long); ultimate branchlets of inflorescence (below pedicel-articulation) 0.7–2.5 mm. long; disk-lobes sparsely hispidulous or glabrous; Samoa. . . . . 5. *S. samoense.*

1. **Spiraeanthemum vitiense** A. Gray, Bot. U. S. Expl. Exped. **1**: 669. *pl. 83, B.* 1854, in Ann. Sci. Nat. IV. Bot. **4**: 177. 1855, in Proc. Am. Acad. **3**: 128. 1857; C. Muell. in Walp. Ann. Bot. Syst. **5**: 24. 1858; Seem. Fl. Vit. 111. 1865; Gibbs in Jour. Linn. Soc. Bot. **39**: 144. 1909.

Shrub or small tree, up to 3 m. high, presumably dioecious or possibly polygamo-dioecious, the branchlets terete, glabrous, the young parts obscurely glandular; very young stipules ovate, glabrous and obscurely glandular, soon caducous, the scars inconspicuous, transversely elliptic, nearly straight; leaves verticillate, in threes or fours (rarely in fives), the petioles shallowly canaliculate or semiterete, 4–20 (–23) mm. long, glabrous or obscurely glandular, distally winged; leaf-blades coriaceous, obovate-elliptic, 4–8 (–10.5) cm. long, 1.5–4.5 (–5) cm. broad, acute to attenuate at base and long-decurrent on the petiole, rounded or broadly obtuse at apex, narrowly recurved and entire at margin, glabrous, the costa slightly elevated above and prominent beneath, the secondary nerves 4–6 per side, arcuate-ascending, usually nearly plane above and elevated beneath, often with inconspicuous domatia in the axils beneath, the veinlet-reticulation intricate, usually plane or immersed above and prominulous beneath; inflorescence paniculate, axillary, solitary, compact, many-flowered, 2–6 cm. long and nearly as broad, the peduncle slender, 7–16 mm. long, very minutely puberulent and soon glabrate, the branches usually ternately arranged, more obviously puberulent than peduncle but subglabrate, the bracts lanceolate-oblong or subfoliaceous, up to 7 mm. long or even approximating leaves in size, soon glabrate, the ultimate bracteoles minute, 0.2–0.3 mm. long; ♂ flowers not seen; ♀ (or perhaps ☿) flowers in clusters of 2–6, each actually solitary at apex of a minute (0.1–0.5 mm. long) ultimate brȃnchlet, the pedicels (above articulation) 0.5–1 mm. long (to 2.3 mm. long in fruit), minutely puberulent, glabrate; calyx 1.2–1.5 mm. long, glabrous or very sparsely puberulent without, deeply 4-lobed (rarely 5- or 6-lobed), the lobes ovate, 0.7–1 mm. broad, subacute; stamens 8 (rarely 10 or 12), the filaments glabrous or very sparsely pale-pilose, 0.7–1.5 mm. long, the anthers broadly ellipsoid, 0.2–0.4 mm. long, dubiously functional; disk-lobes 8 (rarely 10 or 12), free or rarely a pair connate, carnose, angular-obovoid, 0.3–0.4 mm. long, truncate at apex, glabrous; carpels 4 (rarely 5 or 6), ovoid, faintly sericeous, the style 0.7–1.2 mm. long, the ovule solitary, pendulous from near middle; calyx and stamens persistent in fruit, some carpels often aborting; mature carpels ovoid, 2.2–3 mm. long, sparsely hirtellous (hairs 0.1–0.2 mm. long) or essentially glabrate, the style persistent; seed solitary, oblong, 2–2.5 mm. long, 0.8–1 mm. broad, the nucellus ellipsoid, exceeded distally by a wing 0.8–1.2 mm. long, this rounded at apex, the basal wing lacking.

DISTRIBUTION: Endemic to Fiji and apparently infrequent, known only from Viti Levu and Vanua Levu, at elevations of 450–1200 m. The species has been noted as a shrub or small tree, up to 3 m. in height, growing in open or ridge-scrub (Parham) or in a forest clearing (Gibbs). The type is an Exploring Expedition collection, cited below, apparently obtained from two localities, Sandalwood Bay [Mbua Bay] and Mathuata, Vanua Levu.

FIJI: VITI LEVU: *Graeffe 16* in part (BM, K); Mba: Tholo-i-Nandarivatu, *Gibbs 732* (BM); Namosi: Summit of Mt. Voma, *B. E. Parham 1743* (A), *1910* (A). VANUA LEVU: Mbua and Mathuata: Mbua Bay (part) and presumably Mathuata coast (part), *U. S. Expl. Exped.* (GH, K, NY, US 47621 TYPE). Fiji, without definite locality: *Horne 759* (GH, K), *1104* (K), *1113* (K).

As indicated in my key and generic discussion, *S. vitiense* is a strikingly distinct species both in vegetative features and in the more fundamental characters of the ovulation and seed-shape.

2. **Spiraeanthemum graeffei** Seem. Fl. Vit. 111. 1865; Gibbs in Jour. Linn. Soc. Bot. 39: 145. 1909.

Shrub or tree up to 6 m. high, dioecious, the branchlets slender, glabrous or the youngest parts very obscurely strigillose-puberulent; very young stipules ovate and dorsally sericeous, the older ones oblong or ovate-oblong, up to 22 mm. long and 10 mm. broad, obtuse, very sparsely strigose-puberulent on both surfaces or glabrate, soon caducous, the scars elongate, curved; leaves opposite, the petioles semiterete, 1–3 cm. long, glabrous, distally winged; leaf-blades coriaceous or subcoriaceous, lanceolate or ovate-elliptic, 5–10 cm. long, (2–) 2.5–6 cm. broad, obtuse at base and abruptly decurrent on the petiole, acuminate or obtusely cuspidate at apex, entire or inconspicuously serrulate at margin (teeth minute, callose-glandular, 1 or 2 per centimeter, or obsolete), glabrous on both surfaces, sometimes with inconspicuous axillary domatia on lower surface, the costa nearly plane above and prominent beneath, the secondary nerves 5–9 per side, arcuate-ascending, plane above, elevated beneath, the veinlet-reticulation intricate, prominulous on both surfaces; inflorescence paniculate, solitary, axillary, ample, many-flowered, 6–15 cm. long and nearly as broad, the peduncle slender, glabrous, (1–) 4–7 cm. long, the branches opposite or subopposite, very sparsely puberulent with hairs about 0.1 mm. long, often glabrate, the bracts oblong or lanceolate, up to 7 mm. long, essentially glabrous, the ultimate bracteoles about 0.5 mm. long; flowers solitary at apices of short ultimate branchlets (0.2–1.5 mm. long), the pedicels (above articulation) 0.5–1.5 mm. long, essentially glabrous; calyx subcarnose, 1.5–2.2 mm. long, deeply 4-lobed, the lobes 1–1.3 × 0.7–1 mm., subacute; stamens 8, the filaments glabrous, in ♂ flowers 2.5–3 mm. long, in ♀ flowers 0.8–1.3 mm. long, the anthers broadly ellipsoid, in ♂ flowers about 0.4 mm. long, in ♀ flowers minute and apparently sterile; disk-lobes in ♂ flowers 4, obovoid-angled, 0.4–0.6 mm. long, free or loosely connate, truncate or often emarginate at apex and hispidulous there and ventrally with hairs 0.3–0.4 mm. long; disk-lobes in ♀ flowers 8, essentially similar but sometimes more obscurely setulose or strictly glabrous; carpels in ♀ flowers 4, ovoid, copiously sericeous-puberulent (hairs 0.1–0.2 mm. long), the style 0.3–0.5 mm. long, the ovules 2, collateral, narrowed at both ends; calyx and stamens persistent in fruit; mature carpels (1 or more sometimes aborted) elongate-ovoid, 3.5–4 mm. long, 0.7–1 mm. broad, persistently pilose, the style persistent; seeds 2, collateral, 2.5–3 mm. long, the nucellus ellipsoid, about 1 mm. long, the wings subequal in length, the distal wing lanceolate, slightly narrower than nucellus, the basal wing subulate.

DISTRIBUTION: Endemic to Fiji, apparently infrequent, now known from Viti Levu and Kandavu at elevations of 870–1050 m. The species is reported as a shrub or tree, up to 6 m. in height, occurring in dense forest or in forest-clearings; the calyx and filaments are white and the anthers yellow. Recorded local names are ***katakata*** (Smith) and ***kutakuta*** (Gillespie). The type, collected by Graeffe on Kandavu, is cited below.

FIJI: VITI LEVU: Mba: Tholo-i-Nandarivatu ridge, *Gibbs 731* (BM); Naitasiri: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi and Nasonggo, *Smith 5800* (A, US); Namosi: Summit of Mt. Voma, *Gillespie 2728* (Bish, GH, K, NY, US). KANDAVU: Mt. Mbuke Levu, *Graeffe 16* in part (BM, K TYPE).

Spiraeanthemum graeffei and *S. serratum* are readily distinguished from *S. katakata* by their usually strictly glabrous branchlets and leaves, these parts bearing a long-persistent velutinous-puberulent indument in *S. katakata*. Characters pertaining to the indument seem much more reliable here than in the genus *Weinmannia*.

3. **Spiraeanthemum serratum** Gillespie in Bishop Mus. Bull. **83**: 11. *fig. 11.* 1931.

Small tree, up to 4 m. high, dioecious, the branchlets slender, glabrous or distally strigose-puberulent (hairs pale, 0.1–0.2 mm. long); very young stipules ovate, obtuse, copiously sericeous dorsally, glabrate, the scars conspicuous, curved; leaves opposite, the petioles semiterete, 1–2 cm. long, glabrous or faintly puberulent like young branchlets, distally winged; leaf-blades subcoriaceous, lanceolate- or oblong-ovate, 4–8 cm. long, 1.3–3.8 cm. broad, attenuate or acute at base and long-decurrent on the petiole, gradually acuminate or obtusely cuspidate at apex, conspicuously serrate at margin (teeth callose-glandular, 3 or 4 per centimeter), glabrous on both surfaces or sparsely puberulent on costa, sometimes with axillary domatia on lower surface, the costa slightly elevated above and prominent beneath, the secondary nerves 6–10 per side, subascending or arcuate, plane above, slightly elevated beneath, the veinlet-reticulation intricate, prominulous on both surfaces or subimmersed above; inflorescence paniculate, solitary, axillary or pseudoterminal, ample, many-flowered, 6–12 cm. long and nearly as broad, the peduncle slender, glabrous or faintly puberulent, 2–4 cm. long, the branches opposite or subopposite, the distal portions strigose-puberulent with hairs 0.1–0.3 mm. long, the bracts papyraceous, oblong, about 2 mm. long, soon glabrate, the ultimate bracteoles about 0.5 mm. long; flowers scattered, not fasciculate, solitary at apices of short ultimate branchlets (up to 0.8 mm. long or essentially none), the pedicels (above articulation) 0.6–1 mm. long, glabrous at anthesis; calyx carnose, glabrous, 1.6–2 mm. long, deeply 4- (rarely 5-) lobed, the lobes oblong-ovate, 1.2–1.5 $\times$ 0.8–1 mm., obtuse or subacute; stamens 8 (rarely 10), the filaments glabrous, in ♂ flowers 1.2–1.6 mm. long, in ♀ flowers less than 1 mm. long, the anthers ellipsoid, in ♂ flowers 0.3–0.4 mm. long, in ♀ flowers minute and apparently sterile; disk-lobes in ♂ flowers 4–6, carnose, free or loosely connate within stamens, irregularly obovoid, 0.3–0.5 mm. long, truncate or emarginate at apex, glabrous; disk-lobes in ♀ flowers 8 (rarely 10), essentially similar, sometimes sparsely setulose at apex (hairs few, to 0.3 mm. long); carpels in ♀ flowers 4 (rarely 5), ovoid, copiously sericeous (hairs 0.1–0.2 mm. long), the style 0.5–0.7 mm. long, the ovules 2, collateral, falcate, narrowly winged at both ends; mature carpels narrowly ellipsoid, up to 3.5 mm. long and 0.8 mm. broad, sericeous, the style persistent; seeds paired or only 1 developing, lanceolate, 2.5–2.7 mm. long, 0.3–0.5 mm. broad, the nucellus ellipsoid, less than 1 mm. long, the distal and basal wings subequal, very narrow, subacute.

DISTRIBUTION: Fiji, apparently limited to the summits and upper slopes of a few high hills, at elevations of 1100–1323 m., on Viti Levu and Taveuni. The species is recorded as a small tree, up to 4 m. in height, occurring in the dense thickets of high ridges. It is noteworthy that the localities thus far known are the four highest mountains in Fiji. The type, *Gillespie 4107*, is cited below.

FIJI: VITI LEVU: Mba: Mt. Evans Range [presumably Mt. Mbotilamu], *Greenwood 364* (K), *457* (K); summit of Mt. Tomanivi [Mt. Victoria], *Gillespie 4107* (Bish TYPE, GH), *4122.1* (Bish, K, NY); Namosi: Summit ridge of Mt. Korombasambasanga, *B. E. Parham 2200* (A). TAVEUNI: Summit of Uluingalau, *Smith 891* (Bish, GH, K, NY, US).

On the basis of type collections, it would appear that *S. serratum* is very distinct from *S. graeffei*, but actually the suite of specimens now available shows that the two are closely related. Differences in the leaf-margin and the other points mentioned in my key seem to provide adequate grounds for the maintenance of Gillespie's species.

4. **Spiraeanthemum katakata** Seem. in Bonplandia **10**: 36, nomen. 1862, Fl. Vit. 111. *pl. 17.* 1865; Pampan. in Ann. di Bot. **2**: 51. 1905; Gibbs in Jour. Linn. Soc. Bot. **39**: 145. 1909.

Spiraeanthemum samoense sensu Gibbs in Jour. Linn. Soc. Bot. **39**: 145. 1909; non A. Gray.

Spiraeanthemum parksii Gillespie in Bishop Mus. Bull. **83**: 10. *fig. 10.* 1931.

Shrub or tree up to 15 m. high, dioecious, the branchlets terete or distally flattened, copiously velutinous-puberulent toward apices with pale spreading hairs 0.1–0.15 mm. long, the older parts cinereous, glabrate; stipules oblong-ovate, rapidly enlarging in size, up to 15 mm. long and 10 mm. broad, obtuse, densely velutinous-puberulent on both surfaces or closely sericeous, soon caducous, the scars elongate, curved; leaves opposite, the petioles semiterete, 0.8–4 cm. long, narrowly winged distally, copiously puberulent like branchlets, tardily glabrate or not; leaf-blades papyraceous or subcoriaceous, ovate to lanceolate- or ovate-elliptic, 4–14 cm. long, 1.5–8.5 cm. broad, rounded to obtuse or rarely acute at base and abruptly decurrent on the petiole, obtusely cuspidate or short-acuminate at apex, narrowly revolute and entire at margins or undulate or inconspicuously denticulate (teeth if present minute, 1–3 per centimeter), obscurely puberulent on costa above, obviously puberulent on costa and secondaries beneath, otherwise glabrous on both surfaces, usually with obvious axillary domatia on lower surface, the costa nearly plane above and prominent beneath, the secondary nerves 5–11 per side, arcuate-spreading, usually plane above and sharply elevated beneath, the veinlet-reticulation intricate, usually slightly prominulous on both surfaces; inflorescence paniculate, solitary, axillary or pseudoterminal, ample, many-flowered, 5–13 cm. long, 4–8 cm. broad, the peduncle slender, 1–4 (–5) cm. long, copiously and persistently puberulent like young branchlets, the branches opposite or subopposite, persistently puberulent and sometimes also hispidulous with pale hairs to 0.5 mm. long, the bracts oblong, papyraceous, to 2.5 mm. long, rarely larger and subfoliaceous, puberulent on both sides, the ultimate bracteoles about 0.5 mm. long; flowers solitary or in fascicles of 2–5, each actually terminal on a minute ultimate branchlet to 0.6 mm. long or insignificant, the pedicels (above articulation) 0.5–1.4 mm. long, copiously but minutely puberulent; calyx 1.3–1.8 mm. long and broad, sparsely puberulent or glabrate, deeply lobed, the lobes usually 4, rarely 3 or 5, ovate-oblong, 0.7–1.2 × 0.6–1 mm., subacute and minutely cucullate; stamens 8 (rarely 6 or 10), the filaments glabrous, in ♂ flowers 2–2.6 mm. long, in ♀ flowers 0.6–1.2 mm. long, the anthers ellipsoid, in ♂ flowers 0.3–0.4 mm. long, in ♀ flowers minute and apparently sterile; disk-lobes in ♂ flowers usually 4 or 5, rarely 3, free or loosely connate, carnose, obovoid-angled, 0.4–0.7 mm. long, irregularly truncate at apex and setulose or crispate-pilose with pale hairs 0.3–0.6 mm. long; disk-lobes in ♀ flowers 8 (rarely 6 or 10), essentially similar, the apical hairs shorter (0.2–0.3 mm. long) or sometimes lacking; carpels in ♀ flowers usually 4, rarely 3 or 5, ovoid, closely sericeous (hairs about 0.1 mm. long), the style 0.5–1 mm. long, the ovules 2, collateral, attached near middle, narrowed and winged at both ends; calyx and stamens persistent in fruit; mature carpels (1 or more sometimes aborted) falcate- or lanceolate-ellipsoid, 2.5–3 mm. long, persistently puberulent, the style persistent; seeds 2, collateral, 2.2–2.8 mm. long, the nucellus ellipsoid, about 0.8 mm. long, the wings subequal in length, the distal wing oblong, the basal wing subulate.

DISTRIBUTION: Fiji, where it appears to be the most abundant species of the genus, although it is known from only a few islands and is nowhere an obvious feature of the vegetation. A wide range has been recorded for altitudinal occurrence (100–1195 m.) and habitat (dense forest, dry forest, open places, forest-grassland transition, dense ridge thickets and forest, etc.). The species is a shrub or tree, sometimes attaining 15 m. in height; the calyx and filaments are white or greenish white, the styles are white often flushed with pink, and the mature carpels are dull pink. The most frequently recorded local name is *katakata*, but other names, some perhaps questionable, are *kutakuta*, *tandalo*, *vurewai*, *rure*, *singasinga*, and (on Vanua Levu) *wakathere*. The type collection is *Seemann 196*, of which the precise locality is in doubt; in the original description Seemann reports it as Kandavu, but one sheet at Kew with this number is indicated as being from Port Kinnaird (Ovalau) in part and from Namosi (Viti Levu) in part.

FIJI: VITI LEVU: *Milne 69* (K); Mba: Mt. Evans Range, *Greenwood 863A* (A, Bish, US), *1220* (US); summit of Mt. Koroyanitu, Mt. Evans Range, *Smith 4192* (A, US); Mt. Evans Range between Mt. Vatuyanitu and Mt. Natondra, *Smith 4371* (A, US); Mt. Nairosa, Mt. Evans Range, *Smith 4409* (A, US); Nandarivatu and vicinity, *Gibbs 673* (BM), *Parks 20676* (Bish), *20725* (Bish type of *S. parksii*), *Gillespie 4021* (Bish, GH, K, NY, US), *Tothill 777* (K), *778* (K), *778a* (K), *Sykes 27* (A), *Greenwood 863* (A, K, NY, US), *Smith 4904* (A, US), *Vaughan 3260* (BM); western slopes of Mt. Nanggaranambuluta, *Smith 4792* (A, US); valley of Nggaliwana Creek, *Smith 5371* (A, US); western and southern slopes of Mt. Tomanivi, *Smith 5222* (A, US); Ra: Numbumakita (about 10 miles east of Mt. Tomanivi), *Gibbs 880* (BM); Nandronga & Navosa: Northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, *Smith 5429* (A, US); Namosi: Near Namosi, *Gillespie 2589* (Bish, GH, NY); Naitasiri: Nakatia, Navuakethe District, *B. E. Parham 2738* (A). OVALAU: *Milne 52* (K), *267* (K). VANUA LEVU: Thakaundrove-Mathuata boundary: Crest of Korotini Range, *Smith 553* (Bish, GH, K, NY, US); Thakaundrove: Natewa Peninsula, hills south of Natewa, *Smith 1967* (Bish, GH, K, NY, US). Fiji, without definite locality: *Seemann 196* (Kandavu, Ovalau, or Viti Levu?) (GH, K TYPE), *Horne 845* (GH, K), *846* (GH, K), *1007* (GH, K).

The very close velutinous-puberulent indument of vegetative parts readily distinguishes *S. katakata,* from the essentially glabrous *S. graeffei* and *S. serratum* on the one hand, and from the hispidulous- or strigose-pubescent *S. samoense* on the other. Gillespie noted the close relationship of his *S. parksii* with *S. katakata*, suggesting as differentiating characters only the thicker, smaller, and more coriaceous leaves. Among the specimens cited above are many which show, on a single plant, variations in these characters covering the extremes of the two type specimens. As I cannot find any consequential points of difference, either in foliage or inflorescence, among the cited specimens, Gillespie's binomial is reduced to synonymy. The prominence and length of the hairs of the disk-lobes, or even their presence or absence, are not correlated with other characters and appear strictly individual in nature.

5. **Spiraeanthemum samoense** A. Gray, Bot. U. S. Expl. Exped. **1**: 667. *pl. 83, A*. 1854, in Ann. Sci. Nat. IV. Bot. **4**: 177. 1855, in Proc. Am. Acad. **3**: 128. 1857; C. Muell. in Walp. Ann. Bot. Syst. **5**: 23. 1858; Reinecke in Bot. Jahrb. **25**: 633. 1898; Pampan. in Ann. di Bot. **2**: 51. 1905; Rechinger in Denkschr. Akad. Wiss. Wien **85**: 286. 1910; Setchell in Carnegie Inst. Publ. **341**: 92. 1924; Christophersen in Bishop Mus. Bull. **128**: 96. 1935.

Shrub or tree up to 8 m. high, dioecious (or possibly sometimes polygamo-dioecious), the branchlets distally copiously hispidulous with spreading pale brown hairs 0.3–1 mm. long, at length becoming subglabrate; stipules ovate when young, rapidly enlarging, at length lanceolate-oblong, up to 35 mm. long and 10 mm. broad, obtuse, densely or sparsely sericeous or hispidulous without, glabrous within, soon caducous, the scars elongate, curved; leaves opposite, the petioles semiterete, 1–4 cm. long, copiously hispidulous like branchlets, at length subglabrate; leaf-blades subcoriaceous or chartaceous, elliptic- or ovate-oblong, 5–14 (–15) cm. long, 2.5–7 (–7.5) cm. broad, broadly obtuse to acute at base and short-decurrent on the petiole, obtusely cuspidate or callose-apiculate at apex, conspicuously serrulate at margin with 2–4 callose-glandular teeth per centimeter, sparsely strigose-puberulent on both sides (hairs grayish, 0.2–0.7 mm. long), at length glabrate except indument persisting on costa and secondaries beneath, usually with small axillary domatia on lower surface, the costa plane above or elevated in a groove, prominent beneath, the secondary nerves 6–13 per side, arcuate-spreading, usually plane above and strongly elevated beneath, the veinlet-reticulation intricate, plane or immersed above, prominulous beneath; inflorescence paniculate, solitary, axillary or pseudoterminal, ample, many-flowered, 7–17 cm. long, 3–10 cm. broad, the peduncle subterete or slightly flattened, 1.5–6 cm. long, hispidulous-puberulent with hairs 0.1–0.3 mm. long, the branches opposite, persistently hispidulous (hairs 0.2–0.5 mm. long), the bracts lanceolate, often subfoliaceous, to 15 mm. long, strigose-puberulent on both sides, the ultimate bracteoles about 0.5 mm. long; flowers solitary at apices of ultimate branchlets (these 0.7–2.5 mm. long), the pedicels (above articulation) 0.5–1.8 mm. long, strigose-puberulent, often glabrate; calyx 1.7–2.3 mm. long and broad, proximally puberulent, usually glabrate, the lobes 4 or 5, rarely 6, ovate-deltoid, 1–1.5 × 0.7–1.1 mm., acute; stamens 8 or 10 (or 12?), the filaments glabrous, in ♂ flowers 1.5–3 mm. long, in ♀ flowers 1–1.5 mm. long, the anthers broadly ellipsoid, in ♂ flowers 0.2–0.3 mm. long, in ♀ flowers minute and probably sterile; disk-lobes in ♂ flowers 4–6, carnose, loosely coherent or free, oblong, 0.6–1 mm. long, irregularly truncate at apex, ventrally and apically sparsely hispidulous with hairs 0.2–0.3 mm. long or glabrous; disk-lobes in ♀ flowers 8 or 10 (or 12?), similar but slightly shorter, 0.4–0.7 mm. long; carpels in ♀ flowers 4 or 5 (or 6?), ovoid, densely sericeous with stramineous hairs 0.2–0.4 mm. long, the style 0.5–0.7 mm. long, the ovules 2, collateral, pendulous from near middle; calyx and stamens persistent in fruit; mature carpels narrowly oblong-ellipsoid, up to 3 mm. long and 1 mm. broad, persistently sericeous, the style persistent; seeds 2 (1 often smaller or perhaps aborted), 1.5–2 mm. long, the nucellus ellipsoid, 0.8–1 mm. long, the wings subequal in length (0.3–0.5 mm. long), the distal wing oblong, obtuse, the basal wing subulate.

DISTRIBUTION: Endemic to Samoa, where it occurs on at least the larger islands at altitudes of 500–1700 m., being indicated by Christophersen as common at middle and high elevations. It is usually noted as a tree 2–8 m. high, occurring in various types of forest; the flowers are said to be white or yellowish white and fragrant. Recorded local names are *tauli*, *maota mea*, *saitamu*, and *lau matui*. The type is an Exploring Expedition collection, cited below, which Gray cited with a question as being from Tutuila.

SAMOA: SAVAII: Above Letui, *Christophersen 780* (Bish, K); above Safune-Letui, *Christophersen 819* (A, Bish, US); above Matavanu, *Christophersen & Hume 1992* (A, Bish, US), *2069* (Bish, K, NY, US), *2131* (Bish, US). UPOLU: Laulii River basin, *Reinecke 281* (US); above Utumapu, *Rechinger 1518* (BM, K, US); Lanutoo, *Funk 113* (BM), *Rechinger 706* (BM), *1920* (BM, K, US); Malololelei-Lanutoo trail, *Christophersen 373* (Bish, K, NY), 399 (Bish, US). TUTUILA: Matafao Ridge, *Collarino* (in *Setchell*) *549* (Bish), *Christophersen 1048* (Bish, NY), *1067* (A, Bish, US); Le Pioa, *Christophersen 3506* (Bish, K, NY), *3576* (Bish). Samoa, without definite locality: *U. S. Expl. Exped.* (probably from Tutuila) (GH, US 47619 and 47620 TYPE), *Whitmee* (BM, GH), *37* (K), *257* (BM), *957* (K), *Powell* (GH, K, NY), *121* (K).

The single representative of the genus from Samoa is well characterized by the comparatively long indument of its branchlets, lower surface of leaf-costa, etc., by its elongate stipules which are glabrous within, by its serrulate leaf-blades, and by the comparatively elongate ultimate inflorescence-branchlets. In this, as in other species of the genus, the pedicels might be described as "jointed," but only the portion above the articulation is strictly pedicellary.

4. PULLEA Schlechter

The genus *Pullea,* described in 1914 (in Bot. Jahrb. **52**: 164. *fig. 9*), is now composed of six species, all limited to New Guinea, as discussed by Perry (in Jour. Arnold Arb. 30: 163–165. 1949). The species here described as new indicates the occurrence as far east as Fiji of another Papuasian genus. That so many genera with this distribution have not yet been reported from the Solomons and the New Hebrides can only indicate the sparsely collected nature of those archipelagos.

Pullea perryana sp. nov.

Arbor ad 6 m. alta, ramulis teretibus vel superne leviter complanatis, glabris vel apices versus obscure strigillosis, inconspicue lenticellatis, nigrescentibus demum cinerascentibus; stipulis subcoriaceis obovato-suborbicularibus vel obovato-ellipticis, (8–) 10–12 mm. longis, (3–) 8–11 mm. latis, basi angustatis, apice rotundatis, margine valde revolutis, utrinque obscure strigoso-puberulis glabratis, mox caducis, cicatricibus brevibus transverse ellipticis subrectis; foliis oppositis, petiolis crassis semiteretibus vel leviter canaliculatis superne alatis (7–) 10–25 mm. longis parce strigoso-puberulis mox glabratis, laminis coriaceis in sicco brunnescentibus ellipticis vel lanceolato-ellipticis, (7–) 11–18 cm. longis, (3.5–) 4–9 cm. latis, basi attenuatis et in petiolum longe decurrentibus, apice obtuse cuspidatis (acumine ipso ad 1 cm. longo rotundato), margine grosse undulato-crenatis (dentibus circiter 1 per centimetrum) et anguste revolutis, utrinque glabris, costa valida supra plana vel leviter elevata subtus prominente, nervis secundariis utrinsecus 7–11 arcuato-adscendentibus supra subplanis subtus valde elevatis, rete venularum intricato supra subimmerso subtus prominulo vel plano; inflorescentiis axillaribus vel pseudoterminalibus ample paniculatis multifloris, binis vel ternatis superpositis, sub anthesi (3–) 6–11 cm. longis et (2–) 3–7 cm. latis, pedunculo gracili subcomplanato (1.5–) 4–7 cm. longo parce hispidulo (pilis pallidis 0.1–0.2 mm. longis) glabrato, ramulis primariis apice pedunculi 3–7 aggregatis, bracteis primariis subfoliaceis lineari-oblongis ad 9 × 2 mm. puberulis mox caducis, ramulis ut pedunculo minute hispidulo-puberulis; floribus hermaphroditis sessilibus confertis 1-bracteolatis, bracteolis obovatis 1–1.2 mm. longis apice rotundatis extus parce strigillosis intus glabris margine ciliolatis; calyce 2–2.5 mm. longo demum subrotato ad 4 mm. diametro, tubo minute obconico, limbo papyraceo profunde lobato, lobis 5 vel 6 anguste imbricatis oblongo-ellipticis 1.5–1.7 × 1–1.2 mm., inconspicue nervatis, extus parce strigilloso-puberulis vel glabratis, intus dense puberulis, margine ciliolatis, apice rotundatis; petalis nullis; staminibus 10 vel 12 demum deciduis, filamentis gracilibus 2–2.3 mm. longis, antheris ellipsoideis circiter 0.4 mm. longis utroque rotundatis; disci lobis

10 vel 12 carnosis plerumque binatim cohaerentibus oblongo-obovoideis subquadratis 0.3–0.4 mm. longis glabris, apice complanatis vel rotundatis; ovario subsupero, basi in calycis tubo leviter immerso, crispato-tomentello (pilis 0.5–0.7 mm. longis), stylis subulatis curvatis glabris 1.5–2 mm. longis, ovulis in quoque loculo 4 biseriatim pendulis.

DISTRIBUTION: Fiji, known from only two collections, both obtained in southeastern Viti Levu; Parham notes his collection as a tree 6 m. high, growing in ridge forest, with cream-white flowers.

FIJI: VITI LEVU: Naitasiri: Tholo-i-Suva, *B. E. Parham 1646* (A); Rewa or Naitasiri: "Central Road, Suva," November, 1928, *B. H. Tothill 472* (Bish, K TYPE, US).

This remarkable species, so completely unlike anything yet described from Fiji, is most suggestive of the New Guinean *P. decipiens* Perry, from which it differs in its much larger leaves and inflorescences and in having the ovary nearly completely superior, immersed in the calyx-tube only at its base. The New Guinean species seem to have the ovary about half-inferior, but otherwise no basic characters are discerned for segregation of the Fijian plant.

It is a pleasure to name this species for Dr. Lily M. Perry, in recognition of her valuable work on the flora of Papuasia, and with particular reference to her review of the Cunoniaceae (in Jour. Arnold Arb. **30**: 139–165. 1949). As Dr. Perry first suggested that the new species might be sought in *Pullea*, the epithet seems particularly fitting.

DEPARTMENT OF BOTANY,
U. S. NATIONAL MUSEUM,
SMITHSONIAN INSTITUTION.

NOTES ON XANTHOSTEMON F. MUELLER AND KJELLBERGIODENDRON BURRET

E. D. MERRILL

GUGERLI'S * MONOGRAPH OF THE GENUS *Xanthostemon* F. Mueller was published in Germany in 1940 and did not become available to us until about a decade later. My interest in this work is not so much in the New Caledonian species considered, which form the bulk of the described forms, and the few Australian ones, but rather in his treatment of certain Philippine, eastern Malaysian, and Papuasian species. He recognized forty-three species and a few subspecies and varieties, distributed into five newly proposed sections, *Vesicaria*, *Brevistyla*, *Cylindrica*, *Bullata*, and *Campanulata*, the latter subdivided into two subsections, *Multiflora* and *Pauciflora*. I do not criticize these minor categories. Like other revisions of its type it has the merit of a proposed system of classification, and of bringing together the widely scattered published data regarding all the species described up to 1940. One judges that perhaps certain obvious errors in nomenclature may be due perhaps more to a lack of critical editorial work on the manuscript than as wholly chargeable to a beginner who was working with a peculiarly difficult group of plants. In nomenclature the author was apparently misled by Pampanini's erroneous interpretation of the rules of nomenclature governing the validity of certain published binomials in 1905. The several cases are discussed under *Xanthostemon speciosum* Merr., *X. pubescens* C. T. White, *X. multiflorum* (Montr.) Beauvisage, and *X. gugerlii* Merr.

Xanthostemon is a genus of considerable significance from the standpoint of phytogeography. Its great center of diversification is New Caledonia, with a total of about thirty-three endemic species. Five species are recorded from northern and northeastern Australia, three from New Guinea, four from the Philippines, and one from Celebes (this Celebesian form also extending to Moena, Ternate and Batjan). To date no representative of the genus has been reported from any part of the Sunda or Lesser Sunda Islands, the latter group extending eastward from Java. Incidentally Gugerli's distribution map extends the range of the genus, within the Philippines, to northern Luzon, about 250 miles beyond the known actual range of the Philippine representatives.

One problem, not solved by Dr. Gugerli, as he did not have access to certain historical material, was the status of *Xanthostemon celebicum* Koord. He merely quoted the original distinctly unsatisfactory

*__Gugerli, K.__ Monographie der Myrtaceengattung Xanthostemon. Repert. Sp. Nov. Beih. __10:__ 1–49. *pl. 1–16*. 1940. Reprinted without change in pagination as a doctorate thesis, University of Zurich, 1940.

description and left the species as one of the two unknown to him. The large fruits, described as 1.8 cm. long and 1.2 cm. in diameter, might lead one to assume that some genus other than *Xanthostemon* was represented, and this proves to be the case. Koorder's unpublished dissection notes and sketches clearly show that he knew the fruit to be indehiscent and 1-seeded, and that the stamens were arranged in five distinct phalanges; these are not *Xanthostemon* characters. It is unfortunate that he did not include these data in his published description. The species proves to be a representative of the very different *Kjellbergiodendron* Burret. When I initiated this study I had no intention of considering Burret's genus until an examination of material now available indicated that a representative of this genus was involved. Dr. van Steenis informs me that Beccari had recognized, named, and described this striking genus on the basis of his own Celebesian collections at some time previous to 1890. Unfortunately he never published his description. Had he done so his name would have antedated that of Burret by four or five decades and doubtless would have obviated the later Koörders errors.

In the course of this study I have been impressed with the excellent representation of the known species to be found in the herbarium of the Arnold Arboretum. At least two-thirds of the described species are represented by from one to many specimens, and it is of interest to note that many isotypes are to be found here. Most of this material has been acquired within the last fifteen years. I have accounted for both of the described species which Dr. Gugerli could not place, *X. celebicum* Koord. being transferred to *Kjellbergiodendron*, and *X. papuanum* Lauterb. being reduced to *X. novaguineense* Valeton. I add *X. crenatus* C. T. White, of New Guinea, described in 1942, and here describe as new *Xanthostemon brassii* Merr. from New Guinea and *X. confertiflorum* Merr. from Celebes. Certain adjustments in nomenclature are also involved for four previously described species, where Dr. Gugerli erred in selecting wrong specific names.

I am indebted to the officials of the Rijksherbarium, Leiden (L), the United States National Herbarium (U), and the Gray Herbarium (G), for the courteous loan of needed material. Except for collections indicated by the above symbolic letters all other material studied is in the Arnold Arboretum Herbarium (A), although before drafting this paper, and after its completion, I had seen the material at Kew and the British Museum.

Xanthostemon F. Mueller

NEW CALEDONIA

Xanthostemon gugerlii nom. nov.

Xanthostemon speciosum (Brongn. & Gris) Pamp. Nuovo Giorn. Bot. Ital. II. **12:** 688. 1905, in obs.; Gugerli, Repert. Sp. Nov. Beih. **120:** 97. 1940; Guillaumin, Fl. Nuov.-Caléd. 233. 1948, non Merr. 1904.

Fremya speciosa Brongn. & Gris, Bull. Soc. Bot. France **12:** 299. 1865.

Gugerli in accepting the validity of this New Caledonian species in **1940** adopted the name *Xanthostemon speciosum* (Brongn. & Gris) Niedenzu, but I can find no record of an actual transfer of the specific name to *Xanthostemon* antedating Pampanini's overlooked one of **1905.** Even this, when published, was an unnecessary binomial as it was antedated by *X. speciosum* Merr. (**1904**), which belongs to a very different Philippine species. The only reference given by Gugerli is to Zahlbruckner, Ann. Naturhist. Hofmus. Wien **3: 279. 1888,** but there only the binomial *Fremya speciosa* Brongn. & Gris was used, as is the case in all other references I have found and checked. Of course *Fremya speciosa* Brongn. & Gris (**1865**) does not invalidate *Xanthostemon speciosum* Merr. (**1904**). The series of curious errors resulting from Pampanini's misinterpretation of the rules of nomenclature governing the validity of binomials, and perpetuated and expanded by Gugerli in **1940,** is further discussed under *Xanthostemon speciosum* Merr., *q.v.* There is a duplicate of the type collection of this New Caledonian species, *Vieillard 2579,* in the Gray Herbarium.

Xanthostemon multiflorum (Montr.) Beauvisage, Ann. Soc. Bot. Lyon **26:** 46. 1901; Pamp. Nuovo Giorn. Bot. Ital. II. **12:** 673. 1905; Guillaumin, Bull. Soc. Bot. France **81:** 14. 1934.

Draparnaudia multiflora Montr. Mém. Acad. Lyon, **10:** 205. 1860, sphalm. "*Drapernandia.*"

Fremya pubescens Brongn. & Gris, Bull. Soc. Bot. France **10:** 373. 1863.

Xanthostemon pubescens Pampaloni, Nuovo Giorn. Bot. Ital. II. **13:** 128. 1906; Gugerli, Repert. Sp. Nov. Beih. **120:** 126. 1940; Guillaumin, Fl. Nouv.-Caléd. 234. 1948, non C. T. White (1917).

Gugerli states that *Draparnaudia multiflora* was, in part, *Xanthostemon flavum* (Panch.) Schltr. However, Beauvisage clearly states that there was but one poor specimen in the Lyon herbarium named by Montrouzier as *Draparnaudia multiflora* Montr.; the type collection hence could not have been a mixture. But when Beauvisage drew up a complete description of *Xanthostemon multiflorum* (Montr.) Beauvisage, on the basis of about **20** individual collections, he cited about seven synonyms including not only Montrouzier's original *Draparnaudia,* but also *Fremya flava* Brongn. & Gris, *F. deplanchei* Brongn. & Gris, *F. pubescens* Brongn. & Gris, and *F. elegans* Brongn. & Gris, all published in **1863.** Incidentally Montrouzier in **1860** did not prepare and publish an actual species description, other than as such data were included in his generic description, and as he had only one poor specimen there could have been no mixture in his original species concept. But Beauvisage's description of **1901** is definitely of a collective species. Here, then, must be the basis of Gugerli's statement that Montrouzier's species was, in part, *Xanthostemon flavum* (Panch.) Schltr. Yet Pampanini, op. cit. 675, definitely stated that he had seen the Montrouzier type, and on p. 682 repeated the statement. He concluded that this specimen, admittedly a poor one, was the same as *Fremya pubescens* Brongn. & Gris and cited Montrouzier's binomial in the synonymy of *Xanthostemon multiflorum* (Montr.) Beauvisage, making it *X. multiflorum* (Montr). Beauvisage, var. *typicum* Pamp., forma *pubescens* (Brongn. & Gris) Pamp. Under the circumstances I do not hesitate to replace Gugerli's invalid binomial *Xanthostemon pubescens* (Brongn. & Gris) Gugerli by the earlier name of Montrouzier. Until by a reexamination of the Montrouzier type it can be proved that Pampanini erred, there seems to be no other choice, unless one wishes to propose a new specific name which I consider to be uncalled for at present. The species is known only from New Caledonia.

Xanthostemon myrtifolium (Brongn. & Gris) Pamp. Nuovo Giorn. Bot. Ital. II. **12:** 682. 1905; Gugerli, Repert. Sp. Nov. Beih. **120:** 68. 1940.

Fremya myrtifolia Brongn. & Gris, Bull. Soc. Bot. France **12:** 299. 1865, Ann. Sci. Nat. V. Bot. **3:** 227. 1865.

Xanthostemon integrifolium Baker f. Jour. Linn. Soc. Bot. **45:** 311. 1921; Gugerli, op. cit. 58; Guillaumin, Fl. Nouv.-Caléd. 232. 1948, syn. nov.

Fremya integrifolia Brongn. & Gris ex Baker, f. l.c. in syn., syn. nov.

Gugerli noted, which Baker f. did not, that *Fremya integrifolia* Brongn. & Gris was an unpublished herbarium name. But Baker f. in transferring it to *Xanthostemon* in 1921 failed to provide a description, although he did publish Compton's field note to the effect that it was a shrub with small hard leaves with thickened margins, white corollas and pale yellow stamens. This Gugerli accepted as a description and with misguided confidence placed the species in his section *Brevistyla* where it does not belong. His judgment must have been based solely on the statement that the flowers were white.

The actual specimen on which the Brongniart and Gris and the Baker f. binomials were based is in the British Museum herbarium, and Baker f. was correct in referring to it *Compton 826,* but erred, as did Gugerli, in so identifying *Compton 375* (cited by Gugerli as Baker 375). The latter is a small-leaved form of *Metrosideros operculata* Labill. Guillaumin Not. Syst. **1: 109.** *fig. 5,* **1909,** concluded that the proposed varieties of this species should be abandoned because of the intergrading forms. The British Museum specimen of *Fremya integrifolia* carried the collector's ample note, but no collector's name or number. I showed this to Dr. Tardieu-Blot, who was at the British Museum for a few days in July, 1951, and on her return to Paris she completed the record. The same field note appears on a New Caledonia collection, *Baudouin 638*; this Paris specimen is identical with the London one, and both match the type of *X. myrtifolium* (Brongn. & Gris) Pamp. Thus another minor mystery is solved, for in **1934** (Bull. Soc. Bot. France **81:** 14) Guillaumin had stated that *Xanthostemon integrifolium* Bak. f. *nomen* (*Fremya integrifolium* Brongn. et Gris) was totally unknown to him and that it was not represented in the Paris herbarium.

He accepted the species in 1948 solely on the authority of Gugerli. But neither Gugerli, who did not see the British Museum specimen, nor Guillaumin, had any reason to believe that *Baudouin 638*, with which both were familiar, was an isotype of the elusive *Xanthostemon integrifolium* (Brongn. & Gris) Baker f. which now proves to be the case.

AUSTRALIA

Xanthostemon whitei Gugerli, Repert. Sp. Nov. Beih. **120:** 83. 1940, sphalm. *whitii.*

Xanthostemon pubescens C. T. White, Proc. Roy. Soc. Queensl. **28:** 57. 1917; Queensl. Dept. Agr. Bull. **20:** 14. 1918, non Pampaloni, 1906.

The type of this species was from the Atherton and Herberton districts, Queensland, Australia. It is well represented by *Kajewski 1046* (A), May 24, 1929, from Gadgarra, Atherton, not far from the type locality. At first sight one infers that a new name was not needed here. At any rate Gugerli's reason for publishing the new name was invalid as *Fremya pubescens* Brongn. & Gris (1863) did not invalidate *Xanthostemon pubescens* C. T. White (1917); and yet it develops that the new name was needed because of the earlier and still unlisted *Xanthostemon pubescens* Pampaloni (1906) which all authors have overlooked. Gugerli's new specific name was misspelled, he should not have cited C. T. White as the parenthetic author, and the one collection cited by him is not *C. T. White 1046*, but is *S. F. Kajewski 1046*; the identification was by C. T. White.

NEW GUINEA

Xanthostemon brassii sp. nov. Sect. *Campanulata, Multiflora.*

Xanthostemon paradoxum sensu C. T. White, Jour. Arnold Arb. **23:** 83. 1942; non F. Muell.

Arbor usque ad 30 m. alta, decidua, inflorescentiis leviter et brevissime adpresso-pubescentibus exceptis glabra, ramulis ultimis rugosis, 4–5 mm. diametro, cicatricibus distinctis ornatis; foliis alternis, subconfertis, coriaceis vel junioribus subchartaceis, ellipticis vel oblongo-ellipticis, sicco brunneis vel pallide olivaceis, 6–15 cm. longis, 3–7 cm. latis, apice plerumque late rotundatis, rariter obscure retusis, junioribus distincte sed adultis obscure glanduloso-punctatis; nervis primariis utrinque circiter 15, irregulariter dispositis, patulo-curvatis, utrinque distinctis, leviter elevatis, arcuato-anastomosantibus sed venam intramarginalem vix formantibus; petiolo 6–14 mm. longo; inflorescentiis pseudoterminalibus, singulis in axillis foliorum vel delapsorum dispositis, totis ad 8 cm. diametro, leviter adpresse breviter pubescentibus, sub fructu glaberrimis, singulis 3–4 cm. longis, breviter (ca. 1 cm.) pedunculatis, 3–5-floris; floribus 5-meris, flavidis, breviter (5–8 mm.) pedicellatis, bracteolis haud visis, ut videtur cite deciduis; calycibus extus leviter pubescentibus, tubo infundibuliforme, circiter 4 mm. longo, 5–6 mm. diametro, intus glabro, lobis orbiculari-ovatis vel reniformi-ovatis, basi 2–3 mm. latis, sursum vix angustatis, 1.5–2.5 mm. longis, apice late rotundatis; petalis ellipticis, late rotundatis, 4 mm. longis et 3 mm. latis, in partibus medianis obscure glandulosis; staminibus circiter 20, 1-seriatis, filamentis liberis, 1.5–2 cm. longis; antheris ellipsoideis, obtusis, 1.8 mm. longis; ovario glabro 3-loculare, subhemisphaerico; stylo ad 2.5 cm. longo; capsulis globosis, 1 cm. diametro, 3-locularibus, seminibus numerosis, compressis, ambitu subtriangularis, 3–4 mm. longis latisque.

BRITISH NEW GUINEA: type *Brass 7869* (flowers), *7503* (fruits) taken from the same tree, Lake Daviumbu, Middle Fly River, the flowers September 1, the fruiting specimen August 26 "large tree, 30 m., briefly deciduous, a crop of flowers appearing a few days before the fall of the leaves, flowers yellow." Other specimens are *Brass 6556, 5932* (both in fruit), common in the savannah forest at Dagwa, Oriomo River, and Mabaduan, Western Division, and *Brass 8575*, Tatara, Wassi Kussi River, abundant on savannah forest ridges, entering the rain forest. The full notes are given by C. T. White, l.c.

C. T. White after examining F. Mueller's apparently not very satisfactory type, from Arnhem Land [Northern Territory], Australia, considered that all of these Papuan collections represented *Xanthostemon paradoxum* F. Muell., *sensu lat.* While I have available only two good specimens representing the Australian species, and one of these (herb. Gray) is an isotype, there are so many differences that I feel justified in describing the New Guinea form as a distinct species. Gugerli, Repert. Sp. Nov. Beih. **120:** 81. 1940, provided some additional descriptive data for the Australian form, citing about nine individual collections all from the Northern Territory of Australia. These notes are of such a character that they support my opinion that had he had access to the Brass collections at the time he studied the group, he would have recognized this New Guinea form as a distinct species. As White noted, F. Mueller had two individual collections, these not quite identical, and he based his description on the characters of both. In his original description of 1857 Mueller stated: "In collibus petraeis ad flumina Victoria et Fitzmaurice," these two rivers in the western part of what is now the Northern Territory of Australia. In his amplified description of 1858 Mueller cited only the Victoria River locality. It is this Victoria River collection, represented at Kew and at the Gray Herbarium, that I accept as the type. It has distinctly pubescent leaves, and densely cinereous-pubescent inflorescences, including the outside of the calyces. In this the densely pubescent bracteoles are persistent or at least subpersistent. There is in the U. S. National Herbarium another specimen of this pubescent form merely labelled "Schomburgk, North Coast"; this is undoubtedly the Port Darwin collection distributed by Schomburgk, *Schulz 356* as cited by Gugerli. In addition to these two specimens which have been available to me for comparison, I made notes on the Kew collections of *Mueller, Cunningham, Basedow, Spencer,* and *Stokes,* these also seen by Dr. Gugerli.

The individual 3- to 5-flowered inflorescences in *Xanthostemon brassii* Merr. are associated with mature leaves or often with very young leaves, or occur in the axils of fallen leaves. Taken together they give the impression of a terminal many flowered panicle up to 8 cm. long and wide. These individual inflorescences are associated with the deciduous character of the tree, the flowers apparently commencing to develop with the fall of the old leaves and the almost simultaneous appearance of the new foliage.

Xanthostemon crenulatum C. T. White, Jour. Arnold Arb. **23:** 82. 1942. Sect. *Campanulata*, subsect. *Multiflora*.

This addition to the species considered by Dr. Gugerli in 1940 was based on *Brass 5805, 8358, 8473, 8602,* all in the Arnold Arboretum herbarium, collected from various parts of British New Guinea in 1934 and in 1936–37. Aside from its almost strictly opposite leaves (described as subopposite), which is an anomalous character in *Xanthostemon,* another striking feature is its unusually small flowers. These were described by Mr. Brass as white and as greenish white. The bracts and bracteoles, not described in the original description, are present but are deciduous, being present in inflorescences with young buds, falling as the flowers open. They are linear-lanceolate, pubescent, and up to 5 mm. long.

This species may better be placed in *Nani* Adanson (*Nania* Miquel) because of its opposite leaves. Adanson's genus, by common consent, is placed as a synonym of *Metrosideros* Banks. Valeton, however, Ic. Bogor. **1:** 63, 67, *pl. 98, 99.* 1901, accepted *Nania* Miq. as generically distinct from *Metrosideros* Banks, recognizing two species, *Nania vera* Miq., and *Nania petiolata* Valeton, calling attention to the fact that the fruits of *Nania* Miq. (= *Nani* Adanson) are entirely free from the calyx (superior), and that the placentas and seeds are quite different from those of *Metrosideros* Banks; I may add that the valves split to the very base, while in *Metrosideros* the fruits are inferior and open by radiately arranged valves across the truncate tops. I had, at first, included certain of these opposite-leaved species in *Xanthostemon* (New Guinea and Amboina), which I have eliminated, since I am now convinced that they do not belong in the latter genus, but really represent species of *Nani* Adanson. Involved here are *Metrosideros vera* Lindl. (1821–24; Roxb. 1832) from Amboina; *M. suberosa* Roxb. (1814, 1832), Moluccas, *Syncarpia vertholenii* Teysm. & Binn. (1855) = *Metrosideros vera* Lindl., and *Nania petiolata* Valeton (1900) (probably from Celebes, not Java). I have not had access to sufficient material to settle the various matters involved, both as to generic and as to specific limits among the taxa above listed.

Xanthostemon novaguineense Valeton, Bull. Dép. Agr. Ind. Neérl. **10:** [72]. 1907, Ic. Bogor. **3:** sub. *pl. 239.* 1907; Gugerli, Repert. Sp. Nov. **120:** 85. 1940.

Xanthostemon paradoxum sensu Valeton, Ic. Bogor. **3:** 95. *pl 239.* 1907, non F. Muell.

Xanthostemon papuanum Lauterb. Nova Guinea **8:** 854. 1910; Gugerli, op. cit. 130, inter sp. dub.; C. T. White, Jour. Arnold Arb. **23:** 82. 1942, syn. nov.

All the collections involved in this case were from the Humboldt Bay region, north coast of New Guinea. Valeton's type was from Tobadi, a village on the inner bay, and Lauterbach's type was from the lower slopes of the neighboring Cyclops Mountains. Hollandia is the important town here, and the other localities mentioned are near that place. *Sigafoos 42* from near Lake Sentano, exactly matches a duplicate of *Wichtman 125* in the Rijksherbarium, the type collection of Valeton's species and also agrees with the excellent illustration and detailed description of *X. novaguineense* Val., while *Brass 8801* from Hollandia agrees perfectly with Lauterbach's description of *X. papuanum* Lauterb. and with *Gjellerup 488,* in the Rijksherbarium, the latter being the Lauterbach type collection. The only differences I have been able to detect after a searching comparison are that in the taxon of Valeton the inflorescences are glabrous, and in that of Lauterbach they are somewhat pubescent. The Sigafoos note reads, in part, "shrub in the grass savannah on laterite, common 250 to 400 ft., flowers brilliant red. A similar plant observed later was a tree 40 to 60 feet high." The Brass note is "common tree 15 to 17 m. in old seral rainforest, abundant as a small tree or shrub on dry forested slopes covered with grass and ferns, flowers red, alt. 20–100 m." It should be noted that the Lauterbach type from the neighboring Cyclops Mountains at 400 m. was from *alang* covered slopes, *alang* being the coarse grass *Imperata.*

Here Dr. Gugerli cleared up the nomenclatural difficulties appertaining to Valeton's erroneous concept of *Xanthostemon paradoxum* F. Muell. After Valeton's detailed description and illustration was in press he apparently saw authentic material of F. Mueller's Australian species, and published his new binomial first in his corrections to his list of Papuan plants in an unnumbered sheet of the Bulletin in Buitenzorg, and a little later in a supplementary unpaged sheet in the Icones which was printed in Holland. Unfortunately Dr. Gugerli did not see Lauterbach's type, and being unable to place the species in his arrangement of them, left it among the few of doubtful status. It is, however, rather strange that he should have expressed the opinion that a species of the Australian genus *Kunzea* Reichb. might be represented. The description is all of *Xanthostemon,* not at all of *Kunzea,* and apparently no *Kunzea* has as yet been found in New Guinea. My conclusion is that the very slight differences between the two supposedly distinct species, i.e., glabrous as opposed to somewhat pubescent inflorescences, are due to local conditions as to exposure, etc., and that but a single valid species is here represented.

CELEBES

Xanthostemon confertiflorum sp. nov. Sect. *Vesicaria*.

Ut videtur arbor vel arbor parva omnino glabra, ramulis ultimis 1.2–2 mm. diametro; foliis numerosis, plus minusve confertis, coriaceis, vix vel obscure puncticulatis, plerumque obovatis interdum subellipticis vel subelliptico-obovatis, apice late rotundatis vel rariter subretusis, basi late acutis, breviter (5–8 mm.) petiolatis, sicco subolivaceo-brunneis vel pallide brunneis, opacis vel subnitidis, 4–8 cm. longis, 3–5 cm. latis; nervis primariis utrinque 10–12, gracilibus, vix vel obscure elevatis, haud perspicuis, subtus dense reticulatis; inflorescentiis terminalibus, sessilibus, circiter 3 cm. diametro, floribus confertis, 5-meris, breviter (ad 3 mm.) crasseque pedicellatis; bracteolis binis, anguste oblongis, acutis, coriaceis, glabris, circiter 5 mm. longis et 1.2 mm. latis; calycibus, lobis inclusis, circiter 7 mm. longis, glabris, tubo subpatelliformibus, ad 1 cm. diametro, lobis 5, triangulari-ovatis, coriaceis, deorsum 3–4 mm. latis, sursum angustatis, 3 mm. longis, acutis vel subacuminatis, sub fructu saepe recurvatis; petalis 5, orbicularibus, late rotundatis, 6 mm. diametro; staminibus circiter 30, 1-seriatis, filamentis liberis, immaturis (inflexis) 6 mm., maturis rectis 1.5 cm. longis; stylo ad 2.5 cm. longo; ovario superiore vel semisuperiore, glabro, depresso-globoso, 3-loculare, cellulis multiovulatis; capsulis globosis vel subglobosis, 3-loculatis, punctato-glandulosis, circiter 1 cm. diametro; seminibus numerosis, compressis, obovatis, circiter 3 mm. longis.

CELEBES: Malili and vicinity, *Neth. Ind. For. Serv. Cel. III–103* (A, L), *bb. 18018* (L), *18011* (A), *18672* (A), *21782* (A), *22723* (A); Manado, *bb. 19636* (A, L), *31512* (A).

This series of specimens was collected in 1933, 1934, 1935, and 1939. Only *bb. 19636* is sterile, the others having either flowers or just opening flower buds, or mature fruits. The indicated type is the first cited specimen, although its flowers are not quite mature. The capsule characters were taken from *bb. 18011*, and *bb. 31512*. Notes regarding the plant are lacking except that the altitude is indicated as from 25 to 500 m.; all but one of the specimens (and that a sterile one) were apparently dried out from material originally preserved in alcohol, thus all traces of the flower color are lacking, but the flowers were probably purplish. It is the first true *Xanthostemon* to be discovered in Celebes. I have placed it in the section *Vesicaria* because of its shallow calyces, in spite of the fact that it lacks the five protuberances on the calyx tube, which is one of the characters of that section. It is distinguished from the Philippine *M. speciosum* Merr. (*M. merrillii* Pamp., *M. purpureum* Gugerli), not only by lacking the calyx protuberances but also by its leaves being very obscurely or not at all glandular-punctate.

PHILIPPINES

Xanthostemon speciosum Merr. Govt. Lab. Publ. **6:** 10. 1904.

Xanthostemon merrillii Pamp. Nuovo Giorn. Bot. Ital. **12:** 688. 1905.

Xanthostemon purpureum Gugerli, Repert. Sp. Nov. Beih. **120:** 53. *pl. 15. fig. a.* 1940.

This species, Gugerli's description of 1940 having been based on *Merrill 682* from Culion (the type), *Weber 1551* from Busuanga, and *F. B. 29266 Cenabre* from Palawan, is also represented by *F. B. 28902* (A) from Culion, and *Philip. Nat. Herb. 218 Edano* (A), and *12431 Sulit* (A) from Palawan, the first from near Puerto Princesa, the second from the vicinity of Victoria Peak. I have examined specimens of all the numbers cited by Gugerli.

This is the type of section *Vesicaria* Gugerli. The species is distinct from *X. verdugonianum* Naves to which I erroneously reduced it in 1923 (Enum. Philip. Fl. Pl. **3:** 183). Gugerli correctly reinstated it as a species in 1940, even if he erred in redescribing it as new, for already two other binomials had been published for it. In nomenclature and in the recognition of species we here have a strange comedy of errors, for Gugerli cites *Merrill 682* from Culion, as the type of *X. purpureum* Gugerli (1940). He said, op. cit. 131–132, that the Kew specimen of this number actually represented *X. verdugonianum* Naves. I have reëxamined it and find it, like all other specimens of this number, to be *X. speciosum* Merr., and not the Naves species; Mr. H. K. Airy Shaw later verified this at my request. This now historical *Merrill 682,* all specimens taken by me personally from a single tree in the Cogonal Grande, Culion, Feb. 12, 1902, is thus the basis of *X. speciosum* Merr. (1904), *X. merrillii* Pamp. (1905), and *X. purpureum* Gugerli (1940). There is no possibility of a mixture of material under the number discussed. The holotype was destroyed when the Manila herbarium was burned near the close of World War II at the time of the reoccupation of Manila by American troops. I have examined the duplicate types at Kew, the Gray Herbarium, and the U. S. National Herbarium.

The errors commenced with Pampanini in 1905 who proposed the unnecessary new binomial *X. merrillii* Pamp. because, while he correctly accepted the reduction of *Fremya* Brongn. & Gris to *Xanthostemon* F. Muell., he erroneously concluded that *Fremya speciosa* Brongn. & Gris (1863) invalidated *Xanthostemon speciosum* Merr. (1904), which is utterly contrary to the rules of botanical nomenclature. I continued the error when, without checking the details, I accepted Pampanini's conclusion in 1923 and added to the confusion, thus probably aiding Gugerli in some of his misinterpretations, as I then erroneously reduced *X. speciosum* Merr. (*X. merrillii* Pamp.) to *X. verdugonianum* Naves. The superficial resemblances of *X. verdugonianum* Naves and *X. speciosum* Merr. (*X. merrillii* Pamp., *X. purpureum* Gugerli) are close, but the calyx characters are very distinct. And finally Gugerli, in 1940, misled by Pampanini's misinterpretation of the rules governing the validity of binomials redescribed this already twice named Culion species as *Xanthostemon purpureum* Gugerli (p. 53), sect. *Vesicaria*, cited its type collection as representing *X. verdugonianum* Naves (p. 64), sect. *Cylindrica*, and finally (p. 131) listed and discussed *X. merrillii* Pamp. (1905), with *X. speciosum* Merr. (1904) as a synonym, as an excluded species. And all the time *X. speciosum* Merr. was the valid name for this now thrice-named species. He even mentioned the striking calyx characters specified by me in 1904 by which *X. speciosum* Merr. was distinguished from *X. verdugonianum* Naves, which were the very characters on which he based his section *Vesicaria*. And so a page or two of print is now called for to explain the details of this nomenclatural comedy of errors, in which Merrill, Pampanini, and Gugerli are involved.

There is no overlapping in the Philippine ranges of the two superficially similar species, *X. speciosum* Merr. and *X. verdugoniamum* Naves. The latter is confined to the central and southern Philippines, the former to the Calamian-Palawan group in the central western part of the Philippines. Incidentally these islands all lie on the continental shelf, and their floras and faunas contain strong Bornean elements which do not extend into the Philippines proper.

Xanthostemon verdugonianum Naves ex F. Vill. in Blanco Fl. Filip. ed. 3, Novis. App. 82. *pl. 300*. 1880; Merr. Enum. Philip. Fl. Pl. **3:** 183. 1923, excl. syn.; Gugerli, Repert. Sp. Nov. Beih. **120:** 64. 1940, excl. syn.

To be excluded from Gugerli's consideration of this endemic Philippine species are the synonyms *X. merrillii* Pamp. and *X. speciosum* Merr., and from the specimens cited, *Merrill 682*, these being accounted for under *X. speciosum* Merr., above. Otherwise, all of the collections cited by Gugerli manifestly belong with this species of Naves. Additional collections are *F. B. 24422 Miras, Soriano & Mariano* (A, U), from Agusan Province, Mindanao, *F. B. 7546 Hutchinson* (U), *F. B. 22833 Ponce* (A,U), *F. B. 23023 Razon* (G), and *2302* (A), *F. B. 28158 Tomeldan* (A), and *F. B. 29419 Rojas*, all from Surigao Province, Mindanao, *F. B. 23942 Cortes & Knapp* (U), Panay, and *F. B. 19535 José* from Sibuyan. The species, type from Surigao no longer extant, is now known from more than 20 individual collections, its range being Sibuyan, Panay, Leyte, Dinagat, Tinago, and the Provinces of Agusan and Surigao in Mindanao.

UNLISTED BINOMIALS

In the course of this little study I have noted several unlisted binomials, one dating from as early as 1886. These are:

Xanthostemon *myrtifolium [Brongn. & Gris] Pampaloni, Nuovo Giorn. Bot. Ital. II. **13:** 135. 1906 [*Fremya myrtifolia* Brongn. & Gris]; Gugerli, Repert. Sp. Nov. Beih. **120:** 68. 1940.

Doctor Gugerli gave the reference to Pampanini's paper in the Nuovo Giorn. Bot. Ital. II. **12:** 682. 1905, this being an error; the binomial does not there appear, nor is it to be found elsewhere in Pampanini's paper of 1905. The next year it was published without its name-bringing synonym, as above indicated. Yet in his monograph of 1940 Dr. Gugerli also erroneously included a second reference to *X. myrtifolium* Pamp. [ex Baker f.] in Jour. Linn. Soc. Bot. **45:** 34. 1921. But there Baker f. credited the binomial to Guillaumin. Guillaumin however, apparently never published such a name, as a check on his various papers on the New Caledonian flora shows that he correctly credited the binomial to Pampanini. Pampaloni undoubtedly received his binomials from Pampanini.

Xanthostemon *pachyspermum F. Muell. & F. M. Bailey, Occ. Pap. Queensl. Fl. **1:** 4. 1886; F. M. Bailey, Queensl. Fl. **2:** 642. 1900; Gugerli, Repert. Sp. Nov. Beih. **120:** 132. 1940, inter sp. excl. = *Tristania pachysperma* (F. Muell. & F. M. Bailey) Francis, Queensl. Nat. 14: 56. 1951 (*T. odorata* C. T. White, 1920).

Doctor Gugerli cited the authority for the binomial as F. M. Bailey, and gave the reference to the Queensland Flora only; there, however, the reference is to the earlier (but as yet unlisted) place of publication as I have above recorded the entry. He was correct in excluding the species from *Xanthostemon,* as it was described as having but one or two large seeds in each cell of the capsule, these seeds 7 to 10 mm. in diameter. He thought that Bailey might have had a specimen of *Kunzea,* sect. *Salicia.* The mystery is now solved by W. D. Francis' reëxamination of the type in 1950, who finds it to represent the same species as the Queensland *Tristania odorata* C. T. White.

Xanthostemon *pubescens [Brongn. & Gris] Pampaloni, Nuovo Giorn. Bot. Ital. II. **13:** 128. 1906; Gugerli, Repert. Sp. Nov. Beih. **120:** 126. 1940; Guillaumin, Fl. Nuov. Caléd. 234. 1948. New Caledonia = *X. multiflorum* (Montr.) Beauvisage, supra.

Pampaloni cited no synonyms and no authorities; he received his binomials from Pampanini, with whom he was working; but nowhere did the latter author publish this binomial.

Xanthostemon *speciosum Pamp. Nuovo Giorn. Bot. Ital. II. **12:** 688. 1905, *in obs.* (*Fremya speciosa* Brongn. & Gris). New Caledonia.

In Dr. Gugerli's treatment, p. 97, he erroneously credited this binomial to Niedenzu who never published it, overlooking Pampanini's obscure entry. The proper name for this New Caledonian species is *X. gugerlii* Merr.

EXCLUDED SPECIES

Xanthostemon celebicum Koord. Meded. 's Lands Plant. **19:** 465, 637. 1898; Gugerli, Repert. Sp. Nov. Beih. **120:** 130. 1940 = **Kjellbergiodendron celebicum** (Koord.) Merr., infra.

XANTHOSTEMON PACHYSPERMUM F. Muell. & F. M. Bailey, Occ. Pap. Queensl. Fl. **1:** 4. 1886; Gugerli, op. cit. 132 = **Tristania pachysperma** (F. Muell. & F. M. Bailey) Francis, supra.

Kjellbergiodendron Burret

This genus was described in 1936, with two species, on the basis of two collections made by Gunnar Kjellberg in Celebes in 1929. The previously unplaced and inadequately described *Xanthostemon celebicum* Koord. is now found to belong in Burret's very distinct genus. The genus is strongly characterized by its relatively large, more or less fleshy, 1-celled and 1-seeded, indehiscent fruits, 2-celled ovaries, stamens arranged in five phalanges, and its alternate leaves. While the genus is a sharply defined one, this statement apparently does not apply to its few species, as they impress me as being difficult to distinguish from each other. It is probable that this difficulty stems largely from the inadequateness of the available herbarium specimens, most of these being sterile, or with young flower buds or with very immature fruits. Certain sterile specimens from Malili, Celebes, distributed as representing the undescribed *Tristania celebica* Koord., belong with *Kjellbergiodendron hylogeiton* Burret. This Koorders binomial appears as a *nomen nudum* in Koorders-Schumacher, Syst. Verzeich. **3:** 96. 1914; I have seen three of the four *Koorders* specimens listed under this *Tristania*, all sterile.

Kjellbergiodendron celebicum (Koord.) comb. nov.

Xanthostemon celebicum Koord. Meded. 's Lands Plant. **19:** 465, 637. 1898; Koord.-Schum. Syst. Verzeich. **3:** 96. 1914; Gugerli, Repert. Sp. Nov. Beih. **120:** 130. 1940, inter sp. ign.

In Koorders' report on the Celebes flora he first listed this species with brief comments on page 465, and on page 637 he published a short and inconclusive description, some of the reasons for this perhaps to be apparent in the following notes. It was not until 1914 that any of the Koorders Celebes numbers were actually associated with the description (for Koorders cited no numbers and indicated no type in 1898) when Mrs. Koorders listed eleven numbers, all but four of which represent sterile specimens. The description was of such a nature that Dr. Gugerli in 1940, without access to authentically named specimens, could not place the species in relation to the other described ones in *Xanthostemon.*

Five of the Koorders Celebes numbers are sterile, so that in selecting a type we are limited to four numbers only, *18097, 18544,* with not fully developed flower buds, and *18240, 19302,* with fruits. All of these have the smaller leaves, 10 to 15 cm. long, 3.5 to 5.5 cm. wide. I arbitrarily designate *Koorders 18544,* three sheets at Buitenzorg, as the type for flowers, and *Koorders 19302* in the same herbarium as the type for fruits. I have actually seen *Koorders 18097, 18964, 18322,* *18960, 18321,* all in the Leiden herbarium, but I deliberately ignore the last three of these as they are sterile and with very large leaves, up to 33 × 7 and 37 × 9.5 cm.; nos. *18192, 18305* also belong in this category. Koorders thought that these large leaved forms were from young plants; one cannot prove this short of intensive field work, but they may, of course, belong with the species. Numbers *18097, 18240, 18544, 19302* are apparently normal, as these are the specimens with flower buds or with fruits, the leaves being 10 to 15 cm. long and 3.5 to 5.5 cm. wide. They clearly belong to a single species, and *18964,* (sterile) falls in this category.

It is rather curious that Koorders placed this species in *Xanthostemon,* because of its large fruits, which he mentioned as being 1.8 cm. long and 1.2 cm. thick (the largest at Buitenzorg is 1.9 cm. long), and which he apparently knew, from his dissections and sketches, were indehiscent and 1-seeded. In his dissection notes on the flower buds, which he also did not publish, he observed that the stamens were arranged in five phalanges. These fruit and flower characters are remote from those of *Xanthostemon.* A dissection of a flower bud of *Koorders 18097* shows that the strictly inferior ovaries are 2-celled, each with a fair number of ovules. All these characters are those of *Kjellbergiodendron* Burret which was not characterized and published until 1936. I am indebted to Dr. J. H. Kern of Buitenzorg for copious notes on the Koorders Buitenzorg specimens and his unpublished dissection data.

In addition to the several Koorders numbers that I am willing to accept as representing *Xanthostemon celebicum* Koord. I feel safe in referring to this species the following collections, unfortunately all sterile:

CELEBES: Minahassa, *Koorders 18097* (L), *18964* (L); Manado, *Neth. Ind. For. Serv. bb. 19646* (A,L); *Palopo. bb. 20895* (A,L); Moena Island immediately south of southwestern Celebes, *Neth. Ind. For. Serv. bb. 21097* (A,L), *21386* (A), *4187* (L); Moluccas, Ternate and Batjan, *Neth. Ind. For. Serv. bb. 16476* (A,L) (the small islands of Ternate and Batjan are close to the west coast of Halmahera, across the Molucca Passage from the classical locality, Minahassa, northeastern Celebes). Because of the small flower buds, *Neth. Ind. For. Serv. Cel. II. 485* (L) from Malili probably belongs here while *Neth. Ind. For. Serv. bb. 24124, 31513* (A) have puberulent calyces, the buds somewhat intermediate in size between those of Koorders' species and *K. limnogeiton* Burret.

While it is clear that *Xanthostemon celebicum* Koord. is a *Kjellbergiodendron,* it is not easy to determine its relationships with the two previously described species of that genus. The almost mature but as yet unopened flower buds are 6 mm. long, and under a lens the calyces are densely puberulent. Hence the flowers should be distinctly smaller than are those of *Kjellbergiodendron limnogeiton* Burret, which are described as glabrous, while the fruits (mature?) are very much smaller (1.8–1.9 cm. × 7–9 mm.), as opposed to 5–6 cm. × 3.5-3.8 cm. in Burret's species. One may judge by Koorders' sketches and by the thickness of cotyledons observed by him that his fruits were at least partly mature. It is suspected that Koorders species is closest to *K. hylogeiton* Burret, the fruits (mature?) of the latter described as 2.5 to 3 cm. long and 1.5 cm. thick; but its coriaceous leaves are described as being up to 25 cm. long and 9 cm. wide; they are actually up to 30 cm. long and 10 cm. wide.

Some additional descriptive data for this Koorders species are: Leaves normally 12 to 15 cm. long, 4 to 5 cm. wide, firmly chartaceous or subcoriaceous, usually olivaceous above, pale brownish beneath and glandular-punctate when dry; primary nerves up to 15 on each side of the midrib, slender but distinct and somewhat elevated on the lower surface, rather irregular, anastomosing and forming a distinct intramarginal nerve 3 to 5 mm. from the margin, and with a less distinct secondary marginal nerve close to the edge of the leaf; alternating with the primary nerves are less conspicuous secondary ones. Flowers apparently small (only unopened buds seen), the calyces rather densely puberulent, the buds seen not over 6 mm. long. Stamens many, in five distinct phalanges. Ovary wholly inferior, 2-celled, the cells with many ovules. Fruit indehiscent, 1-celled, 1-seeded.

Kjellbergiodendron hylogeiton Burret, Notizbl. Bot. Gart. Berlin **13:** 103. *fig. 5, 4–6.* 1936.

Tristania celebica Koord. ex Koord.-Schum. Syst. Verzeich. **3:** 96. 1914, *nom. nud.*, syn. nov.

The type is *Kjellberg 2016,* from Malili, Celebes, at sea level, its mature flowers not yet known. I have not seen the type, but confidently refer here *Neth. Ind. For. Serv. Cel. 334* (L), two sheets, one with very immature flower buds, the other with immature fruits, and also *Cel. II–261* and *bb. 23269* (A), all from Malili, Celebes. On the sheet with the immature fruits of *Cel. 334,* the leaves are up to 30 cm. long and 10 cm. wide, the stout infructescences up to 20 cm. long, and the immature fruits (seeds not formed) 2 to 2.5 cm. long. It is, of course, possible that some of the smaller leaved sterile specimens above referred by me to *K. limnogeiton* Burret may belong with *K. hylogeiton* Burret. One concludes that it would perhaps be better not to name sterile specimens to the species in this difficult assemblage. I cannot help but feel that certain sterile specimens, and one or two with very immature inflorescences from Malili, partly distributed as representing the undescribed *Tristania celebica* Koord., mentioned above, belong with this Burret species. Some of these are *Neth. Ind. For. Serv. Cel. IV–106, Cel. 106, Cel. 166, Cel. 193, bb. 18800, bb. 26286* (all A).

Kjellbergiodendron limnogeiton Burret, Notizbl. Bot. Gart. Berlin **13:** 103. *fig. 5, 1–3.* 1936.

The type of this, which I have not seen, is *Kjellberg 2170* from Towuti, Celebes, alt. 300 m., on lake margins, its leaves coriaceous, 15–19 cm. long, 5–6 cm. wide, its fruits 5–6 cm. long. Burret's flowering material was very scanty and unsatisfactory, yet he described the flowers as "majusculi," and, as illustrated, about 2 cm. in diameter and 1.2 cm. long (he did not actually specify these measurements; his illustration shows only a single attached flower). This is a much larger flower than one would suspect to develop from the small buds of the Koorders species, as these, nearly mature, are but 6 mm. long. I am certain that the following specimens from Malili, Celebes, represent this Burret species; *Neth. Ind. For. Serv. bb. 23544* (A), its one fruit 4.5 cm. long, 3 cm. thick; *bb. 18920* (A,L), its flower buds about 1.4 cm. long, glabrous, oblong-obovoid, the stout calyx tube 4 mm. thick, glabrous, narrowed below, rugose, and 4–5 mm. long, the concave imbricate petals suborbicular or obovate, rounded, at least 1 cm. long. Sterile but almost certainly belonging here in spite of their, in general, smaller leaves are: *Neth. Ind. For. Serv. Cel. II. 240*; *II. 241*; *II. 243* (A,L); *Cel. II. 242, 253, 485* (L); *bb. 19820* (A,L); *bb. 22730, 23544, 29974* (A); and *Boschwezen Mantri bb. 1836, 1854, 1890* (L), from the Malili region.

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NOTES ON THE FLORA OF CHINA, II

SHIU-YING HU

With two plates

IN 1947 K. M. Feng of the Fan Memorial Institute of Biology made a botanical expedition in southeastern Yunnan, in the region immediately east of Mengtze where A. Henry made his classical collections. From August 5 to December 20 of that year Feng collected 2985 field numbers in a relatively small area between longitude 104° and 105° East, on the Tropic of Cancer and a half-degree south. From working over this collection at the Arnold Arboretum it is apparent that a number of new entities are included. Below are described a new genus, *Styrophyton*, of the Melastomataceae, and several new species of the same family. Critical notes on other taxa in this family are recorded. The material is arranged alphabetically according to the genus and species. All the collections cited belong to the herbarium of the Arnold Arboretum.

Since the system of transliteration employed in Feng's filed labels differs from that used in the Gazetteer of Chinese Place Names based on the Index to the V. K. Ting Atlas compiled by the United States Board on Geographical Names and from that of the Map of China published in 1945 by the National Geographic Society of America, the equivalent spellings for the major localities are given below so that the reader may be helped to find the places on standard maps. After Feng's transliteration, those of the other two systems are entered with their abbreviations USB and NGS following: Ma-kuan, Ma-kuan (USB), Makwan = Anping (NGS); Mar-li-po, Ma-li-p'o (USB), Malipo (NGS); Si-chour, Hsi-ch'ou (USB), Sichow (NGS); Wen-shan, Sen-shan (USB), Wenshan = Kaihua (NGS).

Allomorphia urophylla Diels in Bot. Jahrb. **65**: 102. 1932. — Li in Jour. Arnold Arb. **25**: 10. 1944.

YUNNAN: Si-chour-hsien, Shiang-pyng-shan, in mixed forest by stream, alt. 1400–1500 m., *K. M. Feng 11468* (shrub 5 ft. high, flower pink, common); Ma-kuan-hsien, Ching-kou (Lao-chün-shan), in open thickets, alt. 1100–1500 m., *K. M. Feng 13675* (shrub 5 ft. high, fruit green, common).

As far as we know, *Feng 11468* establishes the eastern and northern limit of the range of the species.

Blastus fengii sp. nov.

Frutex ca. 1.3 m. altus, ramis subquadrangularibus, glabris, tuberculatis, ramulis junioribus squamuloso-glandulosis, glaberrimis; foliis chartaceis, junioribus glandulosis, oblongo-ovatis vel ellipticis, 8–14 cm. longis, 4–7.5 cm. latis, basi obtusis raro rotundatis, apice acuminatis, acumine 2 cm.

longo, margine integris setosisque, nervis primariis 5, marginalibus duobus tenuioribus additis, nervis transversis conspicuis, supra inter nervos sparse setosis, subtus glabris, petiolo 2–4.5 cm. longo, squamuloso-glanduloso, glabro; cymis subsessilibus, 3-floris, ex axillis foliorum delapsorum productis; flores ignoti; pedicellis fructuum 9–12 mm. longis; capsulis subglobosis, 5 mm. diametro (Tab. II, fig. 1), costatis 8 inconspicuis, glaberrimis, sepalis persistentibus, semi-rotundatis, 2–3 mm. longis latisque, glabris; seminibus subovoideis, plus minusve curvatis (Tab. II, fig. 1), 0.4 mm. longis, tuberculatis, breve rostratis.

YUNNAN: Mar-li-po, Chung-dzia, in open thickets, alt. 1800–2100 m., *K. M. Feng 12726* (TYPE) (herb 3 ft. high, fruit yellowish red, common); same region, Sze-tai-po, in mixed forest, alt. 1600–2000 m., *K. M. Feng 13780* (shrub 4 ft. high, flower pink, common).

In its axillary inflorescences situated at the mature portion of the stem where the leaves are often absent, and in its long pedicellate fruits with persistent roundish sepals, this species appears to be nearest to *Blastus hirsutus* Li. The latter species can readily be recognized by its hirsute branchlets and fruits.

Cyphotheca hispida sp. nov.

Herba 1 m. alta, ramis subteretibus, 2 mm. diametro, hispidis, junioribus incanis; foliis membranaceis, oblongo-ovatis, 5.5–10 cm. longis, 3–5 cm. latis, basi rotundatis vel subcordatis, apice acuminatis, acumine 1 cm. longo, margine integris hispidisque, nervis primariis 5, nervis transversis supra obscuris, subtus elevatis, supra inter nervos sparse setosis, basi glanduloso-hirtellis, subtus hispidis nervis praesertim, petiolo 1–5 cm. longo, hispido; inflorescentiis subumbelliformibus cymis, terminalibus, 3- vel 4-floris, pedunculis 8 mm. longis; flores 4-meri (Tab. II, fig. 10), pedicellis 9 mm. longis, receptaculis subcampanulatis, hispidis; sepalis 4, ovatis, hispidis, 2 mm. longis, acutis; petalis 4, rubris, obovatis, 8–10 mm. longis; staminibus 8, inaequalibus, antheris incurvis, apice attenuatis, 1-porosis, thecis basi nonproductis, majoribus 5 mm. longis, minoribus 3 mm. longis, connectivis postice incrassatis; ovario ad receptaculum septis adnato, apice collo tubiformis laciniato laciniis glanduloso-ciliatis ornato, stylo paulo curvato, glanduloso-hirto; fructibus ignotis.

YUNNAN: Si-chour-hsien, Faa-doou, in mixed forest, alt. 1450–1550 m., *K. M. Feng 11746* (TYPE) (herb 3 ft. high, flower pink, common).

The thickened connectives of the anthers of the smaller stamens, the glandular-ciliate corona at the apex of the ovary, and the hirtellous style of this species suggest a relationship with *Cyphotheca montana* Diels. *Cyphotheca hispida* can readily be distinguished from the Diels species by its hispid stem and leaves, its smaller habit, and the lack of any evident overgrowth of the thecae. The thecae of the smaller stamens of *Cyphotheca montana* are slightly produced at the lower front ends.

It is interesting to note that, although the form of the seeds of the

Melastomataceae has been employed as a major character for the delimitation of the genera or sections of the family, the nature of the seeds of *Cyphotheca* has been lacking in botanical descriptions. It seems fitting to add here a note concerning it: Seeds numerous, subovoid-cuneate, beaked (Plate II, fig. 3), 0.8 mm. long, 0.5 mm. wide at the truncate end, the testa brown, distinctly tuberculate, the beaked side with a shiny black aril. This description is prepared from a specimen (*T. T. Yü 16627*) of *Cyphotheca montana* Diels.

Fordiophyton longipetiolatum sp. nov.

Frutex ca. 1.3 m. altus; ramulis glabris; foliis membranaceis, inaequalibus, lanceolatis, majoribus 9–14 cm. longis, 3–4 cm. latis, minoribus 3–6.5 cm. longis, 1–2 cm. latis, basi cordatis, apice acuminatis, acumine 1–2.5 cm. longo, margine obsolete serrulatis, nervis principalibus 5, paulo elevatis, petiolo 1–1.4 cm. longo; inflorescentiis paniculatis; pedunculis 2–3 cm. longis; ramis strictis patentibus, glanduloso-setulosis, bracteolatis; cymis singularibus 1- to 3-floris; bracteis cordatis, 2 mm. longis, 2–3 mm. latis, glabris, persistentibus; floribus pedicellatis, pedicellis 4–6 mm. longis, glabris, receptaculis anguste infundibuliformibus, 6–7 mm. longis, glabris, rare 1–3 glandulosis setis; sepalis deltoideis, 2 mm. longis, 2 mm. latis, apice seta glandulosa; petalis rubris, apice in setulam exeuntibus; staminibus 8, inaequalibus, antheris majoribus linearibus, 15 mm. longis, thecarum basimus cornuto-productis, antheris minoribus oblongis, 4 mm. longis, flavis, thecarum basibus productis; capsulis ignotis.

YUNNAN: Si-chour-hsien, Faa-doou, in mixed forests, alt. 1450–1550 m., *K. M. Feng 11829* (TYPE) (shrub 4 ft. high, flower pink-rose, rare).

In general appearance this species suggests *Fordiophyton strictum* Diels and is probably most closely related to it. The latter species can readily be distinguished from *F. longipetiolatum* by its subsessile leaves and glandular-setose bracts and sepals.

Medinilla nana sp. nov.

Frutex humilis, 0.5–1 m. altus; ramis cinereis, rugosis et verruculosis; ramulis quadrangularibus, brunneis, internodiis 1–3 cm. longis, alatis, axillis foliorum setis sparse vestitis; foliis coriaceis, obovatis, 1–2.3 cm. longis, 0.7–1.7 cm. latis, paucidenticulatis, ad apicem 2 vel 3 dentibus minutis, basi obtusis, apice rotundis et retusis, costa supra impressa, subtus elevata, nervis lateralibus obscuris, petiolo 1–3 mm. longo; inflorescentiis terminalibus, solitariis vel cymosis simplicibus, cymis 2–floris; pedunculis 5 mm. longis; bracteis ovatis, glanduloso-erosis; pedicellis 2–3 mm. longis; flores ignoti; baccis oblongo-subglobosis, 8 mm. longis, 6 mm. diametro; sepalis persistentibus rotundatis, erosis et glandulosis; seminibus numerosis, minutis, ovoideis, 1 mm. longis, 4–5 mm. diametro, testis reticulatis.

YUNNAN: Si-chour-hsien, Faa-doou, in mixed forest, alt. 1500–1600 m., *K. M. Feng 11920* (shrub 1 ft. high, fruit green, common); Mar-li-po, Chungdzai, in mixed forest, alt. 1600–1800 m., *K. M. Feng 12784* (TYPE) (shrub 3 ft. high, fruit green, common).

I can suggest no close relative for this very distinct species. Its broadly winged paired branchlets, its small obovate paucidenticulate coriaceous leaves, and its terminal solitary flowers or simple cymes are unlike any known species of *Medinilla*. Nevertheless, the fleshy berries with their thin calyx tube and exterovarial chambers place the species in Bakhuizen's section *Hetero-Medinilla* of this genus. The small ovoid seeds with their reticulate testas suggest relationship to *Pachycentria fengii* S. Y. Hu.

Medinilla petelotii Merr. in Univ. Cal. Publ. Bot. **13**: 137. 1926.

YUNNAN: Si-chour-hsien, Ting-mann, in mixed forests, alt. 1300–1500 m., *K. M. Feng 12334* (scandent shrub 5 ft. high, flowers pink-rose, rare); Mar-li-po, Huang-jin-in, in mixed forests, alt. 1300–1400 m., *K. M. Feng 13063* (shrub 5 ft. high, flowers lavender, rare); same region, Sze-tai-po, Loa-chün-shan, in mixed forest, alt. 1300–1500 m., *K. M. Feng 13946* (shrub 4 ft. high, fruit green, common).

Feng 13063 fits Merrill's description well, and it matches the photograph of *Pételot 1791* (type of *Medinilla petelotii* Merr.) in every respect. The fertile portion of *Feng 12334* appears to have been a section from the lower part of a creeping stem. It has many fibrous adventitious roots. The inflorescences on such a stem are much more ramified and also appear longer than the typical ones as represented by *Pételot 1791* and *Feng 13063*. With all other aspects identical, I am inclined to think that the larger inflorescence is due to the vigor of the plant.

Tsai 60315 from Ping-pien-hsien, Yunnan, appears to belong here.

Melastoma normale D. Don, Prodr. Fl. Nepal. 220, 1825. — Rehd. & Wils. in Sarg. Pl. Wils. **2**: 421. 1915. — Li in Jour. Arnold Arb. **25**: 8. 1944.

YUNNAN: Si-chour-hsien, Faa-doou, in open thickets on rock, alt. 1450–1550 m., *K. M. Feng 11870* (shrub 4 ft. high, fruit green-yellow, common); Mar-li-po, Sze-tai-po (Loa-chün-shan), in open thickets by stream, alt, 1100–1300 m., *K. M. Feng 14053* (herb 3 ft. high, flowers pink-purple, common).

Feng's designation of the habit of the plant as represented by his number *14053* does not seem to be appropriate, for our specimen of this number exhibits a strong woody third-year stem. In the herbarium this species is often confused with *Melastoma candidum* D. Don, and in botanical literature the diagnostic characters given are rather inadequate, since they were drawn from the indumentum of the stem and the shape of the leaf-base. Both of these characters vary with the ecological conditions under which the plant grows and the age and vigor of the plant. *Melastoma normale* D. Don is generally recorded as, "stem with long spreading hair, leaves with round and obtuse base," and *Melastoma candidum* D. Don as "stem with appressed scale-like hairs and leaves with subcordate bases." Round and subcordate bases are sometimes very hard to distinguish, and the spreading hairs are so coarse and dented that they appear scaly. Detailed examination of our material seems to reveal two constant characters that can be employed in the diagnosis of these two species. In *Melastoma normale* D. Don the sepals are linear-lanceolate and the anterior lobes of the connectives of the large stamens are small, round, and almost undivided, while in *Melastoma candidum* D. Don the sepals are broad deltoid and the anterior lobes of the connectives of the large stamens are pointed and over 2 mm. long. In general *Melastoma normale* D. Don has lanceolate leaves and smaller globose fruits, and the leaves of *Melastoma candidum* D. Don are ovate and the fruits larger and oblong.

Osbeckia chinensis Linn. Sp. Pl. 345. 1754. — Li in Jour. Arnold Arb. **25**: 4. 1944.

YUNNAN: Si-chour-hsien, Faa-doou, on open grassy slopes, alt. 1450–1550 m., *K. M. Feng 11765* (herb 3–10 in. high, flowers pink, common).

This is probably the most widely distributed species of the Melastomataceae in China. It occurs in the coastal region from Foochow to Hongkong and thence westward over all the warm temperate region of China. It can readily be recognized by (1) the small herbaceous habit; (2) the lanceolate leaves; (3) the terminal simple cymes; (4) the stellate tufted calyx tubes; (5) the persistent corona of rigid hairs at the apex of the ovary; and (6) the glabrous urn-shaped fruits. The vernacular name "t'ien-hsiang-lu" (heavenly incense burner) is a very good connotation of the characteristic fruit.

Oxyspora paniculata DC. Prodr. 3: 123. 1828. — Li in Jour. Arnold Arb. **25**: 12. 1944.

YUNNAN: Wen-shan-hsien, Hwang-tsao-bah, by streams on scrub, alt. 1600 m., *K. M. Feng 11011* (herb 2 ft. high, flowers lavender-red, common); Si-chour-hsien, Shiang-pyng-shan, in mixed forests by streams, alt. 1400–1500 m., *K. M. Feng 11472* (shrub 5 ft. high, flower rose-pink, common); Mar-li-po, Sze-tai-po (Loa-chün-shan), in open thickets by streams, alt. 1300–1500 m., *K. M. Feng 14037* (shrub 3 ft. high, flower rose-pink, common).

Oxyspora paniculata DC. is the type species of the genus. It has very unique seeds, the form of which is so characteristic that I have not seen the like in any other Asiatic genus of the Melastomataceae. The embryo proper is straight, club-shaped, or subovoid. The testa is so produced that the seed appears cuneate. It is beaked on the aril side of the truncate end, and opposite the beak there is a distinct spur which is longer than the beak. In a profile view the seed appears like the head of an adze (Plate II, fig. 4).

Pachycentria fengii sp. nov.

Frutex sempervirens, epiphyticus, scandens, ramulis teretibus, glabris, fusco-rubescentibus, extimis compressis, lenticellis albis, prominentibus; foliis subcoriaceis, integerrimis, obovatis, 3.5–8.5 cm. longis, 2–3.5 cm.

latis, basi cuneatis vel obtusis, apice acuminatis, acumine 5–10 mm. longo, obtuso, trinerviis, nervis supra planis, subtus elevatis, reticulis obscuris, petiolo 6–10 mm. longo, glabro; flores ignoti; inflorescentiis fructiferis corymbosis, laxis, terminalibus; pedunculis 1–1.7 cm. longis; pedicellis 5 mm. longis; baccis urceolatis, 6–7 mm. longis, 4–5 mm. diametro (Tab. II, fig. 5–7); sepalis persistentibus deltoideis, apice postice minutis uncis instructis; seminibus numerosis, minutis, ovoides, 1 mm. longis, 0.7 mm. diametro, testis reticulatis (Tab. II, fig. 8).

YUNNAN: Si-chour-hsien, Faa-doou, on trees in mixed forest, alt. 1500–1550 m., *K. M. Feng 11789* (TYPE) (shrub 4 ft. high, fruit green, pedicel red, common).

Pachycentria Blume was first discovered in Java. The center of its distribution is the Malay Archipelago. Hayata in 1912 described a species from Formosa and Ridley in 1915 published another one from the Malay Peninsula. *Pachycentria fengii* S. Y. Hu seems to be the first species recorded from the Chinese mainland. It sets the northern limit for the genus. To Blume, *Pachycentria* differs from *Medinilla* in: "1) tubo calycis sursum cyathiformi–dilatati circa ovarium fortius constricto; 2) petalis acuminatis; 3) staminum structura diversa, quum antherarum connexivum in Medinillis omnibus ad basin antice auriculas duas et postice calcar subulatum exserat, hic autem tantummodo postice calcari parvo crassiusculo muniatur." Bakhuizen f. regarded the degree of union of the ovary with the calyx tube to be more significant for the generic delimitation. He maintained that in *Pachycentria* the ovary is "wholly concrescent with the calyx tube," while in *Medinilla* it is "adnate to the calyx tube with longitudinal septs." The calyx tubes of the Formosan and the Chinese material are not so much constricted as those of the Malaysian species. Nevertheless, the connection between the ovary and the calyx tube is complete. There does not seem to be any doubt that our material is a species of *Pachycentria*.

Phyllagathis wenshanensis sp. nov.

Herba, caulibus petiolisque dense longe crispo-hirsutis, rhizomate prostrato, ramis teretis, 5 mm. diametro; foliis valide membranaceis, orbicularibus, 5–7 cm. longis latisque, olivaceo-viridibus, basi perspicue cordatis, apice rotundatis et plerumque emarginatis, nervis primariis 5 vel 7, nervis transversis supra obscuris, subtus perspicuis et dense crispo-hirsutis, margine integris et ciliatis, supra disperse breve setosis et molliter crispo-hirtis, subtus hirsutis, nervis dense crispo-hirsutis, petiolo 2.5–4.5 cm. longo; inflorescentiis umbellatis, terminalibus, 4-floris, pedunculis 11 cm. longis, hirtellis; flores ignoti; pedicellis fructuum 1 cm. longis, hirtellis; calycibus persistentibus deltoideis, acutis; capsulis turbinatis, hirtellis, 5 mm. longis; apice 5 mm. diametro, placenta supra ramificata, seminibus ovoideis, 0.8 mm. longis, 0.4 mm. diametro, truncatis, tuberculatis, breve rostratis.

YUNNAN: Wen-shan-hsien, Lao-jiun-shan, in mixed forest, alt. 2300 m., *K. M. Feng 11186* (TYPE) (herb 4 in. high, fruit greenish, rare).

The creeping habit and rounded leaves of this species suggest a relationship with *Phyllagathis cavaleriei* (Lévl. & Van.) Guill., which has glabrous capsules and leaves with long setose hairs.

Plagiopetalum henryi (Kränzl.) comb. nov.

Barthea cavaleriei Lévl. in Fedde, Rep. Spec. Nov. **8**: 61. 1910, pro parte, quod *Esquirol 215*.

Sonerila henryi Kränzl. in Viert. Nat. Ges. Zürich **76**: 152. 1931.

Plagiopetalum esquirolii sensu Li, in Jour. Arnold Arb. **25**: 10. 1944, non Rehder.

YUNNAN: Wen-shan-hsien, Pyng-bah, moist sandy margin of mixed forest, alt. 1700 m., *K. M. Feng 11028* (shrub 2 ft. high, flower pinkish-red, rare); Marli-po, Pan-chia-chü, roadside, alt. 1800–2100 m., *K. M. Feng 12674* (shrub 3 ft. high, fruit red, common).

Regarding *Plagiopetalum* Rehder stated, "In its floral structure it seems nearest to *Sonerila*, but that genus is easily distinguished by its trimerous flowers and symmetrical petals." If *Plagiopetalum* is accepted as a genus at all, then the transfer of *Sonerila henryi* Kränzl. is justified because of its tetramerous flowers and asymmetrical petals. Li (1944) interpreted *Sonerila henryi* Kränzl. and *Plagiopetalum esquirolii* (Lévl.) Rehd. to be conspecific. After detailed examination of the materials at hand, including *Wilson 3261*, the type of *Plagiopetalum quadrangulum* Rehder which, in turn is the type species of the genus and has been interpreted by both Diels and Rehder as synonymous with *Plagiopetalum esquirolii* (Lévl.) Rehder, I find it hard to accept this view. *Plagiopetalum esquirolii* (Lévl.) Rehd., as typified by *Wilson 3261*, represents a plant devoid of scabrous hairs on the petioles, peduncles, pedicels and receptacles, while these parts of the specimens that I designated as *Plagiopetalum henryi* (Kränzl.) S. Y. Hu are scabrous.

When Léveillé published *Barthea cavaleriei* he cited three specimens, namely *Cavalerie 1552* and *Esquirol 215* and *1581*. He designated no type. Diels (1932) segregated *Cavalerie 1552* and transferred it to Bredia. Here in our herbarium there is a photograph and a good fragment of *Esquirol 215* which is identical with *A. Henry 9077*, an isotype of *Sonerila henryi* Kränzl. Since *Barthea cavaleriei* Lévl. is a synonym of *Bredia cavaleriei* (Lévl.) Diels, the next published specific name, is here adopted.

The seed of *Plagiopetalum henryi* (Kränzl.) S. Y. Hu has a very unique form. It is oblong in outline, 1 mm. long, 0.5 mm. in diameter, obscurely papillate, and appendaged on three sides (Plate II, fig. 11).

Sarcopyramis bodinieri Lévl. & Van. in Mem. Soc. Nat. Sci. Nat. Cherbourg. **35**: 397. 1906; et in Fedde, Rep. Spec. Nov. **4**: 95. 1907.

Sarcopyramis nepalensis var. *bodinieri* (Lévl. & Van.) Lévl., Fl. Kouy-Tchéou 278. 1914.

Sarcopyramis nepalensis sensu Diels in Bot. Jahrb. **65**: 111. 1932. — Li in Jour. Arnold Arb. **25**: 25. 1944, non Wallich.

YUNNAN: Wen-shan-hsien: Loa-jiun-shan, in mixed forest, alt. 2300 m., *K. M. Feng 11188* (herb 3 inches high, leaves green above, purple below, fruits green and purple, common).

Sarcopyramis bodinieri Lévl. & Van. has been misinterpreted by several authors as *Sarcopyramis nepalensis* or its variety. Additional material in the flowering stage reveals certain characters which prove such a concept to be wrong. The type sheet of *Sarcopyramis bodinieri* Lévl. & Van. (*E. Bodinier 2393*) contains five specimens, four with small colored leaves and one with larger green leaves. Guillaumin (Bull. Soc. Bot. France **60**: 343. 1913) suggested that the plants might represent a smaller form of *S. napalensis* Wall. Léveillé, without giving any reason, published it (1914) as such. Diels (1932) actually sank it into the synonymy of *Sarcopyramis nepalensis*, and his view has been accepted by later authors. In *Feng 11188* we have five plants which match the small plants of the holotype of *Sarcopyramis bodinieri* Lévl. & Van. Careful examination of these specimens as well as of the fragments of *Bodinier 2393* reveals that besides the smaller size of the plants and the purple color of the foliage there are certain floral characters which distinguish them as a distinct species. In *Sarcopyramis napalensis* Wall. the bracts are ovate, acute, the calyx lobes are truncate and ciliate, and the anthers are subelliptic with the notched apical ends slightly pointed. In *Sarcopyramis bodinieri* Lévl. & Van. the bracts are spathulate, the calyx lobes are eciliate, each with two horn-like projections, and the anthers are obcordate, each not much longer than the upward spur on the posterior side of the connective. The leaves of *Sarcopyramis bodinieri* Lévl. & Van. are sparsely setose above and glabrous beneath with an acute apex, while those of *Sarcopyramis napalensis* Wall. are elliptic or ovate-elliptic with an acuminate apex. Judging from the shape, the texture and the pubescence of the leaves, and the horned calyx lobes, *Sarcopyramis bodinieri* Lévl. & Van. is nearer to the Kwangsi specimens which have been named as *Sarcopyramis delicata* C. B. Rob. than to *Sarcopyramis napalensis* Wall. All specimens of the Kwangsi material have solitary flowers. *C. Y. Chiao 1304* from Ya-an, Sikang, with small ovate leaves and umbellate inflorescences, definitely belongs here.

Sarcopyramis napalensis Wall., Tent. Fl. Napal. 32, *pl. 23*. 1824.—Li in Jour. Arnold Arb. **25**: 25. 1944.

YUNNAN: Mar-li-po, Sze-tai-po (Lao-chün-shan), in mixed forest, alt. 1300–1500 m., *K. M. Feng 13974* (herb 4 in. high, fruit green, common).

Sonerila cantonensis Stapf in Ann. Bot. **6**: 302. 1892.—Li in Jour. Arnold Arb. **25**: 35. 1944.

YUNNAN: Si-chour-hsien, Faa-doou, in mixed forest, alt. 1500–1550 m., *K. M. Feng 11877* (Herb 1 ft. tall, flower pink-rose).

This species has been recorded from Kwangtung, Kwangsi, and Fukien. This is a new record for the flora of Yunnan.

Sonerila yunnanensis J. Jeffrey in Notes Bot. Gard. Edinb. **8**: 207. 1914.

YUNNAN: Si-chour-hsien, Ting-mann, on cliffs in mixed forests, alt. 1100–1200 m., *K. M. Feng 12349* (herb 4 in. high, fruit green, rare).

Jeffrey described the seeds of this species as "seminibus ovoideis minute punctulatis." This is true. But on closer examination of *Feng 12349* as well as of *Henry 12337*, the latter an isotype of the species, a very interesting character is revealed, concerning which it is worth while to add a note. This character is the presence of a two-lobed bladder at the apical end of the seed opposite the shiny dark brown aril (Plate II, fig. 9). Seeds of *Sonerila cantonensis* Stapf, *Sonerila hainanensis* Merr., *Sonerila picta* Korth., and *Sonerila tenera* Royle were also examined for comparison. With the exception of *Sonerila tenera* Royle, all these species have seeds with the bladder at the apical end of the aril side. This character correlates with the attenuated anther and the funnel-shaped fruit. One must conclude that such a character is at least subgenerically distinct.

Stapfiophyton erectum sp. nov.

Herba erecta, 0.75 m. alta, ramis subteretibus, 5 mm. diametro, cinereis, junioribus furfuraceis; foliis subcoriaceis, glabris, ellipticis, 10–12 cm. longis, 3.5–5 cm. latis, basi obtusis, apice caudato-acuminatis, acumine 1.5–2 cm. longo, subtus glandulosis, nervis primariis 3, marginalibus duobus tenuioribus additis, nervis transversis supra obsoletis, subtus conspicuis, margine integro; petiolo 1.5–2.5 cm. longo, glanduloso, glabro; inflorescentiis subumbelliformi-cymis, paniculatis, terminalibus, pedunculis 3 cm. longis, cymis 3- vel 4-floris, pedicellis 4–5 mm. longis, glabris; flores ignoti; capsulis subturbinatis, 3–4 mm. diametro, apice depressis, placenta supra ramificata, seminibus ad basim adnatis; seminibus ovoideis, 0.7 mm. longis, 0.4 mm. diametro, rostratis, testa papillata.

YUNNAN: Mar-li-po, Huang-jin-in, in mixed forest, alt. 1300–1500 m., *K. M. Feng 13082* (TYPE) (herb 2 ft. high, fruit whitish yellow, common).

By its ramified placenta this species can be placed either in *Phyllagathis* Blume or *Stapfiophyton* Li. It is because of its paniculate cymose inflorescences that the latter is chosen.

Styrophyton gen. nov.

Anerincleistus ? sensu Diels in Bot. Jahrb. **65**: 101. 1932, non Korthals.

Allomorphia sensu Li in Jour. Arnold Arb. **25**: 11. 1944, non Blume.

Inflorescentiae spicatae (Tab. I, fig. 1), floribus sessilibus, 4-meris; receptaculis subcampanulatis, strigosis; sepalis brevibus; petalis unguiculatis (Tab. I, fig. 5); staminibus 8, subaequalibus, antheris rectis, apice paulo attenuatis, 1-porosis, thecis antice basi paulo productis, connectivo postice non aucto, ovario basi receptaculi adnato, stylo attenuato, basi setis ornati, stigmate capitato. Fructus ovoideo-subglobosus, costis pallidis et prominentibus, quadrilocularibus; semina numerosa, minuta, cuneata, truncata et rostrata. Frutices, ramis dense tomentosis; foliis magnis, ovatis, petiolatis.

TYPE SPECIES: *Styrophyton caudatum* (Diels) S. Y. Hu.

In all recent monographic work on Melastomataceae the inflorescences, whether they are panicles, umbels, scorpioid cymes, or otherwise, have been used as key characters for generic demarcations. Diels in 1932 first saw *Henry 10761*, a specimen from Yunnan with a spicate inflorescence. Realizing that it was unique, he described it as new, and probably because of its superficial resemblance to *Anerincleistus Beccarii* Cogn., he doubtfully assigned it to *Anerincleistus* Korthals. Li in 1944, on the basis of the prominent striation of the fruits, transferred Diels' species to *Allomorphia* Blume and added a description of the immature fruit and seed. With mature fruit from Feng's southeastern Yunnan collection I made careful dissections of the flower of *Henry 10761* (isotype), the young fruit of *Tsai 61591*, and the mature fruit of *Feng 12291*, and compared each with those of *Anerincleistus* Korthals and *Allomorphia* Blume. After a review of all the literature concerning these two genera and a detailed examination of all the material in the Arnold Arboretum and the Gray Herbarium, I feel that the southeastern Yunnan plant is generically distinct. Besides the simple unramified spicate inflorescence, which at once distinguishes it from the paniculate type found in *Allomorphia* Blume, the short calyx tube is also very distinct. In *Allomorphia* Blume the calyx tube is tubular, at least twice as long as wide, and with the ovary attached only at its base. Consequently, in fruit, the free portion of the persistent calyx tube forms a tall collar, which is usually constricted at the base. Moreover, at the apex of the ovary in *Allomorphia* there is no appendage such as bristles or corona, and consequently the apical end of a mature fruit is smooth and concave. In *Styrophyton* the calyx tube (Plate I, fig. 6) is only slightly longer than wide, and in fruit it does not form an evident collar (Plate I, fig. 2). Moreover, the persistent bristles at the apex of the ovary render the apical end of the mature fruit rough. The cuneate, truncate, and beaked seed and the striate fruit of *Styrophyton* indicate a close relationship with *Allomorphia* Blume on the one hand, and its short calyx tube and the rough apical end of the fruit show affinity with *Anerincleistus* Korthals on the other hand. These characters, together with the true spicate inflorescence, constitute my reasons for proposing a new genus whose natural position lies between *Allomorphia* Blume and *Anerincleistus* Korthals. Species of the latter genus can easily be distinguished by their pedicellate flowers, paniculate inflorescences, prominent corona at the apex of the ovary, and smooth capsules with persistent corona exposed at the apical end of the fruit.

Regarding the fruit and seed characters of this taxon Li (1944) recorded, "The somewhat immature fruits are . . . one-celled . . . seeds very minute, oblong." This is far from correct. Both the cross- and the longitudinal sections of the mature, as well as the young fruit, appear to have four cells (Plate I, figs. 3 & 4). The seed of the mature fruit is oblong-cuneate, 0.6–0.7 mm. long, 0.3–0.4 mm. in diameter, indistinctly ridged, truncate and beaked, slightly grooved on the beaked side and appendaged at the proximal end (Plate I, fig. 7). The testa is brown and smooth.

Styrophyton caudatum (Diels) comb. nov.

Anerincleistus ? caudatus Diels in Bot. Jahrb. **65**: 101. 1932.

Allomorphia caudata (Diels) Li in Jour. Arnold Arb. **25**: 11. 1944.

YUNNAN: Si-chour-hsien, Ting-mann, in mixed forests, alt. 1200–1300 m., *K. M. Feng 12291* (shrub 6 ft. high, young fruit green, common). Other specimens that I have examined are: *A. Henry 10761* (ISOTYPE) from Mengtze, *H. T. Tsai 60437*, *60563*, *61279*, and *61591*, all from Ping-pien hsien of Yunnan.

This species is a shrub which grows up to 5 meters high. In southeastern Yunnan it occurs in mixed forests at altitudes varying from 1000 to 1500 meters. The distribution is rather limited. So far, specimens have been collected only from the southeastern region of Yunnan between Long. 103° and 105° E. and Lat. 22°50′ and 23°30′ N. Our material exhibits very little variation even in the vegetative characters. Compared with the isotype, the base of some leaves may be subcordate rather than round, occasionally the upper surface of the leaves may be more or even less verruculose, the pubescence on the lower surface may be brown rather than white, and between these hairs there may be fewer glands. It seems that all these variations may be attributed to the age of the plants, the size of the leaves, or even to the pressing and drying processes in the preparation of the specimens.

EXPLANATION OF PLATES

PLATE I

Styrophyton caudatum (Diels) S. Y. Hu: FIG. 1. A fruiting branch (× ½), the indumentum omitted. FIG. 2. A fruit (× 5). FIG. 3. The same, longitudinal section, lower portion not through the center of the fruit (× 10). FIG. 4. Cross-section of a young fruit (× 10). FIG. 5. A flower (× 5). FIG. 6. The same with part of the calyx tube, petals and stamens removed (× 5). FIG. 7. Some seeds (× 12).

PLATE II

FIG. 1. Fruit of *Blastus fengii* S. Y. Hu (× 3), with seeds in lateral view (× 10). FIG. 2. Habit sketch of *Medinilla nana* S. Y. Hu (× 2), with seeds (× 10). FIG. 3. Seed of *Cyphotheca montana* Diels (× 10), side and front views. FIG. 4. Seed of *Oxyspora paniculata* DC. (× 12). FIG. 5. Longitudinal section of the fruit of *Pachycentria fengii* S. Y. Hu (× 6). FIG. 6. Fruit of the same (× 5), with persistent calyx, each lobe of which has a small hook on the back. FIG. 7. Cross-section of the ovary of the same, diagrammatic. FIG. 8. Seeds of *Pachycentria fengii* S. Y. Hu (× 5). FIG. 9. Seeds of *Sonerila yunnanensis* J. Jeffrey (× 10). FIG. 10. A flower of *Cyphotheca hirsuta* S. Y. Hu (× 3), with 1 petal and 1 smaller stamen removed. FIG. 11. Seed of *Plagiopetalum henryi* (Kränzl.) S. Y. Hu (× 10).

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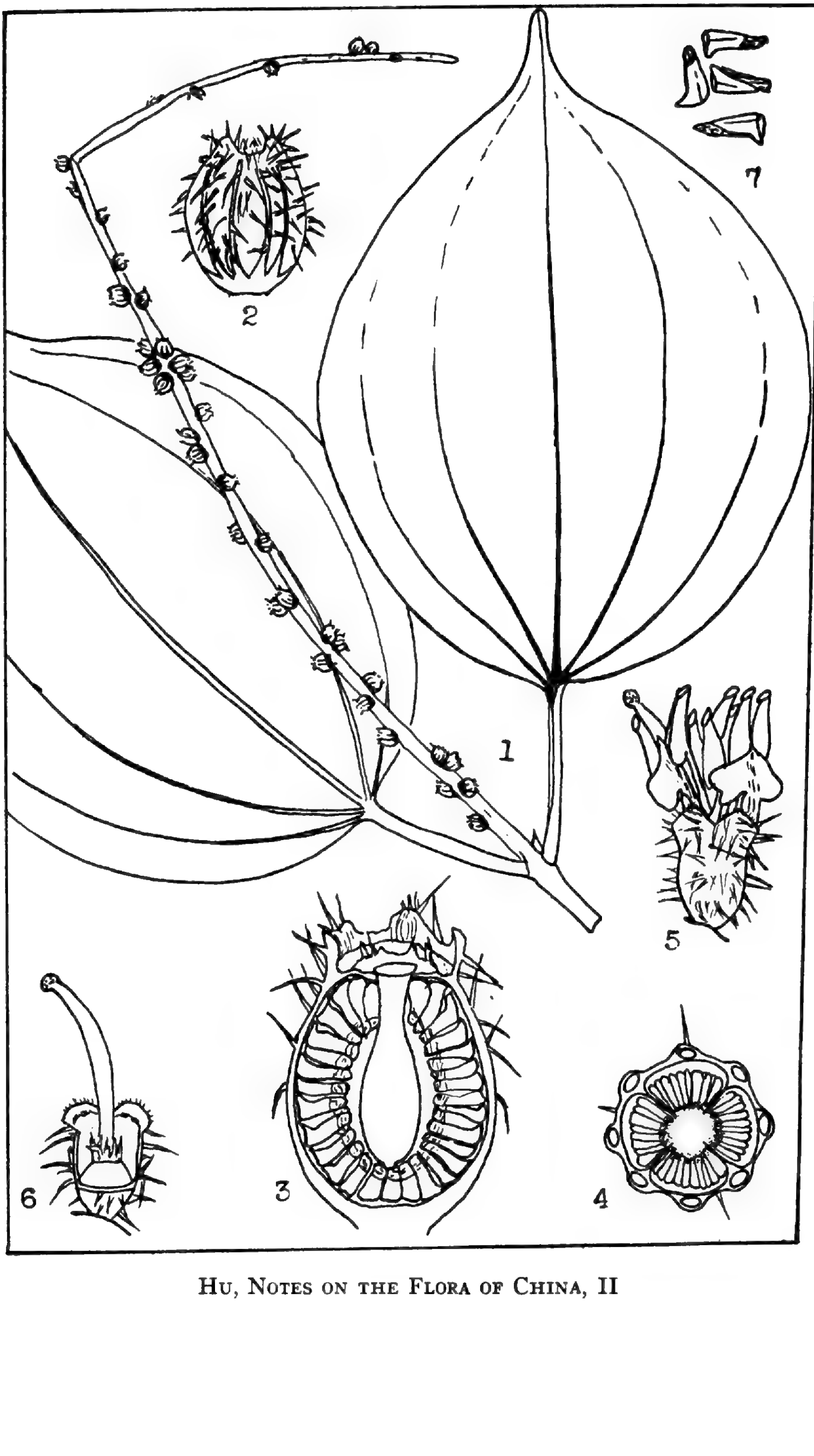
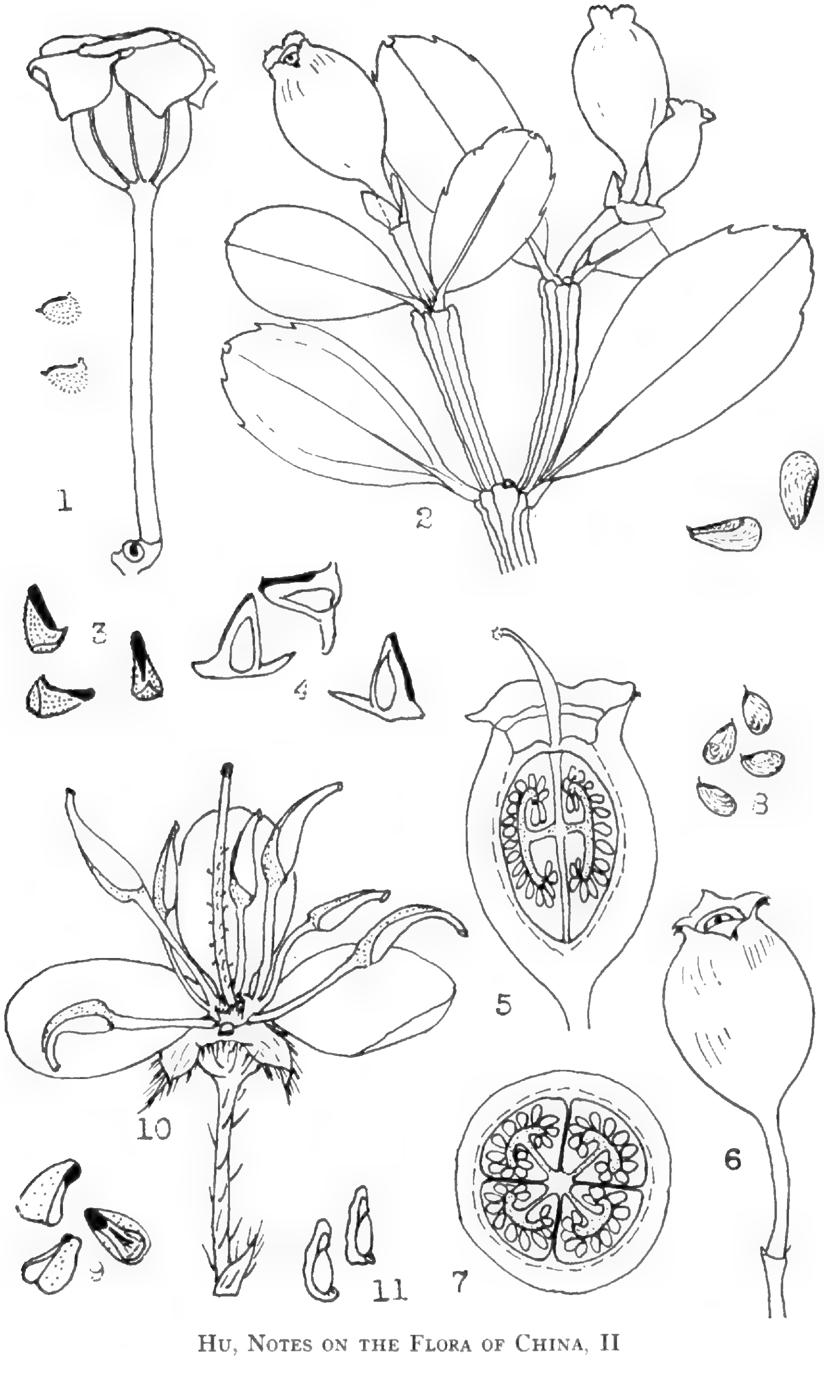


HU, NOTES ON THE FLORA OF CHINA, II



HU, NOTES ON THE FLORA OF CHINA, II

SPONTANEOUS WHITE PINE HYBRIDS

ALBERT G. JOHNSON

With two plates

A NOTEWORTHY FEATURE of the genus *Pinus* L. is the relative abundance of both natural and artificial hybrids. Summaries of known crosses published in recent years include hybrids within both of the subgenera *Haploxylon* Koehne and *Diploxylon* Koehne, usually within the series limits of these subgenera; cf. L. P. V. Johnson (3), Richens (5), Righter and Duffield (6). The hybrids to be described here are hitherto unreported in the subgenus *Haploxylon.*

In the spring of 1949 a five-needled pine growing in the Hunnewell Arboretum, Wellesley, Massachusetts, was observed to differ markedly from the familiar native white pine, *Pinus strobus* L.; and yet it was evidently not one of the known cultivated species of this group of pines. The tree, about twenty years old, twenty-five feet high, and fourteen inches d. b. h., is, in the opinion of Mr. Walter Hunnewell, of spontaneous origin, inasmuch as he has no record nor recollection of it having been planted. Apparently it is a chance seedling which has grown up since annual mowing was discontinued in the Arboretum about 1930. It has been allowed to remain because of its unusually attractive blue-green foliage.

The tree is a vigorous and rank grower of loose open habit. This rapid growth capacity plus the effect of repeated weevil damage has caused it to develop a broad crown with several leaders. Although generally resembling our native white pine it differs in the curved and twisted blue-green foliage, the more massive cones, the larger, purple-brown seeds, and the scaly brown bark. The flowers at the time of initial observation were seen to differ from those of white pine in both position and color. The red female flowers were borne from top to bottom of the tree, while on white pine they rarely are found except in the topmost branches. The flesh-colored male flowers were few and borne in elongated clusters instead of in yellow compact bunches as in white pine. Subsequent examination of the pollen showed it to be 23% defective.

The presence in the Arboretum of *P. parviflora* Sieb. & Zucc. and of *P. parviflora* var. *pentaphylla* Henry, both of which have flowering habits similar to the tree in question, suggested the possibility of hybridization with the native white pine, which is abundant on the grounds. Since the difference between *P. parviflora* and its variety *pentaphylla* is slight and of such a nature as to be obscured in a hybrid, the latter taxon is not being considered as distinct for the purposes of this paper. Moreover, the location of this varietal form in respect to the other trees in the Arboretum substantially reduces the probability of it having had a rôle in the induction of this presumed hybrid or of others discovered later.

Careful comparison of the characteristics of the tree in question with both *P. strobus* and *P. parviflora* supports the hybrid hypothesis. To facilitate comparison of the parental and hybrid forms a hybrid index has been prepared, TABLE I, after the manner of Anderson (1). In making up such an index the characters of diagnostic value of one species are arbitrarily assigned a value of 0, while the corresponding ones of the second species are assigned values of 1 or more, according to their relative importance in separating the two species. Since the genetic bases for most of the characters utilized in this particular instance are still imperfectly understood, the values assigned to the second species have in most cases been kept relatively low. Values for the corresponding traits in the putative hybrid are then determined by interpolation according to the degree of resemblance to one parent species or the other. The summation of these individual values provides an index number for the particular plant indicative of its relative resemblance to one parental species or the other. Such indices are of greatest value, of course, in population studies, where they can assist in the detection of F_2 segregates and backcross individuals, but they are also useful tools for presenting quantitatively conclusions necessarily of a subjective nature, as in the case of the present hybrid, where the summation of its various index values shows it to resemble *P. parviflora* slightly more than *P. strobus*.

The reference to odor in the hybrid index table should perhaps be elaborated, since it is a useful tool in identifying certain pines and the probable parentage of certain hybrids. *Pinus parviflora* branches, when broken, emit a strong and apparently highly specific odor suggestive to some people of bruised tomato plants. This odor is present in induced hybrids of this species with *P. strobus* and *P. monticola* growing at the Arnold Arboretum, and is present in the suspected hybrid under discussion and in other individuals found later. Mirov (private communication) has suggested that the terpenes and sesquiterpenes of *P. parviflora* which he and his co-workers have recently analyzed (2) may predominate in the hybrid over the simple pinene mixture found in *P. strobus* (4). A comparable situation exists in the hybrid between *P. ponderosa* Laws. and *P. jeffreyi* Grev. & Balf., in which the terpenes of *P. ponderosa* predominate over the simple n-heptane of *P. jeffreyi*, although the turpentines of both parental species occur in the hybrid.

With the establishment upon a reasonable basis of the probable hybridity of the tree, it still remained necessary to determine whether the cross occurred as *P. strobus* × *parviflora* or as the reciprocal cross. Several factors favor the first assumption. The position of the hybrid in relation to the probable parent trees suggests that it originated as a wind-borne seed from a near-by *P. strobus*. An essentially wingless seed of *P. parviflora* would have had to be carried by an animal agency nearly twice that distance to the site of the hybrid. The later finding of additional individuals of this hybrid, one of which is almost directly below the probable mother tree, adds further evidence in favor of this parentage. The comparatively poorer showing in vigor and growth rate of two reciprocal hybrid indi-

TABLE 1

SPECIES	LEAF LENGTH	LEAF SHAPE	♂ STROB-ILI	♀ STROB-ILI	PE-DUN-CLE	LENGTH OF SEEDS	SEED WING	SEED COLOR	SEED SHELL	NO. OF CONE SCALES AVER.	ODOR	NO. OF SEEDS PER GRAM	BARK	SUM OF INDEX VALUES
Pinus strobus	(0) 6–14 cm.	(0) straight	(0) yellow clus-tered	(0) cream or pink	(0) long	(0) 5–7 mm.	(0) long	(0) light brown	(0) thin	(0) 38	(0) pleas-ant	(0) 53.08	(0) rough purple brown	(0)
× *P. hunne-welli*	(1) 7.5–8.5 cm.	(1) curved slightly twisted	(2) pink elong. clus-tered	(2) red-dish	(1) sub-ses-sile	(1) 7–9 mm.	(0) long	(2) purple brown	(1) thick	(1) 30	(3) dis-agree-able	(3) 13.88	(1) scaly brown	(19)
P. parvi-flora	(2) 2–3 cm.	(2) curved twisted	(3) pink elong. clust.	(3) red	(2) ses-sile	(2) 10–12 mm.	(2) short	(2) purple brown	(2) very thick	(3) 13	(3) dis-agree-able	(4) 4.58	(2) scaly brown	(32)

viduals at the Arnold Arboretum adds further support to this viewpoint and suggests that some real difference in the reciprocal hybrids may in fact exist. Also it is reported to be much easier to induce the hybrid *P. strobus* × *parviflora* than the reciprocal hybrid (J. W. Wright, private communication).

As already indicated, additional individuals of the hybrid have been found. The second was discovered in the spring of 1951 about two hundred feet from the site of the first tree and only a short distance from the probable female parent, a large white pine thirty inches in diameter. This hybrid tree, designated for purposes of reference as Hunnewell #2, is about the same age as the first (Hunnewell #1) but is slightly smaller, twelve inches d. b. h. and twenty-two feet high. Like #1, it is rank-growing and multiple-stemmed, again in part because of its inherent vigor and in part due to repeated weevil damage. In details of foliage and cones it does not differ materially from hybrid #1.

Following the discovery of this second hybrid a systematic search of the grounds of the Arboretum was made to see if other hybrid individuals might exist. Additional specimens were found and numbered in order of discovery as #3, #4, #5, and #6. Tree #3 was later rejected as a probable hybrid between *P. peuce* Griseb. and *P. parviflora* and will be dealt with independently. To avoid any confusion, however, the original numbers assigned to the remaining hybrids were retained.

The fall of 1951 provided the first opportunity to collect any number of cones from the two largest trees. The three smaller ones did not produce a sufficient number to warrant collection for seed production analysis. In each case, however, enough were found to supply herbarium material for comparative purposes. Although badly hit by cone weevils, *Conophthorus coniperda*, the first tree yielded sixty-two sound cones and the second seventeen. In neither case did this represent the total production of the tree but instead the more accessible sound cones. These were collected when mature and just beginning to open on September 7. The two lots of cones were kept separate, allowed to dry, the seed extracted, cleaned, counted, and weighed. The good seed was found to be readily separable from the empty seeds by water flotation, which allowed the latter to be skimmed off the surface of the water while the filled seed sank to the bottom of the container. In both cases the proportion of good seed was low, being but 0.9% and 1.6% respectively in trees #1 and #2. If the percentage of good seed is calculated on the basis of the potential seed production from the average number of functional scales per cone the figures are further reduced to 0.1% and 0.4%, since many scales yielded nothing but empty wings, possibly due to lack of pollination. The seeds produced were large and relatively thick-shelled. While resembling *P. parviflora* in these respects, the seed wing was of the long functional type of *P. strobus*. The seeds weighed about four times as much as those of *P. strobus* and one third as much as those of *P. parviflora*.

As was pointed out earlier, 23% of the pollen of hybrid #1 was abortive upon visual examination. That of tree #2, however, appeared wholly sound. No germination test was undertaken with either pollen lot, so probable functionability is not known. In both of these trees the amount of pollen produced was so low in 1951 as to virtually eliminate the possibility of any significant amount of self-pollination taking place. In the case of tree #1 similar low pollen production was observed in 1949 and 1950. In fact, in 1950 scarcely any pollen could be found despite a very heavy production of female flowers. This phenomenon of disproportionate female flower production is frequently observed in vigorous young pines and may in part explain the poor seed yield from the cones of such trees. This point was emphasized in the experience of the writer in the fall of 1950 while collecting pines in southern Mexico. On one occasion a considerable number of cones were collected from a small grove of young and extremely vigorous trees of *P. ayacahuite* var. *veitchii* Shaw. The cones of this species are massive and while green are the equivalent in size and weight to quite respectable pieces of stove wood, so that some considerable effort was involved in transporting the cones down the mountain to the car. When processed some months later, all were found to be devoid of good seed.

Inasmuch as this hybrid between the native white pine and the Japanese white pine has occurred at least five times and apparently is capable of recurring repeatedly as long as the parent species remain in close proximity to each other, it seems appropriate to designate it with a specific title in honor of Mr. Hunnewell, a lifelong friend of the Arnold Arboretum and an ardent horticulturist.

× **Pinus hunnewelli** hyb. nov. (*P. strobus* L. × *P. parviflora* Sieb. & Zucc.).

Arbor hybrida fertilis habitu corticeque *P. parviflorae* similis; a *P. parviflora* differt foliis longioribus, strobilis longioribus, seminibus minoribus ala elongata donatus; a *P. strobo* differt ramulis puberulentis, foliis brevioribus, strobilis subsessilibus, apophysis firmioribus crassioribus glaucis; seminibus majoribus.

TYPE: a specimen from hybrid #1 deposited in the herbarium of the Arnold Arboretum.

This hybrid swarm, although limited to small numbers, illustrates the breakdown of a geographically imposed isolating barrier to genic exchange through the chance migration of one species, in this case throuh the agency of man, into contact with another closely related one. The production of fertile hybrids exemplifies the first stage of introgression of *P. parviflora* genes into *P. strobus* and provides the tree breeder, incidentally, with the most important tool of his trade, the F_1 hybrid, with which to produce backcross and F_2 generations. From this point of view the discovery of these trees is of considerable value, since they can save the geneticist many years of waiting for artificially induced hybrids of this nature to reach sexual maturity.

The hybrid vigor so apparent in this hybrid has been observed in two cases to lead to the forking of the branches at a point between the whorls, and in one case to the production of a forked cone (PLATE 2). Also apparently associated with this hybrid vigor is a snakelike or looping type of growth which may be responsible in some degree for the poor form of the trees. The observed tendency of the lowermost branches of the Hunnewell hybrids to turn up and develop leaders has also been noted in specimens of *P. monticola* × *strobus* and *P. monticola* × *parviflora* growing at the Arnold Arboretum. In each case the tendency appears to be associated with the other manifestations of hybrid vigor, and unless closely planted or systematically pruned these trees will inevitably develop multiple and forked trunks. Such undesirable by-products of the heterotic phenomenon suggest the need of considerable caution in its direct application to the problems of forest-tree breeding. Improperly utilized it could quite conceivably discredit considerably the youthful tree-breeding science through the production of coarse, unmarketable trees, in much the same manner as the use of exotic species has fallen into disrepute in the United States largely because of the failure to take into account the need for assessment of the variability within a species chosen and the necessity of choosing a variety adapted to the conditions under which it must grow.

Both hybrids #1 and #2 have been propagated by grafting upon young specimens of *P. strobus*. Hybrid #1 was first so propagated on a small scale in 1950 and in 1951 the three surviving grafts of the original five produced six, eight, and eight female strobili respectively and an unexpectedly large number of male flowers. Additional grafts of this plant were made in 1951. Tree #2 was not discovered until after growth had started in 1951, and to propagate it without loss of a season soft wood scions were used upon the new growth of potted white pines. Further propagation is planned of all five individuals of the Hunnewell pine, as well as of the *P. peuce* × *parviflora*.

SUMMARY

A small hybrid swarm of *Pinus strobus* × *parviflora* is described and the type individual designated as × *P. hunnewelli*. This hybrid is noteworthy as potential breeding stock for incorporating genes of *P. parviflora* into *P. strobus*. It displays marked heterosis and is promising as an ornamental because of its attractive foliage. The hybrid is at least partially fertile and is readily propagated by common grafting techniques. A second hybrid between *P. peuce* and *P. parviflora* is referred to, but the description is withheld pending confirmation of the female parentage.

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EXPLANATION OF PLATES

PLATE I

Cones, leaves, and seeds of *Pinus parviflora* Sieb. & Zucc., × *P. hunnewelli* hybr. nov., and *P. strobus* L. FIGS. 1, 2, & 3, *P. parviflora*. FIGS. 4, 5, & 6, × *P. hunnewelli*. FIGS. 7, 8, & 9, *P. strobus*.

PLATE II

Abnormalities of cone and branch structure of × *Pinus hunnewelli*, apparently associated with the expression of hybrid vigor. FIG. 1, Cone forked near base. FIG. 2, Branchlet showing forking between nodes.

ARNOLD ARBORETUM
HARVARD UNIVERSITY

Johnson, Spontaneous White Pine Hybrids

Johnson, Spontaneous White Pine Hybrids

STUDIES IN THE THEACEAE, XXVI
THE GENUS VISNEA *

CLARENCE E. KOBUSKI

THE GENUS *Visnea* was first described by Linnaeus f. (Suppl. Pl. 36. 1781), and on a later page (251) of the same publication the author recorded the species *V. mocanera*. The specific name refers to the *mocan* of the Guanches, or ancient inhabitants of the Canary Islands, who made from the plant a kind of syrup which was much used with their daily food and in medicines. It is thought that *V. mocanera* is the plant referred to as "mocan." A second generic name, *Mocanera*, was introduced by Jussieu (1789), who actually recognized the existence of the previously described *Visnea*. However, no serious question of nomenclature ever evolved, since *Mocanera* became only a little-used synonym and never challenged the priority of *Visnea*. To this day no other species has been added to the genus.

Originally the species was described from the Canary Islands, and it has been recorded from most of the group, quite extensively from Gran Canary, Teneriffe, Gomera, Palma, and Ferro. It was at first thought that the Canary Islands encompassed the complete range of the species. However, Johnson (Hooker's Jour. Bot. **9**: 161. 1857) reported the species as growing in the northwestern portion of the islands of Madeira between the Ribeira da Janella and the Ribeiro do Inferno. From the works of other authors one may assume that this small area originally mentioned in Johnson's work shows the distribution of the species on Madeira.

It appears that the species is usually found growing in rather wild and inaccessible places. On Madeira its habit is that of a shrub, while in the Canary Islands it more often attains the stature of a small tree.

There seem to have been considerable question and also several suggestions regarding the correct position and relationships of the genus. Endlicher (Gen. Pl. 1018. 1840) first placed it in the Theaceae, but later in the second supplement of the same publication (Suppl. 2, 81. 1842) considered it as belonging to the Ebenaceae. Johnson (1857) suggested a relationship with the genus *Clethra* and suggested *Visnea* as "another link of connection between Ericaceae and Vacciniaceae." However, by 1885 Johnson appears to have changed his opinion, since he treated the genus in his Handbook of Madeira under the Theaceae.

In 1859, two years after Johnson's original article appeared, Schacht (Denkschr. Bot. Ges. Regensburg **4**: 47–60, *t. 1, 2.* 1859), from material sent by Johnson, offered a detailed discussion on the status of *Visnea*.

* This genus was studied originally with the oriental genus *Anneslea*, and a publication comprising the two genera was planned. However, as the study progressed, it was decided to treat the two separately.

This last work was undoubtedly based to a considerable extent on the previous work of Johnson. No definite conclusions were offered. It is interesting to note that in the plates, which are very well done as a whole, the anthers are depicted with almost pore-like openings rather than longitudinal slits.

Toward the end of the nineteenth century botanists in general accepted *Visnea* as belonging to the Theaceae. Szyszylowicz (1895) and Melchior (1925), in their respective treatments of the family in Die Natürliche Pflanzenfamilien, both placed *Visnea*, without reservation, in the Theaceae. They placed it in the tribe Ternstroemieae along with *Adinandra*, *Ternstroemia*, and *Eurya*.

Most botanists, it seems, have interpreted the ovary as inferior or half-inferior. This interpretation stems from the fact that the persistent calyx-lobes are joined at the base, and in the development of the fruit this fused basal portion of the calyx is adnate to the side of the fruit. This appears very much like an inferior ovary, except that the fruit, when dissected longitudinally, shows a clean demarkation from the calyx-lobes in the line and character of the pericarp, which is distinct and not fused with the calyx.

In the flower, the ovary appears to be placed on the torus formed with the base of the connate calyx-lobes, but retains its individual identity. Some authors have described the ovary as projecting "lightly" into the torus. I could detect no projection into the torus from the dissections I made and studied. It does appear, however, that in the development of the fruit and the persistent calyx, the base of the fruit does project somewhat into the torus, but, as I mentioned above, retains its individuality.

Visnea Linnaeus f., Suppl. Pl. 36. 1781. — Endlicher, Gen. Pl. 1018. 1840; Suppl. 2, 81. 1842. — Webb & Berthelot, Hist. Nat. Iles Canar. 3 (2): 144. 1842. — Choisy in Mém. Soc. Phys. Hist. Nat. Genève **14**: 130 (Mém. Ternstr. 42). 1855. — Johnson in Hookers Jour. Bot. **9**: 161. 1857. — Schacht in Denkschr. Bot. Ges. Regensburg **4**: 47–60, *t. 1, 2.* 1859. — Bentham & Hooker, Gen. Pl. **1**: 182. 1862. — Baillon, Hist. Pl. **4**: 257. 1873. — Szyszylowicz in Nat. Pflanzenfam. III. **6**: 190. 1895. — Hubbard in Bailey, Stand. Cyclop. Hort. **6**: 3480. 1917. — Engler in Veg. Erde [Pflanzenwelt Afr. 3 (2)] **9**: 494. 1921. — Melchior in Nat. Pflanzenfam. ed. 2, **21**: 145. 1925. — Lemée, Dict. Pl. Phan. **6**: 877. 1935.

Mocanera Jussieu, Gen. Pl. 318. 1789. — Lamarck, Encycl. **4**: 208. 1797. — Jussieu in Dict. Sci. Nat. **31**: 504. 1824. — Non *Mocanera* Blanco, Fl. Filip. 446–451, 858. 1837.

Flowers axillary, hermaphroditic. Bracteoles 2. Sepals 5, imbricate, connate at the base forming a shallow tube adnate to the base of the ovary. Petals 5, imbricate, connate at the base. Stamens 12 [–21], adhering to the base of the corolla; filaments free; anthers basifixed, erect. Ovary 3-celled, lightly immersed in the torus; ovules few in each cell, pendant from the apex; styles 3, distinct, persistent. Fruit baccate, indehiscent, projecting into the torus, nearly enclosed and adjoined near the base by the persistent calyx, *appearing* subinferior. Seeds small, pyriform, 3-angled, the embryo curved, cylindrical, the albumen pulpy.

Evergreen trees with small flowers.

TYPE SPECIES: *Visnea mocanera* Linn. f.

DISTRIBUTION: Canary Islands and Madeira.

Visnea mocanera Linnaeus f., Suppl. Pl. 251. 1781. — Willdenow, Sp. Pl. 2: 926. 1800. — Bory de St.-Vincent, Essai Iles Fortunées 327, *t, 7.* 1804. — Colla, Hort. Repul. 146, *t. 32.* 1824. — Sprengel, Syst. Veg. 2: 465. 1825. — Hooker, Icon. Pl. 3: *t. 253.* 1840. — Walpers, Repert. Bot. Syst. 1: 368. 1842. — Webb & Berthelot, Hist. Nat. Iles Canar. 3 (2): 145, *t, 69 B.* 1842–44. — Choisy in Mém. Soc. Phys. Hist. Nat. Genève 14: 130 (Mém. Ternstr. 42). 1855. — Walpers, Ann. Bot. Syst. 7: 360. 1868. — Johnson, Handb. Madeira 220. 1885. — Nicholson, Illustr. Dict. Gard. 4: 185, *f. 200*, 1886. — Szyszylowicz in Nat. Pflanzenfam. III. 6: 190. 1895. — Thonner, Blutenfl. Afr. *t. 99.* 1908; Fl. Pl. Afr. *t. 98.* 1913. — Pitard & Proust, Fl. Iles Canar. 134. 1908. — Menezes, Fl. Arch. Madeira 30. 1914. — Hubbard in Bailey, Stand. Cyclop. Hort. 6: 3480. 1917. — Knoche, Vagandi Mos (Die Kanarische Ins.) 220, *t. 17.* 1923. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 145. 1925. — Lindiger, Beitr. Kennt. Veg. Fl. Kanar. Ins. 278. 1926.

Mocanera canariensis Heynhold, Nom. Bot. Hort. 1: 884. 1840, *nom. nud.* — Jaume St.-Hilaire, Expos. Fam. Nat. 2: 371. 1805. — Jussieu in Dict. Sci. Nat. 31: 505. 1824.

Small tree or shrub. Branches brown or grayish brown, terete, glabrous, lenticellate, the young branchlets brown, angled, pubescent when very young. Leaves coriaceous, subelliptic-obovate, 4–7 cm. long, 2–2.5 cm. wide, glabrous (except when very young), acute at the apex, cuneate at the base, the margin subrevolute, serrulate along the upper half, a gland (quickly caducous) to each serration, the veins obscure on both surfaces, occasionally visible below, the midrib 2–3 (–4) mm. long. Flowers axillary, solitary or in twos, occasionally in fascicles of three; pedicel terete, 7–8 mm. long, lightly pubescent at anthesis (lens); bracteoles 2, ovate or long-deltoid, unequal, 1.25–1.5 mm. long, one bracteole immediately below the calyx, the other disposed along the pedicel away from the calyx, rarely opposite; calyx-lobes 5, imbricate, coriaceous, persistent, unequal, glabrous (lightly pubescent at anthesis), 3–5 mm. long, 2.5–2.75 mm. wide, joined at the base for 1.5–2 mm. forming a torus; corolla-lobes 5, imbricate, obtuse, membranaceous, 5–6.5 mm. long, 3.5–4 mm. wide, joined at the very base; stamens ca. 13 [–21], ca. 4 mm. long, unequal, the filament ca. 3 mm. long, free, lightly adnate to the base of the corolla, the anthers long-ovate ca. 1 mm. long, projected into an apicule; ovary subglobose to conical, lightly imbedded in the torus, ca. 1.5 mm. diameter, sulcate and glabrous near the base, densely pubescent above, 3-celled, the ovules few, the styles 3, filiform, persistent, ca. 3 mm. long, free nearly to the base, pubescent, the stigmas punctiform. Fruit baccate, indehiscent, conical, crowned by the persistent styles, during development projecting more deeply into the torus, the cells often indistinguishable, appearing one-celled, crowded with pulp, 1–4-seeded, others abortive. [Seeds 3-angled pyriform, acute, the testa glutinous-granulate].

CANARY ISLANDS: TENERIFFE: above Taganana, in forest, alt. 900 m., *A. Engler s.n.* (AA). — "Cruz de Taganana, Cumbre, in rupibus," alt. 900 m., *J. Bornmüller 927* (AA), June 14, 1900. — Guinar, river ravine, alt. 700–800 m., *O. Burchard 62* (AA), Feb. 1904. — Guinar, river ravine, alt. 500 m., *J. Bornmüller 2588* (AA), Sept. 6, 1901. — In woods, *C. Bolle s.n.* (G), in 1851. PALMA: near Breña Baja, Montagneta, alt. 500 m., *J. Bornmüller 2586* (AA), May 10, 1901. FERRO: El Golfo, Vueltas above the church, *R. T. Lowe H 178* (G), Feb. 18, 1858. — Risco de Jinama, alt. 500–600 m., *J. Bornmüller 2589* (AA), May 17, 1901.

MADEIRA: Ribeiro do Inferno, *W. Barbey 908* (G), Dec. 16, 1858.

CULTIVATED: Teneriffe: Oratava, in garden, *J. Bornmüller 925* (AA), July 1900. — France: Antibes (Alpes-Maritimes), Villa Thuret (AA), Mar. 12 & Apr. 10, 1889.

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THE GENUS AMENTOTAXUS

HUI-LIN LI

Amentotaxus is a coniferous genus, of isolated position, endemic to eastern Asia; there are considerable differences of opinion regarding its proper phylogenetic alliance. The genus has long been considered monotypic. Its species, *A. argotaenia* (Hance) Pilger, was first proposed as a species of *Podocarpus*, having been based on sterile material. Later Pilger transferred it to *Cephalotaxus* (in Engler, Pflanzenr. IV. **5**: 104. 1903), but it was subsequently referred to a separate genus by him (in Bot. Jahrb. **54**: 41. 1916) because of its very distinct long staminate inflorescences. In Pilger's system of 1926 (Engler & Prantl, Nat. Pflanzenfam. ed. 2. **13**: 267. 1926), *Amentotaxus* is placed in the Cephalotaxaceae, the only other genus of which is *Cephalotaxus*. As *Amentotaxus* is very different from *Cephalotaxus*, Kudo and Yamamoto (in Jour. Soc. Trop. Agr. Formos. **3**: 110. 1931) proposed for it the monotypic family Amentotaxaceae. Florin (Palaeontographica 85, Abt. B: 625–630. 1944; Bot. Gaz. **110**: 31–39. 1948), however, is of the opinion that *Amentotaxus* is not closely related to the Cephalotaxaceae but rather to the Taxaceae. Accordingly, in the latest system of classification of the conifers by Janchen (in Sitz. Oest. Akad. Wiss. Math.-Nat. Kl. Abt. I. 1949(3): 155–162. 1950), it is placed with *Torreya* in the tribe Torreyeae of the Taxaceae, while *Cephalotaxus* is considered as representing the monotypic family Cephalotaxaceae. On the basis of both the vegetative and reproductive structures, this disposition is probably the most commendable.

The varied opinions regarding its phylogenetic position show that *Amentotaxus* is of great morphological interest. Also of considerable interest is its geographical distribution. First discovered around Hongkong and in Kwangtung, in southern China, the genus was subsequently reported to occur in southern Formosa, western Hupeh and Szechuan, southern Yunnan, and Tonkin. These later records all attribute the plants from these widely separated localities to a single species. In all cases, the authors recording these findings have apparently studied only local material, and a comprehensive review of the genus, with specimens representative of all localities, has never been made. Although the number of specimens from the different localities now available is still rather few and in some cases inadequate, apparently due to the plants being of rare occurrence, a study shows that the genus is not monotypic, but is rather composed of several distinct entities, each possessing distinct morphological characteristics and an exclusive as well as isolated and restricted range. In other coniferous genera with similar disjunct ranges, such as *Taiwania*, the disjunction is found to be specific in nature. Plants of these remote locations have long been isolated and have undergone considerable differentiation, so that they are recognizable as morphologically and taxonomically distinct entities, here interpreted as species.

The chief differentiating characters among the species are the size and shape of leaves and the relative width of the stomatal bands. Apparently the number of staminate racemes and the size and shape of the mature seeds are also good taxonomic characters. Unfortunately, as most of the specimens now available are sterile, these latter important characters are not revealed in all species. However, the stomatal bands on the undersurface of the leaves are especially conspicuous and strikingly distinct, especially in combination with other characters, rendering the differentiation of species very certain even when the locality of a given specimen is not indicated. The width of the stomatal bands and the proportion of these to the marginal green bands are very constant among plants of the same general region, that is, of the same species. While only one collection of the genus in Yunnan is so far noted, a larger and more complete series of Formosan specimens is available for study. In all cases, the stomatal bands are of nearly uniform width among plants of the same general range, clearly indicating the taxonomic dependability of this character.

As a result of this study, four species are recognized: one, the type species, occurring in Kwangtung, one in southern Formosa, one in Hupeh-Szechuan, and one in southern Yunnan and possibly also in northern Tonkin. These species all occur at medium to high altitudes, varying from 300 to 1600 meters, in ravines and on rocky cliffs, mostly in shady damp situations or sometimes along borders of streams. They are not only of very restricted range but also of rare occurrence, probably an indication that these ancient plants are on the verge of becoming extinct. As the species are highly ornamental because of their striking foliage, and as they are also of great botanical interest, it would be desirable to exert more effort toward bringing them into cultivation.

The material utilized in this study is deposited at the following herbaria, listed with respective abbreviations used for cited specimens: AA = Arnold Arboretum; NTU = National Taiwan University, Formosa; US = U. S. National Herbarium.

I am indebted to the officials of these institutions for permission to study specimens in their care, and to Dr. A. C. Smith, U. S. National Museum, for reading the manuscript and offering suggestions.

Amentotaxus Pilger in Bot. Jahrb. **54**: 41. 1916

Evergreen shrubs or small trees, glabrous, the branchlets opposite, terete or more or less quadrangular, patent or ascending. Leaves persistent toward the upper part of the branchlets, sessile, subsessile, or very shortly petiolate, opposite, coriaceous, decurrent, linear-lanceolate, usually acutish at apex, with a prominent or subprominent costa, green above, with 5 distinct longitudinal bands beneath, the costal and marginal bands pale or silvery green, alternating with 2 broad whitish stomatal bands. Flowers dioecious, on the year's branchlets. Staminate inflorescences of 2–4 (rarely 1 or 5) spike-like racemes, long and more or less pendulous, short-pedunculate, in the axils of imbricate bracts, the flowers composed of fasciculate stamens of peltate or subpeltate short-stipitate scales, the anther-cells 2–8, ovoid. Ovulate flowers solitary, in the axil of a lateral bract, on short thick to long slender pedicels, the ovule solitary, erect, subtended by minute imbricate scales below. Seeds solitary, large, drupe-like, ovoid or ellipsoid, surrounded by a reddish yellow aril open at the apex, subtended by several persistent scales at base.

TYPE SPECIES: *Amentotaxus argotaenia* (Hance) Pilger.

Four species in eastern Asia.

As all previous references pertain to a single species, the synonymy given below is adjusted on the basis of the specimens cited or locations attributed. Pilger, the author of the genus, erroneously credited the species *Amentotaxus argotaenia* (in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 13: 268. 1926) to western China only, while actually the type locality is in southern China. His description, which is rather brief, is based on composite elements from different localities, the staminate characters on the basis of only one collection, *Westland* from Taimo Mountains opposite Hongkong, and the ovulate characters on the basis of a single flower from *Wilson 3005* from an unspecified locality in western China.

KEY TO THE SPECIES

A. Stomatal bands white, as broad as or narrower than the outer green marginal bands.
  B. Leaves comparatively short, 4–7 cm. long, straight, rarely slightly falcate, acute to obtuse at apex; stomatal bands as broad as the green marginal bands. . . . . 1. *A. argotaenia*.
  BB. Leaves longer, 6–11 cm. long, mostly falcate, sometimes straight, long-acuminate at apex; stomatal bands about ⅔ as broad as the green marginal bands. . . . . 2. *A. cathayensis*.
AA. Stomatal bands white or brownish, 2 or more times as broad as the outer green marginal bands.
  B. Leaves comparatively long and narrow, 5–8.5 cm. long, 7–9.5 mm. broad, mostly slightly falcate, the base acute to obtuse; stomatal bands white, twice as broad as the marginal bands. . . . . 3. *A. formosana*.
  BB. Leaves shorter and broader, 3–7 cm. long, 8–11 mm. broad, usually straight; the base broadly acute to subrounded; stomatal bands brownish or yellowish white, 2.5–3 times as broad as the green marginal bands. . . . . 4. *A. yunnanensis*.

1. **Amentotaxus argotaenia** (Hance) Pilger in Bot. Jahrb. **54**: 41. 1916, p. p. (quoted plants from Kwangtung and Hongkong).

Podocarpus argotaenia Hance in Jour. Bot. **21**: 357. 1883; Masters in Jour. Linn. Soc. Bot. **26**: 547. 1902, p. p.; Dunn & Tutcher in Kew Bull. Misc. Inf. Add. Ser. **10**: 256. 1912.

Podocarpus insignis Hemsl. in Jour. Bot. **23**: 287, 312. 1885.

Cephalotaxus argotaenia Pilger in Engler, Pflanzenr. IV. **5**: 104. 1903; Patschke in Bot. Jahrb. **48**: 629. 1913.

Shrub, 2–4 m. high; branchlets spreading or sometimes ascending, subterete or quadrangular; leaves thickly coriaceous, subsessile to very shortly petiolate, linear-lanceolate, generally straight, sometimes slightly falcate toward the tip, 4–7 cm. long, 6.5–8.5 mm. broad, acute to obtuse at apex, cuneate at base, slightly revolute at margins, green above, the costa prominent and raised above, scarcely raised beneath, 1–1.5 mm. broad, the stomatal bands whitish to silvery whitish, 1.5–1.8 mm. broad, about as broad as the marginal bands, the marginal bands pale silvery green, 1.3–2 mm. broad; petioles thick, scarcely 1–1.5 mm. long; staminate racemes subterminal or lateral, solitary or 2 or 3 together, in the axils of minute scales, short-pedunculate, more or less pendulous, 5–6.5 cm. long, the flowers composed of subfasciculate peltate or subpeltate stamens, the filaments short, the anther-cells 2–5, mostly 3, ovoid; ovulate flowers and mature seeds unknown.

Kwangtung Province at Lofaushan Mountains, and also around Hongkong, in wet rocky situations or along edge of streams, at altitudes of 600–1500 meters.

CHINA: Kwangtung: Lofaushan (type locality), *Levine & McClure 704* (US), *C. O. Levine 1502* (AA, US). Hongkong: Lantoa Island, *Hongkong Herb. 2068* (AA).

The specimens examined are all sterile. The only staminate specimen known is the type of *Podocarpus insignis*, *Westland s. n.* from Taimo Mountains opposite Hongkong, the basis of descriptions by both Hemsley and Pilger. The type of *Podocarpus argotaenia* Hance is a sterile specimen of E. Faber, Sept. 1882, from Lofaushan, Kwangtung, in the British Museum (Natural History).

2. **Amentotaxus cathayensis** sp. nov.

Cephalotaxus argotaenia Pilger in Engler, Pflanzenr. IV. **5**: 104. 1903, p. p.; Rehder & Wilson in Sarg. Pl. Wils. **2**: 6. 1916 (excl. syn.).

Amentotaxus argotaenia Pilger in Bot. Jahrb. **54**: 41. 1916, p. p. (quoted plants collected by Wilson), in Engler & Prantl, Nat. Pflanzenfam. ed. 2. **13**: 270. 1926.

Podocarpus argotaenia sensu Masters in Jour. Bot. **41**: 269. 1903, in Jour. Linn. Soc. Bot. **37**: 414. 1906; non Hance.

Frutex vel arbuscula 2–5 m. alta; ramulis patentibus, teretibus vel quadrangularibus, subcrassis, internodiis ad 1.5 cm. longis; foliis breviter petiolatis, longe lineari-lanceolatis, gracilibus, distincte falcatis, interdum rectis, 6–11 cm. longis, 6–8 mm. latis, superne gradatim attenuatis, apice calloso-acuminatis, basi attenuatis, margine leviter revolutis, costa supra leviter elevata subtus vix elevata circiter 1.5 mm. lata, striis stomatiferis albidis circiter 1.2 mm. latis, latitudine circiter 2/3 striarum marginalium aequalibus, striis marginalibus pallidis plus minusve argenteo-viridibus, circiter 2 mm. latis; petiolis crassis 2–3 mm. longis; floribus masculis ignotis; floribus ovulatis (fide Pilger) in axilla bracteae ad basim ramuli foliati enatis, breviter crassiuscule pedicellatis, pedicellis apice squamis imbricatis instructis, ovulo solitario; seminibus maturis ignotis.

Western Hupeh and western Szechuan (?), cliffs of ravines, at altitudes of 300–1100 meters, rare.

CHINA: Western China: No precise locality (presumably western Szechuan), *E. H. Wilson 3005* (AA, TYPE). Szechuan: Mt. Omei, *W. K. Wu 9209* (AA, US). Hupeh: Hsing-shan Hsien, *E. H. Wilson 2107* (AA, US).

Only sterile specimens are available. Rehder and Wilson originally indicated *Wilson 3005* as an ovulate specimen, but the available one does not bear any flowers. In Pilger's original description of the genus, the ovulate flower is described on the basis of a single flower from *Wilson 3005*, received through Rehder. In vegetative characters alone, these western Chinese specimens clearly represent a species distinct from those of other regions.

A sterile specimen from Dupha Hills, *J. L. Lister* in 1874 (AA), has long narrow falcate leaves very similar to those of *A. cathayensis*, but with slightly broader stomatal bands, which are as wide as the marginal bands. This specimen may indicate a more western extension of the range of the species.

3. **Amentotaxus formosana** sp. nov.

Podocarpus argotaenia sensu Henry in Trans. Asiat. Soc. Jap. **24.** Suppl: 91. 1896 (List Pl. Formos.); Masters in Jour. Linn. Soc. Bot. **26:** 547. 1902, p. p.; Matsum. & Hayata in Jour. Coll. Sci. Tokyo **22:** 399. 1906 (Enum. Pl. Formos.); non Hance.

Cephalotaxus argotaenia sensu Forbes & Hemsl. in Jour. Linn. Soc. Bot. **26:** 547. 1907, p. p., non Pilger.

Amentotaxus argotaenia sensu Yamamoto in Bot. Mag. Tokyo **40:** 453. 1926, Suppl. Icon. Pl. Formos. **3:** 1, *t. 1.* 1927, op. cit. **5:** 7, *f. 1–2.* 1932, in Jour. Jap. Bot. **8:** (64). *f. 1–6.* 1932; Kanehira in Trans. Nat. Hist. Soc. Formos. **84:** 80. 1926, Formos. Trees rev. ed. 33, *f. 2.* 1936; Kudo in Jour. Soc. Trop. Agr. Formos. **3:** 110. 1931; Chen, Ill. Man. Chin. For. Trees & Shrubs 13, *f. 2.* 1937; non Pilger.

Arbor vel arbuscula vel frutex ad 10 m. altus, sparse ramosus; ramulis oppositis, patentibus, subteretibus vel subquadrangularibus, internodiis 6–12 mm. longis; foliis subsessilibus vel breviter et crasse petiolatis, lanceolatis, leviter sed distincte falcatis, raro rectis, 5–8.5 cm. longis, 7–9.5 mm. latis, superne gradatim attenuatis, apice calloso-acuminatis, basi acutis vel obtusis, margine revolutis, supra atro-viridibus, costa supra subplana subtus leviter elevata circiter 1.5 mm. lata, striis stomatiferis albidis circiter 2 mm. latis, quam striis marginalibus duplo latioribus, striis marginalibus pallide argenteo-viridibus, circiter 1 mm. latis; petiolis nullis vel crassis vix 1 mm. longis; racemis masculis ad apicem ramulorum plerumque 3- vel 4-fasciculatis, raro 5–fasciculatis vel solitariis, gracilibus, circiter 3 cm. longis, breviter pedunculatis, basi squamis coriaceis 2–4-seriatim imbricato-obtectis, squamis plerumque 7, carinatis, superioribus gradatim majoribus, oblongo-lanceolatis, ad 15 mm. longis et 5 mm. latis, basalibus ovatis ad 5 mm. longis et 3–4 mm. latis, pedunculis circiter 5 mm. longis; floribus masculis subsessilibus, antheris subpeltatis brevistipitatis fasciculatis 1.5 mm. crassis, loculis plerumque 5–8 pendulis circiter 0.7 mm. longis et 0.5 mm. latis, filamentis brevibus vix 1 mm. longis; floribus ovulatis solitariis lateralibus, subglobosis, circiter 3 mm. crassis, longe pedicellatis, basi squamis circiter 10 minutis opposite imbricato-obtectis, squamis 5-seriatis, carinatis, subaequalibus, circiter 3.5 mm. longis vel latis; ovulo 2 mm. longo et 1.5 mm. crasso, disco parvo cupuliformi carnoso, 2.5 mm. diametro et 1.5 mm. longo; semine maturo solitario axillari, longe pedicellato, oblongo-ellipsoideo, 20–25 mm. longo, 9–11 mm. crasso, apice mucronulato-rostrato, basi squamis minutis persistentibus imbricatis instructo, arillo rubro-luteo, demum atropurpureo; pedicello gracili, 1.5–2 cm. longo.

Southern Formosa (Taiwan), in broad-leaved forests in shady places, near ravines and cliffs, at altitudes of 700–1300 meters, rather scarce.

CHINA: Taiwan: Taito, Daibu, Taririku, *R. Kanehira*, May 11, 1924 (AA), *R. Kanehira & S. Sasaki*, Feb. 19, 1925 (AA), *S. Sasaki*, Feb. 25, 1925 (NTU, TYPE), *R. Kanehira*, Dec. 27, 1925 (AA); Southern Koshun, *R. Kanehira* in 1924 (AA).

The Formosan plant is better known than plants from the mainland, although it is also more or less rare. It has been described in detail by Yamamoto and others and illustrated by numerous photographs and drawings. The source of the figure given by Chen is not indicated, but it is an exact copy of Kanehira's figure. Chen's generic description also fits only the Formosan plant.

4. **Amentotaxus yunnanensis** sp. nov.

Amentotaxus argotaenia sensu Hu in Bull. Chin. Bot. Soc. 1(1): 8. 1935, non Pilger.

Arbuscula, ramis crassis, ramulis oppositis, erecto-adscendentibus, gracilibus, teretibus vel subquadrangularibus, internodiis ad 1.3 cm. longis; foliis subsessilibus, linearibus, rectis, raro apicem versus leviter falcatis, 3–7 cm. longis, 8–11 mm. latis, apice obtusis vel acuminatis, basi late acutis vel subrotundatis, margine leviter revolutis, supra viridibus vel pallide viridibus, costa supra prominula elevata subtus subplana vix elevata circiter 1.5 mm. lata, striis stomatiferis leviter fuscis vel luteo-albidis circiter 2.5 mm. latis, quam striis marginalibus 2.5–3-plo latioribus, striis marginalibus pallide argenteo-viridibus ad 1 mm. latis; floribus masculis ovulatisque ignotis; semine maturo pedicellato, ovoideo, circiter 2.2 cm. longo et 1.5 cm. crasso, apice leviter rostrato, arillo rubro-luteo, basi squamis coriaceis 3-seriatim imbricatis instructo, squamis oppositis, circiter 12, distincte carinatis, superioribus gradatim majoribus ad 4 mm. longis et

5 mm. latis, basalibus ovatis ad 2 mm. longis et latis; pedicello crasso, circiter 1.4 mm. longo, in sicco plano.

Southern Yunnan, a moss-clad plant on rocky hill at an altitude of 1600 meters.

CHINA: Yunnan: Makwan, *H. T. Tsai 51887*, March 2, 1932 (US, TYPE).

Merrill (in Jour. Arnold Arb. 19: 21. 1938) records *Amentotaxus argotaenia* from Chapa, Tonkin, basing the record on *Pételot 3897*. I have not seen specimens of this collection, but judging from the location the plant is probably referable to the Yunnan species, although it may possibly represent *A. argotaenia*, definitely known only from Kwangtung and Hongkong.

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WILLIAM JACK'S GENERA AND SPECIES OF MALAYSIAN PLANTS

E. D. Merrill

With one plate

This paper was not planned to consider other than certain phases of Jack's botanical work. Hooker published an excellent biographical sketch of William Jack prefixed to one of the series of papers in which the Jack plant descriptions of 1820–22 were republished, to which the reader is referred.[1] Supplementing these data are the remarkably interesting letters written by Jack to Nathaniel Wallich from Penang, Jan. 14 to May 19, 1819, from Singapore, June 8 to June 18, 1819, and from Bencoolen, Sumatra, Aug. 19, 1819, to Oct. 26, 1821.[2] These letters contain a wealth of information regarding Jack's experiences and observations as a pioneer botanist operating in the then botanically unknown and very rich forests of Penang, Singapore, and Sumatra. For Jack was indeed the pioneer post-Linnean Malaysian botanist, his work antedating the investigations of Blume at Buitenzorg, Java, which were initiated, as to publication, in 1823, a year after Jack's death. On February 12, 1819, he wrote to Wallich, "I am overwhelmed with the treasures that pour in upon me; I have been employed night and day so as not even to leave time for correspondence. I actually wish for a little remission, as my cough has been teasing me, but how is it possible! I cannot even now get through all; my specimens are in piles that are quite alarming and I have not time to look over them. I must however take a day or two to make a selection for you." An excellent summary of the essential data regarding William Jack and his botanical accomplishments has been included by Mrs. M. J. van Steenis-Kruseman in her recent publication.[3]

[1] **Hooker, W. J.** Description of Malayan Plants. By William Jack. With a brief Memoir of the Author and Extracts from his Correspondence. Comp. Bot. Mag. **1**: 121–147. 1835.

[2] **Burkill, I. H.** William Jack's Letters to Nathaniel Wallich, 1819–1821. Jour. Straits Br. Roy. As. Soc. **73**: 148–268. 1916.

[3] **Van Steenis-Kruseman, M. J.** Malaysian Plant Collectors and Collections, Fl. Malesiana I, **1**: 256–257. 1950.

Briefly, William Jack was born in Aberdeen, Scotland, Jan. 29, 1795, and died at Bencoolen, Sumatra, Sept. 15, 1822, of pulmonary tuberculosis, apparently complicated by malaria contracted on a trip to Moco-moco. His physical condition was so serious that he had been placed aboard a ship bound for England, the actual sailing of which was delayed by adverse weather conditions; but failing very rapidly he was removed to Government House, Bencoolen, where the end came. The entry in Pritzel's Thesaurus that he died on shipboard near the Cape of Good Hope is erroneous. He was a very precocious student, excelling in languages and developing an interest in botany at an early age. Receiving his M.A. degree from Aberdeen University at the age of sixteen, he then studied for the M.D. degree, finishing his medical training in London where he was admitted as a Fellow of the College of Surgeons at the end of January, 1812. Having received an appointment for service in India he left England in January, 1813. His services with the British East India Company were in the medical field. It was while actively engaged in the Nepalese war that he commenced to correspond with Nathaniel Wallich in Calcutta, and it was in this campaign that he unfortunately contracted pulmonary tuberculosis, which a few years later was to terminate what promised to be a most brilliant botanical career. William Jack was unquestionably one of the most able botanists ever to become associated with the tremendously rich and the then very little known flora of the Malay Peninsula and Archipelago.

In November 1818, having been strongly recommended by Nathaniel Wallich to Sir Stamford Raffles, he was appointed by the latter to serve as botanist on his staff in an attempt to rehabilitate the British East India Company's controlled areas on the west coast of Sumatra, where British influence had long been dominant. What he was able to accomplish in less than three years was most remarkable. His publishing activities, commencing in the remote settlement of Bencoolen in 1820, terminated there in 1822, the year of his untimely death, and finally ceased a year later with the posthumous appearance of the three papers he had prepared in Bencoolen and sent to the Linnean Society in London. How well he developed his knowledge of those parts of Malaysia which he personally explored is manifest from his published papers. Had not his herbarium, his manuscript descriptions and notes, and his drawings of many species been destroyed in the burning of the "Fame" at the time when the British East India Company relinquished control of its Sumatra holdings in 1824 to concentrate on the building up of Singapore, Jack's name would undoubtedly have been written much larger in the annals of Malaysian botany than is now the case. As it is, no botanist who has concentrated on a study of the flora of the region has accomplished so much of lasting value in such a limited time as did William Jack. And what he published is of very high order indeed. His usually ample descriptions, as contrasted with the very short diagnostic data provided by Blume in his early work, as Griffith noted in 1843, are actually autographs of plants. To write a technical description is a simple matter, but to include in not overlong descriptions, as Jack did, all or most of the essential data needed by a later monographer to place a species in association with those described by other authors is an art in which Jack excelled. Thus it is that in such large and critical genera as *Antidesma* and *Ilex*, I do not hesitate in reducing, from Jack's descriptions, associated with an examination of Sumatra specimens collected by others, *Antidesma frutescens* Jack (1822) to *A. ghaesembilla* (Linn.) Gaertn., and *Octas spicata* Jack (1822) to *Ilex spicata* Blume (1826), although up to this date European monographers have retained the former as a valid species allied to *A. ghaesembilla*, while although *Octas* Jack has been correctly reduced to *Ilex* Linn., no author has even hinted that Jack's species is identical with that of Blume. In the very much larger and exceedingly critical genus *Ficus* Linn. I do not hesitate in replacing *F. diversifolia* Blume (1825) by the earlier *F. deltoidea* Jack (1822), and *F. glaberrima* Blume by the earlier *F. rigida* Jack (1822), although no extant Jack types are known.

DEVELOPMENT OF INTEREST IN JACK PROBLEMS

In my somewhat more than two decades of residence in the Philippines, I had access to only a part of the reprinted William Jack plant descriptions. In building up the botanical library in Manila, starting with nothing in the way of books, I was never able to acquire a copy of the Companion to the Botanical Magazine containing many of the republished Jack descriptions. It was only toward the end of my Philippine career that I discovered the 1887 Trübner reprint of the Jack papers and acquired a copy of it. This experience stimulated my interest in problems appertaining to the Jack species when, in later years, I did have access to certain records never available in Manila. Perhaps the chief reason for the preparation of this index to the Jack species was my own difficulty encountered in earlier years in locating various descriptions needed for reference — and difficulties continue to face all systematists who seek original or reprinted Jack descriptions, except those located in a very few favored centers. This applies particularly to those taxa characterized in the short-lived and never generally available Malayan Miscellanies published in Bencoolen, Sumatra, 1820–22. Indices are lacking in the original Jack papers and in the Hooker reproductions of 1830–36, the latter still being the most generally available source of the Jack descriptions. In standard works of the Index Kewensis type references included are for the most part only to the original places of publication of new names, not to subsequent republications of descriptions.

The original Jack Malayan Miscellanies papers are exceedingly rare and are to be found in only a very few of the older botanical libraries. I know of only two complete sets, one at Kew and one at Calcutta, and while these are complete for the regular Malayan Miscellanies papers, the Kew set lacks the "Appendix" of 1820. Two of the three Jack papers were in the Linnean Society Library, but one of these was unfortunately lost. I judge that Blume must have been familiar with at least a part of the Malayan Miscellanies botanical papers when he initiated his botanical work at Buitenzorg, Java, in 1823. Perhaps Jack took with him to Buitenzorg copies of the parts then issued when he visited Java in 1821; see Burkill, Jour. Straits Br. Roy. As. Soc. 73: 198. 1916, footnote 188. However, no copies of the original Jack papers exist today in either the Buitenzorg or the Leiden libraries.

Where library facilities are limited, as was the case in Manila — and is the case in a great many institutions established within the present century, or for that matter within the past century or more — it occurred to me that an index to all the Jack taxa (1820–23), with references to all the reprinted Jack descriptions (1830–36, 1843, 1877), might serve a useful purpose. The preparation of a mere list would have been a simple matter, but the decision to inquire into the status of each name in relation to those proposed by other authors made the task a more complicated and time-consuming one. Certain data were compiled in 1950, including basic lists. The rough draft of the index proper was written at El Zamorano, Honduras, in February and March, 1951, data therein rechecked in Boston later in the year, and the introductory matter was mostly drafted on the S.S. "Mauretania" en route from New York to Southampton in June, and finished in London in July, 1951.

The Jack papers were so significant at the time they were originally printed that their appearance created a great deal of interest in the work of that young botanist. The very fact that the technical plant descriptions of 1820–22 have since been reprinted three times (or four times if we consider the Griffith separately paged reprint of 1843 to constitute a distinct publication) speaks for itself. I do not know of a parallel case in the literature of systematic botany. Jack was the first post-Linnaean botanist to work in the field on the exceedingly rich Malaysian flora. In his time, from a botanical standpoint, "all the world was new" in Penang, in Singapore, and in Sumatra. In the period 1819–22 one may safely estimate that out of every hundred plant species that Jack actually observed at least seventy-five were unnamed and undescribed, and in Jack's time many of the widely distributed Malaysian genera had not been named or characterized.

JACK'S ORIGINAL PUBLICATIONS 1820–23

What concerned and still concerns most botanists are the Jack descriptions of 1820–22.[4] These were the papers published in remote Bencoolen, of which few copies were distributed at the time of publication and of which the undistributed stock was destroyed in the burning of the "Fame" in 1824. No copy of these papers is to be found in any American library. For a microfilm of the Kew copy I am indebted to Mr. H. S. Marshall, Librarian, Royal Botanic Gardens, Kew. In addition to these

[4] **Jack, W.** Descriptions of Malayan Plants. Mal. Miscel. 1 (1): 1–27. 1820; 1 (5): 1–49. 1821; 2 (7): i–iii. 1–96. 1822. Sumatran Mission Press, Bencoolen.

three papers another was printed but never published which has caused some confusion and misunderstanding. This [5] was actually printed in 1820, not in 1823 as Hooker surmised. Its purpose was to assemble certain descriptive data in form for easy reference and to provide Nathaniel Wallich in Calcutta with a copy for his criticism of various proposed new taxa. Actual publication of the document was neither planned nor consummated. Regarding it Hooker, Comp. Bot. Mag. 1: 259. 1836, states:

"In point of interest, the 'Third' Memoir, as it is called, of Mr. Jack, far exceeds the previous ones . . . . I have reason to think that the present Memoir is very little known in this country, as I have never seen it quoted, nor met with any copy but that which has been kindly lent to me by the mother of the lamented author. This number of the Malayan Miscellaney is without date, and only bears the title 'Appendix, Descriptions of Malayan Plants, by William Jack, No. 3.' "

The only known extant copies of this document appear to be the one sent by Jack to Wallich and now preserved in the library of the Calcutta Botanic Garden, and a copy in the library of the Asiatic Society of Bengal, presented by Major General Hardwick, July 14, 1821. For bibliographic data regarding this item I am indebted to Dr. K. Biswas, Director of the Calcutta Botanic Garden. The included taxa, some of which were published elsewhere by Jack himself and by other authors, date from the time of effective publication by Jack himself, G. Don (one case), Griffith (one case), and Hooker. The latter thought, with expressed doubt, that this Appendix was printed in 1823. But Jack died in 1822, and by the time of his death publication of the Malayan Miscellanies had ceased. As Burkill notes, Jour. Straits Br. Roy. As. Soc. 73: 227. 1916, footnote 273, on the basis of evidence supplied by Jack and by Raffles, the document was printed in 1820, and we now know that a copy was in the library of the Asiatic Society of Bengal as early as July 14, 1821. Some of the more or less confused references to it which one notes in botanical literature are: "Mal. Misc. iii. [1823?]," "Descr. Mal. Pl. iii. 12 [1823]," "Mal. Misc. App. Ined. [1823] 21," etc.

Yet at least one other botanist in Great Britain must have had access to the document. G. Don probably saw Mrs. Jack's copy, as he actually published the technical descriptions of *Stagmaria* Jack and *S. verniciflua* Jack in 1832, four years prior to Hooker's similar action. Wallich, for whom, in part, the document was originally printed, as noted above, had a copy in Calcutta, and Griffith had access to it in 1843.

If referred to at all this Jack "Appendix" should be cited as "ined." In this paper I have included references to it in square brackets, thus: "[App. Descr. Mal. Pl. . . . 1820]" followed by a reference to the later validating description in each case. Unfortunately Hooker in reprinting the Jack descriptions gave no bibliographic references to individual species.

[5] **Jack, W.** Appendix. Descriptions of Malayan Plants. No. 3. p. 1–26. [1820]. Sumatran Mission Press, Bencoolen.

Jack's other botanical contributions were limited to the three papers published in London in 1823,[6] the year following his untimely death. The plant descriptions included in these papers have been generally available to botanists who have at times needed to consult them. They were reprinted only by Griffith in 1843.

Certain other manuscript descriptions were sent by Jack to Nathaniel Wallich in Calcutta, to whom discretionary powers were extended. Some of these appear in volume two of the Carey and Wallich edition of Roxburgh's Flora Indica (1824), and one, *Pittosporum serrulatum* Jack, was first published by Griffith in 1843. The Jack *Melastoma* and *Cyrtandraceae* papers were summarized in Oken Isis **22**: 1036–1039, 1176–1181. 1829.

THE HOOKER REPRINTS, 1830–36

These, initiated in 1830 and completed in 1836, include the genera and species originally published by Jack in the Malayan Miscellanies papers, plus most of those contained in the unpublished Appendix discussed above.[7] It has been in this series that the Jack descriptions of 1820–22 have been, and still are, most accessible to botanists, in spite of the later reprintings of 1843 and 1887. Because these reprinted Jack descriptions are scattered through four unindexed volumes of three different serials issued over a period of seven years, one must often search for an individual description when needed. One of the reasons why Griffith again reprinted the Jack descriptions in 1843 was the difficulty encountered both in securing access to sets of the Hooker periodicals and in locating individual Jack descriptions when needed. Griffith had in mind the need of individuals located as he was, remote from the botanical centers of Europe. It is of course to Hooker's distinct credit that he did rescue the contents of these very rare Jack papers from practical oblivion.

We learn from Hooker's own statement, Comp. Bot. Mag. **1**: 122. 1835, that it was Nathaniel Wallich who suggested to him the desirability of reprinting the Jack papers, and it was for this purpose that Wallich provided Hooker with the set of the Malayan Miscellanies now on the library shelves of the Royal Botanic Gardens at Kew. Wallich, of course, knew the fate of Jack's herbarium and the undistributed stock of the Malayan Miscellanies, and he knew that because of the burning of the "Fame," Feb. 4, 1824, it would be impossible for future botanists to acquire copies of this Bencoolen serial. For on the "Fame" were the Bencoolen records, Jack's herbarium, manuscript descriptions, notes, drawings, the extensive natural history collections assembled by Sir Stamford Raffles, and finally, all the reserve stock of the Malayan Miscellanies.

[6] **Jack, W.** On the Malayan Species of Melastoma. Trans. Linn. Soc. **14**: 1–22. *pl. 1*. 1823; On the Cyrtandraceae, a New Natural Order of Plants. Op. cit. 23–45. *pl. 2*. 1823; Account of Lansium and Some Other Genera of Malayan Plants. Op. cit. 114–130. *pl. 4*. 1823.

[7] **Hooker, W. J.** Descriptions of Malayan Plants, by William Jack. Hook. Bot. Misc. **1**: 273–290. 1830; **2**: 60–89. 1830; Hook. Jour. Bot. **1**: 358–380. 1834; Comp. Bot. Mag. **1**: 121–157. 1835; 219–224, 253–272. 1836.

THE GRIFFITH REPRINTS, 1843

William Griffith, inspired by much the same reasons that in 1830 induced Hooker to commence the reprinting of the original Malayan Miscellanies descriptions of Jack, republished all of the Jack descriptions known to him in a series of three papers in the Calcutta Journal of Natural History in 1843.[8] He noted the rarity of the Jack papers published in 1820–22 and commented on the very inconvenient subdivision of the parts as reprinted by Hooker.

This Griffith series includes not only those descriptions reprinted by Hooker (1830–36) from the Malayan Miscellanies, but also all of those included in the three Jack papers published in London in 1823, most of those which had been published by Wallich under Jack's name in volume two of the Carey and Wallich edition of Roxburgh's Flora Indica (1824), and even one (*Pittosporum serrulatum* Jack) which appears only in the Griffith document. Occasionally one finds complete or partial copies of these Griffith papers with the original Calcutta Journal of Natural History pagination, as in the case of the libraries of the British Museum (Natural History) and the Rijksherbarium at Leiden.

THE GRIFFITH SEPARATELY PAGED REPRINT OF 1843

Immediately following the issue of the Jack papers in the Calcutta Journal of Natural History in 1843, Griffith reprinted them in the form of a separately paged volume under the same title as that used in the Journal itself. The pagination is 1–230, i–iii. In the two copies of this work that I have seen (Linnean Society Library and the Lindley Library, Royal Horticultural Society) the text covers the descriptions of three plates, but the plates themselves are missing. There is also a copy of this reprint in the library of the British Museum (Bloomsbury). Because of an irregularity in including on pages 135–160 of the volume the data published in Griffith's own paper on some remarkable plants in the Calcutta Garden (Calc. Jour. Nat. Hist. 4: 231–256. 1843) it is suspected that very few copies of this reprint were distributed. The essential data regarding this separately paged reprint were kindly supplied by Mr. I. H. Burkill, and I later examined the copies mentioned above.

Of this pages 1–62 are identical with the first paper in the Calcutta Journal series. On pages 63 to 77 certain adjustments in page contents are made, but there are no changes in the text. Pages 135 to 160 include the Griffith paper above mentioned. Then the rest of the Jack descriptions appear on pages 161 to 227. Pages i–iii consist of an index by families and genera.

Had this Griffith Calcutta reprint of the Jack descriptions been generally available, probably any further consideration of them would have been

[8] **Griffith, W.** Descriptions of Malayan Plants. By William Jack. Arranged According to their Natural Families, etc. Calc. Jour. Nat. Hist. 4: 1–62: 159–231; 305–347. *pl. 14–16.* 1843.

unnecessary. But sets of the Calcutta Journal of Natural History are lacking in very many, perhaps most botanical libraries, and the separately paged reprint was apparently suppressed; at any rate it was never widely distributed.

THE TRÜBNER REPRINT OF 1887

The Trübner Oriental Series consists of four volumes, a first series of two volumes, 1886, and a second series, also of two volumes, 1887. A total of fifty-one papers were reprinted from various sources, covering important contributions to our knowledge of the botany, zoology, geology, exploration, history, philology, linguistics, anthropology, inscriptions, climate, minerals, and other subjects appertaining chiefly to the Malay Peninsula and Archipelago. Many of the original papers appeared in serial literature that is sometimes not generally available. I judge that these reissued papers are not well known to botanists and botanical bibliographers, for this 1887 reprint of the important Jack papers escaped the attention of Rehder when he compiled the remarkably complete Bradley Bibliography, published from 1911 to 1918, covering the literature of the world appertaining to woody plants, appearing before the end of the nineteenth century. The Trübner[9] series is well worth a place on the shelves of all special research libraries devoted to the subjects above mentioned. The main title is a somewhat unfortunate one as it appears on the first series, but it was emended in the second series by the addition of the phrase, following Indo-China "and the Indian Archipelago." As a matter of fact, in the republished papers there are very few which in any way appertain to Indo-China, most of them applying strictly to the Malay Peninsula and Archipelago. The initiative behind the selection and republication of this distinctly important series of 51 technical papers came from the officers and council of the Straits Branch, Royal Asiatic Society, Singapore.

It is in volume two of the second series that one can now gain the easiest access to the early Jack descriptions, for the technical names of all species are included in the index to the volume. This paper occupies pp. 209–295 of volume two of the second series, 1887. Appended to it and occupying pages 296 to 302 are various botanical references giving the then accepted names for many of the Jack species prepared by Sir J. D. Hooker, with many philological notes on the significance of the Malay names listed by Jack, these prepared by D. F. A. Hervey.

JACK'S HERBARIUM

It is known from the published records that Jack industriously increased his herbarium wherever he had an opportunity of botanizing, but chiefly in Penang, Singapore, and on the west coast of Sumatra and its neighbor-

[9] TRÜBNER'S ORIENTAL SERIES. Miscellaneous Papers Relating to Indo-China. Reprinted for the Straits Branch of the Royal Asiatic Society. **1**: i–xii. 1–318; **2**: 1–309. 1886. Second Series. **1**: 1–viii. 1–307; **2**: 1–313. 1887. Trübner & Company. London.

ing islands. It must have been a large collection, but there are no extant records as to its actual size. The Jack holotypes were destroyed with all of his undistributed duplicates, and all of his unstudied or partly studied material when the "Fame" burned just after sailing from Bencoolen Feb. 4, 1824. Such Jack material as now exists represents duplicates of his Penang and Singapore collections which he sent to Wallich and which were numbered in the Wallich List ("Catalogue"). There are certain Jack Sumatra specimens in the Delessert herbarium at Geneva, and others at the Rijksherbarium, Leiden, but the total number is apparently not great. Among those at Geneva are specimens representing *Aeschynanthus radicans* Jack, *Connarus semidecandrus* Jack, *C. villosus* Jack, *Cyrtandra hirsuta* Jack, *C. macrophylla* Jack, *Didymocarpus corniculata* Jack, and *Melastoma obvolutum* Jack.

There are also certain Jack specimens in the herbarium of the British Museum (Natural History) other than those in the Wallich distribution. These seem to be entirely duplicates of his Penang and Singapore collections sent by Jack directly to Robert Brown. No extant list is known. On March 7, 1819, writing from Penang, Jack notified Brown that accompanying his letter he would receive the box of specimens mentioned in an earlier letter. The highest number located is "59" for a specimen of a *Trichomanes* from Penang. Later Jack sent at least four *Nepenthes* specimens from Singapore, where he arrived from Penang, May 31, 1819. The labels on these fugitive Jack collections are in his handwriting, but on at least some of them somebody at the Museum later wrote the name "Wallich" as the collector, which doubtless explains why many of these specimens were not previously recognized as being actual Jack duplicates.

At Leiden, in 1950, without making an intensive search, I located *Ternstroemia serrata* Jack, *T. rubiginosa* Jack, *Salacia* . . . Jack (an unpublished binomial), and *Lasianthus attenuatus* Jack, and Dr. Hoogland located *Tetracera arborescens* Jack. These Jack Sumatra specimens bear his original labels. They are indicated as having been received in 1829, and they later reached the Rijksherbarium via the Hasskarl private herbarium. It is suspected that these specimens may have represented a small lot that was perhaps left behind when the British left Bencoolen in 1824, which was probably retrieved by some Dutch official and transmitted by him to Holland, where the specimens came into the possession of Hasskarl.

It is evident that Jack sent certain Sumatran material home, but it is not known what became of some of these collections. Thus in a Jack letter to Wallich dated at Bencoolen September 9, 1820, there is a very amusing account of a collection of botanical specimens he selected at the request of a certain Marchioness for the Edinburgh Museum.[10] In this letter, *inter alia*, he says: "My best specimens are all gone home as you know." Mr. Burkill's attempts to locate the Jack specimens of this particular sending failed, nor in the relatively little time I could spend in the Edinburgh herbarium in July, 1951, did I succeed in locating any of these fugitive

[10] **Burkill, I. H.** Jour. Straits Br. Roy. As. Soc. **73**: 215. 1916.

specimens. Late in 1951 Mr. Burtt found one specimen, of which Dr. J. M. Cowan kindly supplied a photograph. Jack had mentioned the poor quality of the specimens he selected for the Edinburgh Museum, and the type collection of *Didymocarpus crinita* Jack verifies his statement. I have introduced the photograph (Plate 1) chiefly because its extended label provides an excellent specimen of William Jack's handwriting.

It is recorded that Jack, as well as Raffles, sent botanical material to Lambert in England. Burkill notes, op. cit. 200, footnote 194, that at the Lambert sale in 1842 lot no. 111, catalogued as probably from Jack, was sold for £1 to William Pamplin, a dealer, and that lot 255, listed as from Raffles and others, was purchased by a Mr. Rich for £3. What may have become of the lot purchased by Mr. Pamplin is unknown, but the Jack Sumatra specimens now in the Delessert herbarium in Geneva certainly came from the Lambert collection. In 1879 Mr. Pamplin, then living at Llandderfel, North Wales, provided Henry Trimen with the information that Mr. Rich, and his father before him, were the accredited British agents of Delessert; see Jour. Bot. **17**: 275. 1879, footnote.

In April, 1952, Dr. Van Steenis found in a *Gnetum* loan from the Barker Webb Herbarium, Florence, a single Jack specimen from Penang which proved to be a representative of the genus *Petunga*. As the label carried the statement "misit amicissime Guilielmus Jack," it is probable that this Jack specimen had passed through the hands of Wallich, as the above is the phrase that Wallich used in his List where he included Jack material. There may, of course, be other Jack specimens in the Barker Webb Herbarium.

SOURCES OF JACK'S BOTANICAL MATERIAL

After Jack's arrival in India, attracted by its luxuriant flora, which was, of course, entirely new to him, he commenced, during the Nepal campaign, to correspond with Nathaniel Wallich in Calcutta, sending him a certain amount of botanical material from northern India. This correspondence apparently commenced in May, 1815. In July, 1818, after his return to Calcutta, he called on Wallich at the Calcutta Botanical Garden, and the latter insisted that Jack remain as his guest while prosecuting his botanical investigations there. It developed that Jack was ill, and from a letter written by Sir Stamford Raffles January 1, 1823, we learn that this illness was pulmonary tuberculosis contracted during his tour of service in the Nepalese war. This was soon to terminate a short but very productive botanical career, for Jack died at Bencoolen, Sumatra, in September, 1822. In November, 1818, after Wallich had introduced him to Sir Stamford Raffles, his plans were abruptly changed, for he was offered a position on Sir Stamford's staff for botanical and other investigations primarily in western Sumatra, centered at Bencoolen. He sailed with Raffles from Calcutta December 10, 1818, and reached Penang on December 31. Possibly on this trip the ship on which he was a passenger stopped at Car Nicobar, the most northern island of the Nicobar group, where Jack collected some botanical material for the types of *Microcos glabra* Jack and *Connarus jackianus* Wall. = *Lepidopetalum jackianum* Radlk.; yet it is possible that these Car Nicobar specimens were collected when Jack made a trip from Bencoolen to Calcutta and return later in 1819. Otherwise all the Jack species were based on specimens collected by him in Penang, Singapore (one on Pulo Bintang in the neighboring Rhio Archipelago), and at various places, chiefly Bencoolen, on the west coast of Sumatra and its neighboring islands.

PENANG AND SINGAPORE

William Jack commenced his field work in Penang, exploring that island from January 1 to May 21, 1819. Thus about fifty of his published new species were based wholly on Penang specimens. On May 31 he landed at Singapore and he remained there until June 28. From the botanical specimens he then prepared sixteen new species were described. For these Penang and Singapore species supplementary material was mentioned in a few cases as coming from Malacca, Sumatra, and in one case from Pulo Bintang in the Rhio Archipelago southeast of Singapore. Most fortunately, both Penang and Singapore have been intensively explored, and their floras are very well known. Again Jack sent to Wallich in Calcutta specimens representing most of his species, which were listed and distributed by Wallich. Thus it is that there seems to be little or no doubt as to the limits and relationships of all the Jack taxa based on material originating in these two islands, for authentically named Jack specimens have been available to his successors, in addition, of course, to Jack's excellent published descriptions.

SUMATRA

The longer period spent in Sumatra naturally resulted in much larger collections of botanical material being made at various places on the west coast of that large island and on various islands and islets off its west coast. While Jack was engaged to prosecute botanical investigations, he could not devote full time to this work, as various tasks quite unrelated to botany were from time to time assigned to him. On the basis of the Sumatran collections assembled by him a total of about 125 new species were described. Of these about fifty are not more closely localized than being from "Sumatra," but in most cases it can safely be assumed that the material on which they were based came largely from the Bencoolen region. Somewhat over thirty species were definitely from Bencoolen and its vicinity, including Gunong Bunko or Sugar Loaf Mountain, about eighteen miles to the northeast of that town. Sixteen species are definitely indicated as from Tapanuly and Tapanuly Bay, six species were from Pulo Nias, one of the larger islands off the west coast, five from Natal on the west coast, and for smaller west coast localities and west coast small islands one or two species each were indicated as from Salumah, Kataun, Laye, the Musi country, Moco-moco, Pulo Nica, Pulo Mosella, Pulo Pegang, and Pulo Bintangor. These for the most part can be located with little trouble on any of our better maps.

The flora of Sumatra is still inadequately known, particularly when contrasted with our knowledge of such areas as the Malay Peninsula (including Penang and Singapore) and Java. If comprehensive and adequate modern collections were available from the west coast of Sumatra and from certain adjacent islands, the task of matching Jack's descriptions with such material would be relatively simple. Until such collections are available and are intensively studied, there will be a residue of Jack's species which will remain known only from his published descriptions. And to a certain degree Jack has suffered because many of his published descriptions were not generally available to his successors; and his types had been destroyed.

JACK'S GENERA

In his relatively short career as a botanist, what Jack actually accomplished in descriptive botany is distinctly remarkable. When he reached Penang the first of January, 1819, he found himself in a very luxuriantly forested region rich in species regarding which he know nothing, and up to the end of his most unfortunately short life he was surrounded by a profusion of unclassified and unnamed plants, a very high percentage of them quite unknown to the botanists of Europe and of India. There were then no professional botanists in all of Malaysia, Jack's chief contact with the botanical world being by correspondence with Nathaniel Wallich in Calcutta. He proposed and characterized one new family of plants, the Cyrtandraceae, now placed as a subdivision of the Gesneriaceae, thirty-one new genera, and about two hundred new species of plants. But he published only a part of the descriptions he prepared. Writing from Penang March 7, 1819, which he had reached just over two months earlier, he stated that he had then described about 130 plants, of which eighty were probably new, "besides examining and ascertaining the characters of at least as many more." Of some he personally prepared drawings, and he employed a Chinese artist to prepare others. And this for Penang only, with Singapore to come, and then the richer Sumatran flora which awaited his attention!

Although at the beginning of the present century only two of Jack's new genera remained that had not been placed in their proper families, these have now been disposed of. *Coelopyrum* Jack (1822) = *Campnosperma* Thwaites (1854), and *Octas* Jack (1822) = *Ilex* Linn. (1753). *Helospora* Jack (1823) is identical with the officially conserved *Timonius* DC. (1830); *Enchidium* Jack (1822) is earlier than the universally accepted *Trigonostemon* Blume (1825); *Psilobium* Jack (1822) antedates the later and identical *Acranthera* Arnott (1838) by sixteen years; and *Coelopyrum* Jack (1822) antedates the universally accepted *Campnosperma* Thwaites (1854) by thirty-two years. Unless officially conserved here are three cases where Jack's earlier generic names should replace the later equivalents of Blume, Arnott, and Thwaites.

The other actually (and correctly) reduced Jack genera, as generic limits are currently accepted, are *Epithinia* Jack (1820) = *Scyphiphora* Gaertn. f. (1805); *Glaphyria* Jack (1823) = *Leptospermum* Forst. (1776); *Pyrrhanthus* Jack (1822) = *Lumnitzera* Willd. (1803); *Sphalanthus* Jack (1822) = *Quisqualis* Linn. (1753); *Stagmaria* Jack (1820; 1832) = *Gluta* Linn. (1753); *Hedycarpus* Jack (1823) = *Baccaurea* Lour. (1790); *Chionotria* Jack (1822) = *Glycosmis* Corr. (1805); and *Monocera* Jack (1820) = *Elaeocarpus* Linn. (1753). The eighteen remaining genera, all universally accepted, are characteristic of the Indo-Malaysian floras, some small in the number of known species, others large or very large.

There are doubtless those who might feel inclined to criticize Jack for his failure properly to interpret a few previously described genera. Thus *Veratrum* Linn. (one species), *Pittosporum* Banks (one species), *Ternstroemia* Mutis ex Linn. (five species), and *Halorrhagis* Forst. (one species) were clearly misinterpreted, but in most other cases he correctly interpreted genera proposed by his predecessors. In the *Ternstroemia* case he merely followed Roxburgh. One must constantly bear in mind that he did not have access to herbarium material other than that which he himself had prepared, that his library facilities were limited, and that conditions in 1819–22 in the then primitive Penang, Singapore, and in the much more remote port of Bencoolen, isolated as it was on the west coast of Sumatra, were not favorable for scientific work. There were then in all Malaysia no established scientific institutions or reference libraries, for up to that time strangely little scientific work had been done in any field of biology, following the pioneer work of Rumphius, who finished his extensive manuscript in Amboina about 1690. Jack was the pioneer Malaysian botanist after the binomial system was established, and he doubtless assumed that if Roxburgh and his contemporaries and immediate successors could prosecute descriptive botany to advantage in India in the opening decades of the nineteenth century, then he could do likewise in Malaysia. Some of us who entered the field at the beginning of the present century with very limited (or no) herbarium and library facilities may only hope that our percentages of error were as small as were those of William Jack nearly a century earlier. It is one thing to initiate descriptive work with ample herbarium and library facilities available; it is quite another matter when one starts in as did William Jack. To a distinctly high degree, with few books, no specimens, and no previous knowledge of the flora, Jack was dependent on his own efforts in such remote and primitive places as were Penang and Singapore in 1819, to say nothing of the now almost forgotten Bencoolen. He had no one to turn to for assistance or advice other than Wallich in distant Calcutta, and yet he took full advantage of his opportunity. Very few individuals would have had the courage to initiate descriptive work in botany under the conditions that William Jack so successfully faced in the early decades of the last century.

JACK'S VALIDATION OF CERTAIN ROXBURGHIAN NOMINA NUDA

Jack actually validated certain *nomina nuda* proposed by Roxburgh in his Hortus Bengalensis (1814) by accepting the binomials and associating technical descriptions with the names from three to twelve years before Roxburgh's own validating descriptions were published. Jack had a manuscript copy of Roxburgh's Flora Indica for consultation, the dates of publication of the several volumes (two editions) of Roxburgh's work being 1820, 1824, and 1832.. In some cases, doubtless, identifications of Jack specimens with Roxburghian species were made in Calcutta by Wallich. Cases are *Curculigo sumatrana* Roxb., *Gmelina villosa* Roxb., *Loranthus ferrugineus* Roxb., *Melastoma decemfidum* Roxb., *Phyteuma begonifolium* Roxb., *Rottlera alba* Roxb., *Sterculia angustifolia* Roxb., and *Vitex arborea* Roxb. There are a few similar cases in relation to Wallich's binomials. In one or two cases it is evident that the species actually described by Jack under a Roxburghian epithet is not the same as the one to which Roxburgh assigned the binomial and which Wallich later published; see the case of *Clerodendron nutans* Jack (*C. penduliflorum* Wall.), 1820, not *C. nutans* Wall. List 1829, *nom. nud.*, et ex Hook. Bot. Mag. **53**: *pl. 3049.* 1831, descr. These and various other minor bibliographic adjustments are made in this paper, and under the priority rule a certain number of new binomials appear in the index proper which follows this introduction.

The number of changes in names is small, indicating that much time and attention have been given by various botanists to ascertaining the status of these early Jack species, even if others, in the absence of types, may have ignored the Jack species, or at least made no really serious attempt to interpret them. As a result, a certain number of species proposed and described by later authors as new are reduced to synonymy. Gradually the situation clears, for the status and relationships of most of the Jack species, whether the types be preserved or not, are now clear.

WILLIAM ROXBURGH'S CONCEPT OF THE MOLUCCAS

As one examines the Roxburgh text of his Flora Indica, one notes an occasional entry, accompanied by a short description, followed by the entry "Moluccas." The natural assumption in such cases is that the material on which these short descriptions came originated in that group of islands south of the Philippines and east and southeast of Celebes to which the term Moluccas is now and probably always was correctly limited. But Roxburgh's concept of the Moluccas included, at times, also the Malay Peninsula and the Sunda Islands proper,[11] and so it is that various "Moluccan" species of Roxburgh unquestionably came from Penang or from various localities on the Malay Peninsula or in the Sunda Islands proper. It is not necessary, as some have done, to suggest that in such a case as

[11] **Prain, D.** A Brief Memoir of William Roxburgh. Ann. Bot. Gard. Calcutta **5**: 1–9, *portr.* 1895 (p. 6).

Sonerila moluccana Roxb. he perhaps intended to derive his specific name from Malacca. Examples are: *Ardisia divergens* Roxb., *Melastoma impuber* Roxb., *Sonerila moluccana* Roxb., *Uvaria pilosa* Roxb. (= *Uvaria hirsuta* Jack), and others. These species are now known from Penang and neighboring places, but have never appeared in any Moluccan collections and are still unknown from any part of eastern Malaysia. Yet Roxburgh did indeed have much botanical material from Amboina and from other parts of the Moluccas proper. Some idea of the importance of Roxburgh's contributions in his Flora Indica to our knowledge of the Malaysian flora is indicated by the following data. About 540 Roxburghian descriptions are to be interpreted from Malaysian material. Of these approximately 435 were proposed and described as new on the basis of Malaysian specimens. Of these 435 "new species" 104 were from Penang, 157 indicated as from the Moluccas, plus 54 from Amboina and Honimoa, 56 from Sumatra, 36 from the Malay Archipelago, with a few indicated more definitely as from Singapore, Malacca, Banda, etc. Doubtless some, perhaps many, of the "Moluccan" species were from the Moluccas proper, but one must constantly bear in mind that probably most of these were from the Sunda region proper, the Malay Peninsula, Penang, Singapore, and Sumatra, and not from the Moluccas. These Roxburghian Malaysian species have not been properly studied and an investigation of them in relation to those described by other authors is highly desirable.

EXPLANATION OF THE SEVERAL CATEGORIES USED IN THE FOLLOWING LIST APPERTAINING TO THE REPUBLISHED JACK DESCRIPTIONS

In the following list of the Jack species I have included references to the original place of publication of each taxon, and also references to those places where the descriptions were republished. To save repetition of references the classification I to V is accepted as explained below, of which I is scarcely used as such, II seldom used (because in these cases the references are repeated), but III to V are always used if individual Jack descriptions were included in this or that set of reprinted descriptions.

I. The original Jack papers. In each case a reference is given, the category indication I not used.

II. The Hooker reprinted descriptions 1830–1836. For details see p. 204. In each case the complete reference is given rather than merely II.

III. The Griffith Calcutta Journal of Natural History papers, volume four (1843). For details see p. 205.

IV. The separately paged Griffith reprint of the above. For details see p. 205.

V. The 1887 reprint in Trübner's Oriental Series. For details see p. 206.

These technical names preceded by an asterisk, such as *Acacia *graveolens* Jack still remain unlisted in standard indices. Most of these are *nomina nuda* and appear in Jack's letters to Nathaniel Wallich, which were published in 1916. Yet although actual descriptions may never have been published, most of these fugitive binomials are safely identifiable.

ACACIA Willdenow.

A. *graveolens Jack, Mal. Misc. **2** (7): 78. 1822; reimpr. Hook. Comp. Bot. Mag. **1:** 224. 1836; III. 163; IV. 67; V. 285, *nom. nud.* in obs. [Sumatra] = *Parkia graveolens* King, Jour. As. Soc. Beng. **66** (2): 241. 1897 (Mater. Fl. Mal. Pen. **3:** 241) *nom.* in obs. = *Parkia speciosa* Hassk. Flora **25** (2): Beibl. 55. 1842 (*P. macrocarpa* Miq. Fl. Ind. Bat. **1:** 53. 1855). Malay Peninsula, Sumatra; introduced in Java. *Acacia graveolens* Jack, *Parkia graveolens* Prain, and the very much older *Acacia gigantea* Noronha (1790) are all *nomina nuda*, although all are safely identifiable by the cited Malay name *pete* or *petek*.

ACROTREMA Jack, Mal. Misc. **1** (5): 36. 1820; reimpr. Hook. Bot. Misc. **2:** 81. 1830; III. 217; IV. 121; V. 240.

A. costatum Jack, l.c.; reimpr. Hook. op. cit. 82; III. 217; IV. 121; V. 240. Penang. Common in the Malay Peninsula; see Ridley, Fl. Malay Penin. **1:** 7. 1922. Also in Borneo and Sumatra.

ADINANDRA Jack, Mal. Misc. **2** (7): 49. 1822; reimpr. Hook. Comp. Bot. Mag. **1:** 153. 1835; III. 205; IV. 110; V. 271.

A. dumosa Jack, op. cit. 50; reimpr. ll.cc. Sumatra and other Malay Islands. The type of the genus; common in the Malay Peninsula, Sumatra, Java (probably only planted), and Borneo, represented by very numerous collections; for synonymy see Kobuski, Jour. Arnold Arb. **28:** 55. 1947.

A. sylvestris Jack, Mal. Misc. **2** (7): iii. 1822; reimpr. Calc. Jour. Nat. Hist. **4:** 208. 1843; IV. 112; V. 295. Western Sumatra at Moco Moco. Not actually described and cannot be placed from the inadequate data; see Kobuski, op. cit. 93.

AESCHYNANTHUS Jack, Trans. Linn. Soc. **14:** 42. 1823; reimpr. Calc. Jour. Nat. Hist. **4:** 60. 1843; IV. 60, *nom. conserv.* (*Trichosporum* G. Don, 1822).

A. radicans Jack, op. cit. 43; reimpr. III. 62; IV. 62. Sumatra, inland from Bencoolen. (*Trichosporum radicans* Nees). Jack's type is apparently in the Geneva herbarium; see C. B. Clarke, Monog. Phan. **5:** 41. 1883. Sumatra, Malay Peninsula, Borneo.

A. volubilis Jack, l.c. *pl. 2, fig. 3, a–i*; reimpr. III. 61. *pl. 15, fig. 3*; IV. 61. Sumatra, near Bencoolen (*Trichosporum volubile* Nees). Definitely known only from Sumatra, but has been credited to Celebes.

AGLAIA Loureiro.

A. odorata Lour. Fl. Cochinch. 173. 1790; Jack, Mal. Misc. **1** (5): 33. 1821; reimpr. Hook. Bot. Misc. **2:** 79. 1830; III. 192; IV. 96; V. 238. [Malay Islands; planted]. Widely planted in the Old World, native of southeastern Asia.

ALPINIA Roxburgh (1810), *nom. conserv.*, non Linnaeus.

A. capitellata Jack, Mal. Misc. **2** (7): 4. 1822; reimpr. Hook. Jour. Bot. **1:** 360. 1834; III. 5; IV. 5; V. 248. Inland from Bencoolen, Sumatra. See Holttum, Gard. Bull. Singapore **13:** 143. 1950, who tacitly accepted Ridley's 1899 interpretation of the species. There is no extant type. Sumatra and the Malay Peninsula.

A. elatior Jack, Mal. Misc. **2** (7): 2. 1822, reimpr. Hook. Jour. Bot. **1:** 359. 1834; III. 4, *sphalm*, "elatoir"; IV. 4; V. 247. Pulo Nias and Ayer Bangy =

Nicolaia elatior (Jack) Horan. Monog. Scit. 32. 1862. This case is an illustration of how one may sometimes be led astray by accepting modern interpretations, even in standard monographic treatises, without checking the record. *Nicolaia* Horan. was validly published in 1862, its type being *N. imperialis* Horan. Its author knew of the earlier but invalidly published generic name *Phaeomeria* Lindl., for he listed it as a synonym. The latter was published by Lindley, Nat. Syst. ed. 2, 446. 1836, the entire entry being "Phaeomeria = Alpinia magnifica *Bojer in Bot. Mag. t. 3192.*" This does not constitute valid publication under the conditions specified in Article 41 of the Code of Botanical Nomenclature, in spite of K. Schumann's acceptance of Lindley's generic name in 1904 (who first published a description of *Phaeomeria* Lindl., although Ridley in 1899 had treated it as a section of *Hornstedtia* Retz.) and Loesener's selection of it in preference to *Nicolaia* Horan. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, **15a**: 593. 1930. K. Schumann in 1904 had recognized sixteen species of *Phaeomeria* Lindl. The code provision is clear in that the name of a genus "is not validated by mention of included species" (this is all that Lindley did, for he never published a generic description); nor can Lindley's generic name be validated under any of the exceptions to this rule. Both K. Schumann and Loesener should have accepted *Nicolaia* Horan., as this is the proper name for this genus. In 1921 Valeton [12] correctly interpreted the situation, accepting *Nicolaia* Horan. and critically considering fourteen species. It is unfortunate that he did not explain why he rejected *Phaeomeria* Lindl. (correctly), for such action might have rendered this discussion unnecessary. However, this is perhaps an optimistic statement, considering the conservatism of the average taxonomist and the tendency that some have to justify the name-selections of their predecessors, regardless of approved rules. Except for his several new species being properly listed in Index Kewensis, Valeton's paper has been rather consistently ignored. It is worthy of note that although Valeton did not accept Jack's specific name (which he listed as a synonym of *Nicolaia speciosa* Horan.), he did have specimens from the type locality (Nias Island) and cited other collections from Sumatra. The last to consider our particular species was Holttum, Gard. Bull. Singapore **13**: 181. 1950, who, while providing a nicely detailed description, was not at all impressed by Valeton's correct selection of *Nicolaia* Horan. as the correct generic name; nor was he impressed by the manifest fact that Jack's specific name had five years priority over the one he accepted. Thus it is that Jack's beautifully described species has been rather consistently ignored, and in the meantime it has acquired a rather extensive synonymy, being, I suppose, the most spectacular species in the Zingiberaceae. The extensive synonymy is due, in fact, to the reluctance of some taxonomists to interpret species from descriptions alone when the types are lost, even when some of these descriptions, like those of Jack, are remarkable for their clarity, and further, to the reluctance of others to accept what manifestly is the oldest valid name for a particular species. These synonyms include *Elatteria speciosa* Blume (1827), *Alpinia magnifica* Rosc. (1828), *Phaeomeria *imperialis* Lindl. ex K. Schum., Pflanzenr. **20** (**IV. 46**): 262. 1904, *Alpinia speciosa* Dietr. (1839), *Nicolaia imperialis* Horan., and *N. speciosa* Horan. (1862), *Phaeomeria magnifica* K. Schum. (1904), *Amomum magnificum* Benth. (not published until it appeared in Index Kewensis **1**: 108. 1893), *Hornstedtia imperialis* Ridl. (1899), *Phae-*

[12] **Valeton, T.** Nicolaia Horan. Description of New and Interesting Species. Bull. Jard. Bot. Buitenz. III. **3**: 128–140. *pl. 1–5.* 1921.

omeria speciosa Koord. (1911; Merr., 1923), and *Alpinia*longiscapa* Jack ex Burkill, Jour. Straits Br. Roy. As. Soc. **73:** 225. 1916, *nom.* No matter how desirable it may be to retain Lindley's invalidly published generic name of 1836, I fail to see how this can be done unless one wishes to ignore the code provisions governing valid publication. In selecting the name *Phaeomeria*, Lindley was undoubtedly influenced by Bojer's suggestion, in the discussion of the beautiful plate of *Alpinia magnifica* [Rosc.], Bot. Mag. **59:** *pl. 3192.* 1832, that a new genus might be represented. It is most unfortunate that he never found time to characterize his suggested new genus; but K. Schumann's tardy recognition of the validity of the group as a genus in 1904, and Loesener's action in 1930, in an apparent attempt to justify K. Schumann's selection of a generic name for the group, do not save the day for Lindley's generic name. *Nicolaia elatior* (Jack) Horan. is widely distributed in Malaysia, much of its range being due to this strikingly ornamental plant being man-distributed; it has also been introduced in many other tropical countries in both hemispheres, but is unquestionably of Malaysian origin.

AMOMUM Linnaeus.

A. biflorum Jack, Mal. Misc. **1** (1): 2. 1820; reimpr. Hook. Bot. Misc. **1:** 274. 1830; III. 3; IV. 3; V. 210. Penang. For the best modern consideration of the species, with synonymy, see Holttum, Gard. Bull. Singapore **13:** 199. 1950. Siam to the Malay Peninsula.

ANTIDESMA Linnaeus.

A. frutescens Jack, Mal. Misc. **2** (7): 91. 1822; reimpr. Hook. Comp. Bot. Mag. **1:** 257. 1836; III. 229; IV. 133; V. 292. Bencoolen, Sumatra = *Antidesma ghaesembilla* Gaertn. This was accepted as a valid species by Pax & Hoffmann, Pflanzenr. **81 (IV. 147. XV):** 157. 1922, and was placed by them in the alliance with Gaertner's species. An attentive comparison of Jack's excellent description (there is no extant type) with Gaertner's species clearly indicates that what Jack described is only a form of the very common and widely distributed *A. ghaesembilla* Gaertn., which might have been expected from Jack's comparison of his species to *A. pubescens* Roxb. *Rahmat si Toroes 4185* from Sumatra, which is clearly *A. ghaesembilla* Gaertn., agrees closely with Jack's description, as do other Malayan collections. Western India and the tropical Himalayan region to Ceylon, eastward to southeastern China and southward throughout Malaysia, including the Philippines, to New Guinea and tropical Australia.

ARDISIA Swartz.

A. punctata Jack in Roxb. Fl. Ind. **2:** 275. 1824. Penang. A species known only from Penang and of which *A. divergens* Roxb. Hort. Beng. 85. 1814, *nom. nud.*, Fl. Ind. l.c., is a synonym. Roxburgh said that his specimen came from the Moluccas, but it should be realized that his concept of the Moluccas covered all of the Malay Peninsula and Archipelago; see Prain, Ann. Bot. Gard. Calcutta **5:** 6. 1895. The actual type of *A. divergens* Roxb. undoubtedly came from Penang. The Roxburgh description, compared with that which Wallich prepared for Jack's species, is very short.

Ardisia punctata Jack was overlooked by Griffith when he prepared his 1843 paper on the Jack descriptions. This interpretation of the Jack species necessitates a new specific name for the common Chinese *Ardisia punctata* Lindl., Bot. Reg. **10:** *pl. 827.* 1824, as this plate is dated Sept. 1, 1824. The introduction to volume two of Roxburgh's Flora Indica is dated March, 1824. The proper name for the Chinese *Ardisia punctata* Lindl., non Jack, is *Ardisia lindleyana* D. Dietr. Syn. **1**: 617. 1839.

ARECA Linnaeus.

A. tigillaria Jack, Mal. Misc. **2** (7): 88. 1822; reimpr. Hook. Comp. Bot. Mag. **1**: 256. 1836; III. 12; IV. 12; V. 290. Sumatra and the Malay Islands = *Oncosperma tigillaria* (Jack) Ridl. (*O. filamentosum* Blume). In transferring the specific name to *Oncosperma* Ridley credited the original binomial to Griffith, who, however, was merely concerned with Jack's species. Malay Peninsula, Sumatra, Borneo, and Java.

ARISTOLOCHIA Linnaeus.

A. hastata Jack, Mal. Misc. **2** (7): 6. 1822; reimpr. Hook. Jour. Bot. **1**: 362. 1834; III. 358; IV. 214; V. 249, non HBK. (1817). West coast of Sumatra at Natal = *A. jackii* Steud. Apparently known only from Jack's description.

BAUHINIA Linnaeus.

B. bidentata Jack, Mal. Misc. **2** (7): 76. 1822; reimpr. Hook. Comp. Bot. Mag. **1**: 223. 1836; III. 160; IV. 63; V. 284. "Native of Malayan Forests." This species of the Malay Peninsula and Sumatra is amply described by King, Jour. As. Soc. Beng. **66** (2): 187. 1897 (Mater. Fl. Mal. Penin. **3**: 187).

B. emarginata Jack, op. cit. 76: reimpr. ll.cc., non Mill. (1768). Sumatra = ? *Bauhinia lucida* Wall. Baker's interpretation of Jack's species is possibly correct, although *B. lucida* Wall. seems to be definitely recorded only from Penang and Perak. However, there is in the Gray Herbarium a Marsden specimen from Sumatra named by Hooker as *B. lucida* Wall. which may represent both it and the form Jack characterized. In any case Jack's specific name is an invalid one.

BEGONIA Linnaeus; Jack, Mal. Misc. **2** (7): 8. 1822; reimpr. Hook. Jour. Bot. **1**: 363. 1834; III. 342; IV. 198; V. 250.

B. bracteata Jack, op. cit. 13; reimpr. II. 367; III. 346; IV. 202; V. 353. Gunong Bunko, inland from Bencoolen, Sumatra. A de Candolle's description, Prodr. **15** (1): 316. 1864, was based on that of Jack; type not extant. Placed in *Diploclinium* by Miquel and in *Knesebeckia* by Hasskarl. But Koorders in 1912 reduced it to *Begonia lepida* Blume (1827), although Jack's name is older.

B. caespitosa Jack, l.c.; reimpr. II. 363; III. 342; IV. 198; V. 250. West coast of Sumatra at Bencoolen. Known only from Jack's description; see A. de Candolle, op. cit. 397. Placed in *Diploclinium* by Miquel.

B. fasciculata Jack, op. cit. 12; reimpr. II. 365; III. 345; IV. 201; V. 252. West coast of Sumatra at Tapanuly. See A. de Candolle, op. cit. 322. Placed in *Diploclinium* by Miquel and in *Petermannia* by Klotzsch. Known only from Jack's description.

B. geniculata Jack, op. cit. 15; reimpr. II. 368; III. 347; IV. 203; V. 253. Sumatra = *B. isoptera* Dryand. (1791), fide A. de Candolle, op. cit. 320, the latter occurring in the Malay Peninsula, Borneo, and Java, as the species is currently interpreted.

B. orbiculata Jack, op. cit. 9; reimpr. II. 364; III. 343; IV. 198; V. 250. West coast of Sumatra at Bencoolen. Known only from Jack's description. Placed in *Diploclinium* by Miquel; see A. de Candolle, op. cit. 398.

B. pilosa Jack, op. cit. 13; reimpr. II. 366; III. 345; IV. 201; V. 252. West coast of Sumatra inland from Bencoolen. Known only from Jack's description. By Miquel placed in *Diploclinium*; see A. de Candolle l.c.

B. racemosa Jack, op. cit. 14; reimpr. II, 367; III. 346; IV. 202; V. 253. West coast of Sumatra, inland from Bencoolen. Known only from Jack's description. Placed by Miquel in *Diploclinium* and by Klotzsch in *Petermannia*; see A. de Candolle, op. cit. 322.

B. sublobata Jack, op. cit. 10. 1822; reimpr. II. 364; III. 343; IV. 198; V. 251. Under moist rocks on Pulo Pegang, west coast of Sumatra. Known only from Jack's description. Placed by Miquel in *Diploclinium*; see A. de Candolle, op. cit. 354.

CALLA Linnaeus.

C. angustifolia Jack, Mal. Misc. **1** (1): 24. 1820; reimpr. Hook. Bot. Misc. **1:** 288. 1830; III. 11; IV. 11; V. 221. Penang = *Homalomena humilis* (Jack) Hook. f. var. *pumila* (Hook. f.) Furtado, Gard. Bull. Straits Settl. **10:** 203. 1939, cum syn. Malay Peninsula, Sumatra, Borneo (*Chamaecladon angustifolium* Schott).

C. humilis Jack, op. cit. 22; reimpr. Hook. Bot. Misc. **1:** 288. 1830; III. 11; IV. 11; V. 221. Penang = *Homalomena humilis* (Jack) Hook. f. Fl. Brit. Ind. **6:** 533. 1893; Furtado, Gard. Bull. Straits Settl. **10:** 199. 1939. Malay Peninsula, Sumatra (Batu Island), and Anambas Islands.

C. nitida Jack, op. cit. 24; reimpr. Hook., op. cit. 289; III. 12; IV. 12; V. 221. Penang = *Aglaonema nitidum* (Jack) Kunth, Enum. **3:** 76. 1841 (*A. oblongifolium* (Roxb.) Schott; Engl. Pflanzenr. **64 (IV, 23, Dc.):** 13. *fig. 4.* 1915, cum syn.). Malay Peninsula, Buru, Borneo, Sumatra. Engler should have adopted Jack's specific name, as it was published twelve years earlier than that of Roxburgh; the two species are clearly identical.

CAREYA Roxburgh.

C. macrostachya Jack, Mal. Misc. **1** (5): 47. 1820; reimpr. Hook. Bot. Misc. **2:** 88. 1830; III. 305; IV. 161; V. 245. Penang = *Barringtonia macrostachya* (Jack) Kurz. Malay Peninsula, Sumatra, Borneo.

CELASTRUS Linnaeus.

C. bivalvis Jack, Mal. Misc. **1** (5): 19. 1820; reimpr. Hook. Bot. Misc. **2:** 71. 1830; III. 196; IV. 100; V. 231. Penang = *Microtropis bivalvis* (Jack) Wall. List, no. 4340. 1840; Merr. & Freem. Proc. Am. Acad. Arts Sci. **73:** 301. 1940, cum syn. (*Paracelastrus bivalvis* Miq.). Jack's original collection was distributed as a part of *Wallich 4340*. A species still known only from Penang.

CELTIS Linnaeus.

C. *attenuata Jack ex Burkill, Jour. Straits Br. Roy. As. Soc. **73:** 196. 1916, *nom. nud.* Sumatra at Tapanuly, said to be frequent.

CHIONOTRIA Jack, Mal. Misc. **2** (7): 53. 1822; reimpr. Hook. Comp. Bot. Mag. **1:** 155. 1835; III. 193; IV. 97; V. 273 = *Glycosmis* Correa (1805).

C. rigida Jack, op. cit. 54; reimpr. Hook. l.c.; III. 193; IV. 97; V. 273. Penang = **Glycosmis rigida** (Jack) comb. nov. (*Glycosmis macrophylla* Lindl. in Wall. List no. 6377. 1830, *nom. nud.*; Ridl. Jour. Straits Br. Roy. As. Soc. **75:** 13. 1917, *descr.*, incl. var. *macrorachis* (King) Ridl. l.c.; *G. pentaphylla* Corr. var. *macrorachis* King). In the first place Ridley never should have validated

Lindley's species, for, as a binomial, it was invalidated by the different *G. macrophylla* Miquel; hence, as long as an invalid binomial is currently applied to this Penang species, I do not hesitate to replace it by the much earlier specific name published by Jack in 1822. The only character indicated by Jack that does not conform to Ridley's description is that he stated that the leaves were opposite; they are alternate in all species of *Glycosmis*. Note particularly Jack's description of the inflorescences as racemes. Actually the inflorescences are very narrow panicles, the distant branchlets being often only 0.1 inch long, varying from 0.1 to 0.4 in. in length, and thus simulating racemes. When Ridley considered the species in 1917, he stated, "a very distinct plant peculiar apparently to Penang," and in his Fl. Mal. Pen. **1**: 349. 1922, he had not extended its range. The only other possibility would be *G. malayana* Ridl., which occurs also in Penang, but this has pinnate leaves (had Jack's specimen had other than simple leaves surely he would have mentioned it), while its paniculate inflorescences have branches up to one inch long; Jack never would have characterized such an inflorescence as a raceme. A species characterized essentially by its very narrow raceme-like inflorescences. still known only from Penang.

CLERODENDRON Linnaeus.

C. divaricatum Jack, Mal. Misc. **1** (5): 48. 1820 (*Clerodendrum*); reimpr. Hook. Bot. Misc. **2**: 89. 1830; III. 40; IV. 40; V. 246. West coast of Sumatra at Laye = *Clerodendron serratum* (Linn.) Spreng. India and Ceylon to Madagascar and the Mascarene Islands through Malaysia to the Lesser Sunda Islands and Celebes.

C. molle Jack, Mal. Misc. **1** (1): 15. 1820; reimpr. Hook. Bot. Misc. **1**: 283. 1830; III. 38; IV. 38; V. 217, non HBK. (1817). Sumatra and Penang = *C. villosum* Blume (1826). Another synonym is *Clerodendron velutinum* Wall. List no. 1797. 1829, *nom. nud.* India and Burma to the Malay Peninsula and Archipelago, including the Philippines.

C. nutans Jack, Mal. Misc. **1** (1): 17. 1820; reimpr. Hook. Bot. Misc. **1**: 284. 1830; III. 39; IV. 39; V. 217, omn. sub *C. molle* Jack. Penang (*C. penduliflorum* Wall. List no. 1795. 1829, *nom. nud.* et ex Schauer in DC. Prodr. **11**: 664. 1847, *descr.*), non *C. nutans* Wall. List no. 1793. 1829, *nom. nud.* et ex D. Don, Prodr. Fl. Nepal. 103. 1825, *descr.* Jack's description, although short, is excellent. It was based on Penang material, as he thought that which he had before him represented the as yet undescribed *C. nutans* Wallich. When one scans Jack's graphic description, "paniculis longissimis terminalibus nutantibus, pedunculis [ramis] remotis paucifloris," and again "these panicles or racemes hang gracefully from the extremity of the branches," it is understandable why Jack thought that he had before him a representative of Wallich's species. Wallich erred, List no. 1794. 1829, when he renamed what he supposed to be the form Jack had described as *C. jackianus* Wall.; this, as later described by Schauer, based on the actual Wallich specimen, explains why the very different *C. disparifolium* Blume, *C. laevigatum* Blume, and *C. acuminatum* Wall. became involved here. Mr. H. K. Airy Shaw reports that *Wallich 1794* from Penang (this was collected by Wallich in 1822, not by Jack), in his opinion, represents the very different *C. disparifolium* Blume. For the binomial as here accepted and applied, that is *C. nutans* Jack (non, Wall.), *C. penduliflorum* Wall. is a synonym, as Wallich's species is defined and amply described by Gamble in King and Gamble, Jour. As. Soc. Bengal **74** (2): 830. 1909 (Mater. Fl. Mal. Pen. **4**: 1040), and accepted by Ridley.

Its range is apparently Burma, the Nicobar Islands, Penang, and various parts of the Malay Peninsula. I am confident that a Korthals collection from Mt. Singalang, Sumatra (a rather poor specimen of which is before me), which Hallier f., Meded. Rijksherb. **37:** 72. 1918, listed as *C. nutans* Wall., really represents *C. nutans* Jack. The Indian form was not introduced into cultivation in Malaya before 1820; and Ridley is clear, as to this Malay Peninsula form with pendulous inflorescences, that it occurs here and there in forests — i.e., that it is a native of the region.

Schauer, in 1847, recognized *C. nutans* Wall. (Bengal, Sylhet), *C. jackianum* Wall. (Penang), and *C. penduliflorum* Wall. (Tavoy) as distinct species. All taxonomists have overlooked the fact that as far as the binomial *C. nutans* is concerned, Jack was the first author who associated a description with it, and that the binomial to be maintained must hence be *Clerodendron nutans* Jack (1820). It seems to be clear that the common Indian form, currently known as *Clerodendron nutans* Wall., of which at least fifteen individual collections are available to me from northern India to Burma, as well as specimens taken from cultivated plants in Cuba and in Australia, has no valid name. This is unfortunate, because now that species is widely distributed in cultivation. For this a new binomial is proposed, **Clerodendron wallichii** nom. nov. (*C. nutans* Wall. List no. 1793. 1829, *nom. nud.*, et ex D. Don, Prodr. Fl. Nepal. 103. 1825, *descr.*, et auctt. plur., non Jack, 1820). This species was beautifully illustrated by Hooker, Bot. Mag. **58:** *pl. 3049.* 1831. The species occurs in the Malay Archipelago only as an introduced and cultivated plant, unless one be willing to interpret *C. nutans* Wall. as being identical with *C. nutans* Jack, together with *C. penduliflorum* Wall., a proceeding that I am not willing to approve. *Clerodendron jackianum* Wall., as described by Schauer, and *C. acuminatum* Wall. are totally different from *C. wallichii* Merr.

CNESTIS Jussieu.

C. emarginata Jack, Mal. Misc. 2 (7): 42. 1822; reimpr. Hook. Comp. Bot. Mag. **1:** 150. 1835; III. 166; IV. 70; V. 267. Sumatra, at Bencoolen = **Roureopsis emarginata** (Jack) comb. nov. (*Roureopsis javanica* Planch. Linnaea **23:** 424. 1850, excl. syn. Blume; Schellenb. Pflanzenr. **103 (IV. 127):** 113. 1938). Schellenberg erred, op. cit. 142, when he disposed of Jack's species as a synonym of the utterly different *Santaloides mimosoides* (Vahl) O. Kuntze, which has numerous small, truncate-emarginate leaflets. Jack clearly states that the 5 to 7 leaflets of *C. emarginata* Jack were long-acuminate and emarginate, the terminal leaflet frequently 7 inches long. His graphic description agrees perfectly with *Roureopsis javanica* Planch. *Connarus javanica* Blume (1826) = *Rourea javanica* Blume (1850), which has been confused here, is a synonym of *Santaloides floridum* (Jack) O. Kuntze. There are now very many collections available from western Sumatra which agree with Jack's excellent description, such as *Rahmat Si Toroes 3279, 3369, 3421, 3506, 3599, 3746, 3813, 3939, 4095, 4147, 4246, Bartlett 2882, 6894,* as well as those of Planchon and of Schellenberg. The very conspicuously acuminate leaflets, the distinctly retuse tips of the acumens are characteristic.

C. florida Jack, op. cit. 43; reimpr. Hook. op. cit. 151; III. 167; IV. 70: V. 267. Sumatra, west coast, and Pulu Nias = *Santaloides floridum* (Jack) O. Kuntze; Schellenb. op. cit. 124, cum syn. Malay Peninsula, Sumatra, Java, Borneo, and Morotai.

C. *longifolia Jack ex Burkill, Jour. Straits Br. Roy. As. Soc. **73:** 197, 249. 1916, *nom. nud.* Singapore.

C. mimosoides Jack, op. cit. 44; reimpr. Hook. l.c.; III. 167; IV. 71; V. 268. Sumatra at Tapanuly = *Santaloides mimosoides* (Vahl) O. Kuntze; Schellenb. op. cit. 142, cum syn. (excl. *Cnestis emarginata* Jack). Jack cited *Connarus mimosoides* Vahl as the basis of his binomial and his interpretation of Vahl's species was apparently correct. Siam and Indo-China, the Malay Peninsula, Nicobar Islands, Sumatra, Borneo, and Java.

COELOPYRUM Jack, Mal. Misc. 2 (7): 65. 1822; reimpr. Hook. Comp. Bot. Mag. 1: 220. 1836; III. 341; IV. 197; V. 279 = *Campnosperma* Thwaites (1854).

C. coriaceum Jack, l.c.; reimpr. ll.cc. West coast of Sumatra near Bencoolen = *Campnosperma coriacea* (Jack) Hallier f. ex van Steenis, Fl. Males. Bull. 3: 74. 1948 (*C. macrophylla* (Blume) Hook. f.). Malay Peninsula, Sumatra, Borneo.

This genus remained among the unplaced ones until Hallier f., Beih. Bot. Centralbl. 39 (2): 161, 162. 1921, correctly associated it with *Campnosperma* Thwaites. Van Steenis, l.c., has recommended that Thwaites' generic name be officially conserved against Jack's earlier one. I cannot distinguish *C. macrophylla* (Blume) Hook. f. from Jack's species, Blume's taxon dating from 1850.

CONNARUS Linnaeus.

C. ferrugineus Jack, Mal. Misc. 2 (7): 37. 1822; reimpr. Hook. Comp. Bot. Mag. 1: 149. 1835; III. 170; IV. 73; V. 264. Penang. Widely distributed in the Malay Peninsula; see Schellenb. Pflanzenr. **103 (IV. 127)**: 258. 1938.

C. grandis Jack, op. cit. 40; reimpr. Hook. Comp. Bot. Mag. 1: 150. 1835; III. 172; IV. 76; V. 266. Sumatra at Tapanuly. The species is now known from the Malay Peninsula, Sumatra, Borneo, Java, and the Moluccas; see Schellenb. op. cit. 257, cum syn.

C. lucidus Jack, op. cit. 41; reimpr. Hook. Comp. Bot. Mag. 1: 150. 1835; III. 172; IV. 76; V. 266. Sumatra. See Schellenb. op. cit. 112, who discussed this species under *Roureopsis pubinervis* Planch. (1850) of the Malay Peninsula, Lingga, Bangka, Sipora, and Sumatra; but as Schellenberg noted, Jack's description does not wholly agree with the characters of Planchon's species.

C. semidecandrus Jack, op. cit. 39; reimpr. Hook. Comp. Bot. Mag. 1: 149. 1835 (*semidecander*); III. 171; IV. 75; V. 266. West coast of Sumatra. A species known only from Sumatra, *C. pyrrhocarpus* Miq. (1863) being a synonym. Jack's type is preserved in the Delessert herbarium at Geneva; see Schellenberg, op. cit. 281.

C. villosus Jack, op. cit. 38; reimpr. Hook. Comp. Bot. Mag. 1: 149. 1835; III. 171; IV. 74; V. 265. Sumatra. Also in the Malay Peninsula and Borneo. According to Schellenberg, op. cit. 228, Jack's type is preserved in the Delessert herbarium at Geneva.

CURCULIGO Gaertner.

C. sumatrana Roxb. Hort. Beng. 24. 1814; Roxb. ex Jack, Mal. Misc. 1 (1): 9. 1820; reimpr. Hook. Bot. Misc. 1: 277. 1830; III. 8; IV. 8; V. 212; Roxb. Fl. Ind. ed. 2, 2: 146. 1832. Sumatra and Penang = *C. latifolia* Ait. (1811), the type of which was also from Penang. Burma to Indo-China southward through the Malay Peninsula and Archipelago to the Moluccas. *Involucrum* Rumph. Herb. Amb. 6: 114. *pl. 53.* 1750, actually typifies Roxburgh's taxon as published in 1814; it was also cited by Jack. It has been erroneously referred to the different *C. recurvata* Dry. = *C. capitulifera* (Lour.) O. Kuntze. The Singapore form with hirsute leaves, mentioned but not named or described by Jack, was undoubtedly *C. villosa* Wall.

CYRTANDRA Forster.

C. aurea Jack, Trans. Linn. Soc. **14**: 29. 1823; reimpr. Calc. Jour. Nat. Hist. **4**: 50. 1843; IV. 50. At the foot of Gunong Bunko inland from Bencoolen, Sumatra. Also in Java; see C. B. Clarke, Monog. Phan. **5**: 260. 1883.

C. bicolor Jack, op. cit. 27; reimpr. III. 47; IV. 47. Sumatra. There is a Jack specimen in the Delessert herbarium, fide C. B. Clarke, op. cit. 242. Also in the Malay Peninsula.

C. carnosa Jack, op. cit. 30; reimpr. III. 51; IV. 51. No locality indicated but probably from Sumatra. Known only from Jack's description; see C. B. Clarke, op. cit. 207.

C. frutescens Jack, op. cit. 31; reimpr. III. 51; IV. 51. No locality indicated, but Jack's specimen in the Delessert herbarium at Geneva is from Sumatra, fide C. B. Clarke, op. cit. 205.

C. glabra Jack, op. cit. 28; reimpr. III. 49; IV. 49. Inland from Bencoolen, Sumatra. Occurs also in Java, fide C. B. Clarke, op. cit. 245.

C. hirsuta Jack, op. cit. 27; reimpr. III. 48; IV. 48. Sumatra. Known only from the type collection, there being a Jack specimen in the Delessert herbarium at Geneva, fide C. B. Clarke, op. cit. 246.

C. incompta Jack, op. cit. 29; reimpr. III. 48; IV. 48. Sumatra, no locality indicated. Known only from Jack's description, fide C. B. Clarke, op. cit. 285; no extant specimen known.

C. macrophylla Jack, op. cit. 25. *pl. 2, fig. 1, a–g;* reimpr. III. 46; IV. 46. Sumatra, no locality indicated, but Jack's type (the only known collection) in the Delessert herbarium is from Selebang, in the jurisdiction of Bencoolen, Sumatra, fide C. B. Clarke, op. cit. 243.

C. maculata Jack, op. cit. 26; reimpr. III. 47; IV. 47. Sumatra. No definite locality indicated. Known only from Jack's description, fide C. B. Clarke, op. cit. 286.

C. peltata Jack, op. cit. 30; reimpr. III. 50; IV. 50. Sumatra, no definite locality, type not preserved, but represented by various Sumatran collections, fide C. B. Clarke, op. cit. 241.

C. rubiginosa Jack, op. cit. 32; reimpr. III. 52; IV. 52. No locality cited, probably from Sumatra; type unknown; see C. B. Clarke, op. cit. 285.

DIDYMOCARPUS Wallich.

D. barbata Jack, Trans. Linn. Soc. **14**: 38. 1823; reimpr. Calc. Jour. Nat. Hist. **4**: 57. 1843; IV. 57. Sumatra = *Chirita horsfieldii* R. Br. (1838); see C. B. Clarke, Monog. Phan. **5**: 123. 1883. Sumatra, Java. Here Jack's specific name should have been accepted by Clarke, but it is now invalidated in *Chirita* by the different *Chirita barbata* Sprague (1908).

D. corniculata Jack, Mal. Misc. **1** (5): 4. 1820; reimpr. Hook. Bot. Misc. **2**: 62. 1830; III. 55; IV. 55; V. 224; et Jack, Trans. Linn. Soc. **14**: 36. 1823. Sumatra at Tapanuly. According to C. B. Clarke, DC. Monog. Phan. **5**: 86. 1883, there is a Jack specimen in the Delessert herbarium at Geneva. Known only from Sumatra.

D. crinita Jack, Mal. Misc. **1** (5): 1. 1820; reimpr. Hook. Bot. Misc. **2**: 60. 1830; III. 53; IV. 53; V. 223; et Jack, Trans. Linn. Soc. **14**: 33. *pl. 2, fig. 2, a–i.* 1823. Penang. A valid species. Malay Peninsula, Sumatra, with varieties in

Borneo; see C. B. Clarke, op. cit. 93. A duplicate of Jack's type is in the Edinburgh herbarium; see pl. 1.

D. elongata Jack, Trans. Linn. Soc. **14:** 37. 1823; reimpr. III. 56; IV. 56. Pulo Bintangor, an island off the west coast of Sumatra = *Didissandra elongata* (Jack) C. B. Clarke in DC. Monog. Phan. **5:** 67. *pl. 7.* 1883. Also in Borneo.

D. frutescens Jack, Mal. Misc. **1** (5); 5. 1820; reimpr. Hook. Bot. Misc. **2:** 63. 1830; III. 58; IV. 58; V. 225; et Jack, Trans. Linn. Soc. **14:** 39. 1823. Penang = *Didissandra frutescens* (Jack) C. B. Clarke, l.c. Malay Peninsula, Sumatra.

D. *ornithopus Jack ex Burkill, Jour. Straits Br. Roy. As. Soc. **73:** 198. *fig. 1.* 1916, descr. abbr. Sumatra at Tapanuly = *D. corniculata* Jack, supra.

D. racemosa Jack, Trans. Linn. Soc. **14:** 34. 1823; reimpr. III. 54; IV. 54. West coast of Sumatra at Tapanuly. A species known only from Sumatra; see C. B. Clarke, op. cit. 94.

D. reptans Jack, Mal. Misc. **1** (5): 3. 1820; reimpr. Hook. Bot. Misc. **2:** 61. 1830; III. 55; IV. 55; V. 224; et Jack, Trans. Linn. Soc. **14:** 35. 1823. Penang. Reported by C. B. Clarke, op. cit. 95, also from lower Burma and from Java; widely distributed in the Malay Peninsula.

DRYOBALANOPS Gaertner f.

D. camphora Colebr. As. Res. **12:** 535. 1816; Jack [App. Descr. Mal. Pl. . . . 1820]; reimpr. Hook. Comp. Bot. Mag. **1:** 264. 1836; III. 213; IV. 117. West coast of Sumatra at Tapanuly = *D. aromatica* Gaertn. f. (1805). Malay Peninsula, Sumatra, Lingga, Borneo.

ELAEOCARPUS Linnaeus.

E. nitidus Jack, Mal. Misc. **1** (5): 41. 1820; reimpr. Hook. Bot. Misc. **2:** 84. 1830; III. 224; IV. 128; V. 242. Penang. I accept Corner's interpretation of this species, Gard. Bull. Straits Settl. **10:** 323. 1939, as he clearly demonstrated that King's earlier interpretation of 1891 was erroneous. I found in the British Museum herbarium an unnamed *Elaeocarpus* labeled in Wallich's handwriting "Elaeocarpus e, Penang miscet Wm. Jack, 1819." This is *E. nitidus* Jack as interpreted by Corner and is unquestionably an isotype of Jack's species. Common, Malay Peninsula, Sumatra, Borneo; see Merrill, Jour. Arnold Arb. **32:** 184. 1951, for synonymy.

ELODEA Jack, Mal. Misc. **2** (7): 21. 1822; reimpr. Hook. Jour. Bot. **1:** 371. 1834; III. 208; IV. 112; V. 256, non *Elodes* Adanson (1763), nec *Elodea* Juss. (1789) = *Cratoxylon* Blume (1825).

E. egyptica Jack, op. cit. 25; reimpr. Hook. Comp. Bot. Mag. **1:** 154. 1835; III. 211; IV. 115; V. 272, in obs., sub *Ixonanthes* = *Hypericum aegyptiacum* Linn.

E. formosa Jack, op. cit. 22; reimpr. Hook. Jour. Bot. **1:** 374. 1834; III. 210; IV. 114; V. 258. Sumatra = *Cratoxylon formosum* (Jack) Dyer in Hook. f. Fl. Brit. Ind. **1:** 258. 1874; Corner, Gard. Bull. Straits Settl. **10:** 28, 34. 1939, cum syn. Malay Peninsula and Sumatra to Java, Borneo, the Philippines, and the Moluccas. Corner, l.c., has definitely shown that my application of the binomial *Cratoxylon cochinchinense* (Lour.) Blume to this species was erroneous.

E. sumatrana Jack, op. cit. 22: reimpr. Hook. op. cit. 372; III. 209; IV. 113; V. 257. Pulo Nias, off the west coast of Sumatra = *Cratoxylon sumatranum* (Jack) Blume. See Corner, Gard. Bull. Straits Settl. **10:** 27. 1939, for a discussion of this species. He suggests that *C. racemosum* Blume (type from Java) is its most likely synonym; to be compared, however, is *C. clandestinum* Blume (type from Java), if *de Voogt 1168* from Bencoolen, Sumatra, was correctly named.

EMBELIA Burman f.

E. canescens Jack in Roxb. Fl. Ind. **2:** 292. 1824. Penang. A well-understood species now also known from the Malay Peninsula and Sumatra. Overlooked by Griffith when he compiled the Jack descriptions in 1843.

ENCHIDIUM Jack,[13] Mal. Misc. **2** (7): 89. 1822; reimpr. Hook. Comp. Bot. Mag. **1:** 257. 1836; III. 228; IV. 132; V. 291 = *Trigonostemon* Blume 1827 (*Trigostemon* Blume, 1825).

E. verticillatum Jack, op. cit. 90; reimpr. ll.cc. "Sumatra and the Malay Islands" = *Trigonostemon verticillatus* (Jack) Pax, Pflanzenr. **47 (IV. 147):** 87. 1911 (*T. indicus* Muell.-Arg., 1865; *Telogyne indica* Baill., 1858). Malay Peninsula, Penang, Sumatra. Jack's actual type was from Sumatra, and is apparently no longer extant. His addition "and the Malay Islands" was apparently made because he thought that the Moluccan *Abor spiculorum* Rumph. Herb. Amb. **3:** 167. pl. 106. 1743, represented his species; but what Rumphius illustrated was a sterile specimen of what is clearly an *Actinodaphne* of the Lauraceae, and is *A. rumphii* Blume.

EPITHINIA Jack, Mal. Misc. **1** (5): 12. 1820; reimpr. Hook. Bot. Misc. **2:** 67. 1830; III. 24; IV. 24; V. 228 = *Scyphiphora* Gaertn. f. (1805).

E. malayana Jack, l.c.; reimpr. ll.cc. Singapore = *Scyphiphora hydrophyllacea* (Jack) Gaertn. f. (1805). A common and widely distributed species growing within the influence of salt or brackish water in the Indo-Malaysian region.

EURYCOMA Jack, Mal. Misc. **2** (7): 44. 1822; reimpr. Roxb. Fl. Ind. **2:** 307. 1824; reimpr. Hook. Comp. Bot. Mag. **1:** 151. 1835; III. 168; IV. 72; V. 268.

E. longifolia Jack, op. cit. 45; reimpr. ll.cc. Tapanuly and Bencoolen, west coast of Sumatara, and at Singapore. A small genus, this species common in parts of Sumatra, Borneo, and the Malay Peninsula, extending to Siam and Indo-China.

EUTHEMIS Jack, Mal. Misc. **1** (5): 15. 1820; reimpr. Roxb. Fl. Ind. **2:** 203. 1824; reimpr. Hook. Bot. Misc. **2:** 69. 1830; III. 200; IV. 104; V. 230.

E. leucocarpa Jack, op. cit. 16: reimpr. ll.cc. Singapore, Malay Peninsula, Borneo, and probably Sumatra.

E. minor Jack, op. cit. 16; reimpr. Roxb. op. cit. 304; II. 70; III. 201; IV. 105; V. 231. Singapore. Widely distributed in the Malay Peninsula, Borneo, and apparently also in Sumatra.

FAGRAEA Thunberg.

F. auriculata Jack, Mal. Misc. **2** (7): 82. 1822; reimpr. Hook. Comp. Bot. Mag. **1:** 254. 1836; III. 29; IV. 29; V. 287, omn. sub *F. carnosa* Jack; Jack ex Roxb. Fl. Ind. **2:** 34. 1824, *descr.* Singapore and the west coast of Sumatra at

[13] Jack's generic name has priority, but because about eighty binomials have been published in *Trigonostemon* and only one in *Enchidium*, van Steenis, Fl. Males. Bull. **3:** 74. 1948, has recommended that Blume's name be conserved, which is manifestly desirable.

Tapanuly. Now recorded from the Malay Peninsula, Sumatra, Banka Billiton, Borneo, Java, and Mindanao (*F. epiphytica* Elm.).

F. carnosa Jack, op. cit. 81 (sphalm, *Fagroea*); reimpr. ll.cc. Sumatra, near Bencoolen. Known only from Sumatra; *F. monantha* Miq. (1857) is a synonym.

F. racemosa Jack, op. cit. 82; reimpr. ll.cc., omn. *nom.* sub *F. carnosa* Jack; Jack ex Roxb. Fl. Ind. **2:** 35. 1824, *descr.* Penang. A common species extending from Indo-China through the Malay Peninsula and Sumatra, Java, Borneo, the Philippines southward to New Guinea. *Fagraea volubilis* Wall. in Roxb. Fl. Ind. ed. 2, **2:** 36. 1824, is sometimes erroneously listed as a Jack species. It is a synonym of *F. racemosa* Jack, its type, a fruiting specimen sent to Wallich by Jack from Bencoolen; but Wallich, who described it, expressed doubt if it was distinct from *F. racemosa* Jack.

FICUS Linnaeus.

F. deltoidea Jack, Mal. Misc. **2** (7): 71. 1822; reimpr. Hook. Comp. Bot. Mag. **1:** *222.* 1836; III. 369; IV. *225*; V. *282*. Sumatra (*F. diversifolia* Blume, 1825). A species with exceedingly variable leaves. Malay Peninsula, Sumatra, Java, Borneo, and Palawan.

F. ovoidea Jack, l.c.; reimpr. ll.cc. Singapore, west coast of Sumatra, and neighboring islands. Clearly only a form of *F. deltoidea* Jack.

F. rigida Jack, op. cit. 72; reimpr. Hook. Comp. Bot. Mag. **1:** *222.* 1836; III. 369; IV. *225*; V. *282*. Sumatra, no locality indicated (*F. glaberrima* Blume, Bijdr. 457. 1825; King, Ann. Bot. Gard. Calcutta **1:** 37. *pl. 43.* 1887; Koord. & Val. Atlas Baumart. Java **4:** *fig. 710.* 1916). Northern India to Burma, Indo-China, southern China and Hainan, the Malay Peninsula, Sumatra (*Yates 741!*), and Java. Jack's description is an excellent one and can apply only to this widely distributed, well-known species; his specific name is valid and has priority.

FLACOURTIA Commerson.

F. inermis Roxb. Hort. Beng. 73. 1814, *nom. nud.*, Pl. Coromand. **3:** 16. *pl. 222.* 1819, Fl. Ind. ed. 2, **3:** 833. 1832; Jack, Mal. Misc. **1** (1): 25. 1820; reimpr. Hook. Bot. Misc. **1:** 289. 1830; III. 230; IV. 134; V. 221. Jack's material was from Sumatra and Penang, and it seems to be evident that he correctly interpreted Roxburgh's species. Roxburgh said that his material came from the Moluccas, but as noted elsewhere, he interpreted the Moluccas to be synonymous with Malaya, including Penang and Sumatra. Van Slooten, Bull. Jard. Bot. Buitenz. III. **7:** 373. 1925, has critically considered the species, and concluded that the *tomi tomi* or *lobi lobi*, as this cultivated fruit tree is widely known, is an introduced species in the Moluccas, as it is in many other parts of Malaysia, and further cited Reinwardt as recording the fact that the species was common in the Moluccas in 1820, although it was apparently unknown to Rumphius. He surmised that its introduction in Amboina might have been between 1700 and 1800. It has been introduced into Ceylon, India, and other tropical countries, and in Malaysia extends from the Malay Peninsula to Sumatra, Java, Borneo, Celebes, the Moluccas, and New Guinea, chiefly in cultivation and largely man-distributed. See Koord. & Val. Atlas Baumart. Java **2:** *pl. 335.* 1914 and Ochse, Fruits Dutch East Ind. 47. *pl. 18.* 1931.

GARDENIA Ellis

G. anisophylla Jack in Roxb. Fl. Ind. **2:** 561. 1824. Penang, Singapore = *Randia anisophylla* (Jack) Hook. f. Fl. Brit. Ind. **3:** 114. 1880. This was published by Roxburgh under *Gardenia*, not under *Randia*, as Hooker f. and King indicate. Malay Peninsula, Borneo.

GLAPHYRIA Jack, Trans. Linn. Soc. **14:** 128. 1823; reimpr. Calc. Jour. Nat. Hist. **4:** 306. 1843; IV. 162 = *Leptospermum* Forster (1776).

G. nitida Jack, l.c.; reimpr. ll.cc. Gunong Bunko or Sugarloaf Mountain, inland from Bencoolen, Sumatra = *Leptospermum javanicum* Blume (1826) (*L. commune* Sm. var. *javanica* King). Widely distributed in Malaysia, Smith's species is Australian. Jack's binomial antedates that of Blume, but his specific name is invalidated in *Leptospermum* by the different *L. nitidum* Hook. (1860).

G. sericea Jack, op. cit. 129; reimpr. III. 307; IV. 163. "Found on Pulo Penang [Pegang], an island on the western coast of Sumatra." Ex descr. = *Decaspermum fruticosum* Forst., *sensu lat.* Indo-Malaysia to Polynesia.

GLOBBA Linnaeus.

G. ciliata Jack, Mal. Misc. **2** (7): 5. 1822; reimpr. Hook. Jour. Bot. **1:** 361. 1834; III. 7; IV. 7; V. 248; K. Schum. Pflanzenr. **20 (IV, 46):** 143. 1904. Sumatra. Known only from Jack's description.

GMELINA Linnaeus.

G. villosa Roxb. Hort. Beng. 46. 1814, *nom.*; Roxb. ex Jack, Mal. Misc. **1** (1): 17. 1820, *descr.;* reimpr. Hook. Bot. Misc. **1:** 284. 1830; III. 42; IV. 42; V. 218; Roxb. Fl. Ind. ed. 2, **3:** 86. 1832. Native of Sumatra = *Gmelina elliptica* Sm. (1810). Burma through Malaysia to the Philippines and the Moluccas eastward to Palau.

GOMPHIA Schreber.

G. sumatrana Jack, Mal. Misc. **1** (5): 29. 1820; reimpr. Hook. Bot. Misc. **2:** 77. 1830; III. 198; IV. 102; V. 237. Sumatra = *Ouratea sumatrana* (Jack) Gilg = *Ouratea angustifolia* (Vahl) Baill. = *Ouratea zeylanica* (Lam.) Alst. in Trimen Handb. Fl. Ceyl. **6:** 42. 1931. India and Ceylon through Malaysia to the Philippines and Celebes, represented by very many collections. The oldest specific name is that of Lamarck which Alston accepted. The particular Sumatra form is represented by *Gomphia sumatrana* Jack as interpreted by Planchon in Hook. Ic. **8:** *pl. 712.* 1848. There are those who will perhaps not be satisfied with the generic designation here accepted, and certainly those who will not accept the species as thus interpreted, *sensu latiore.* Thus Ridley, Kew Bull. **1925:** 79. 281. 1925, retained *Gomphia* as the generic name with *G. sumatrana* Jack limited to Sumatra, and the Malay Peninsula form separated as *G. oblongifolia* Ridl.

HALORRHAGIS Forster.

H. disticha Jack, Mal. Misc. **2** (7): 19. 1822; reimpr. Hook. Jour. Bot. **1:** 371. 1834; III. 336; IV. 192; V. 256 (as *Haloragis*). Sumatra, Singapore, and other parts of the Malay Archipelago = *Anisophyllea disticha* (Jack) Baill. (*A. trapezoidalis* Baill.). Malay Peninsula, Sumatra, Borneo.

HEDYCARPUS Jack, Trans. Linn. Soc. **14:** 118. 1823; reimpr. Calc. Jour. Nat. Hist. **4:** 184. 1843; IV. 88 = *Baccaurea* Lour. (1790).

H. malayanus Jack, l.c.; reimpr. III. 185; IV. 89. Sumatra = *Baccaurea malayana* (Jack) King, quoad syn. Jack. Corner, Gard. Bull. Straits Settl. **10:** 288. 1939, demonstrated rather convincingly that the Malay Peninsula form referred here does not represent Jack's species and that the latter stands as a species known only from Jack's description. Jack says that the fruit of *bera tampui* ranks in point of taste and flavor with the *lanséh* (*Lansium domesticum*), which is one of the excellent Malayan fruits. There is an adage to the effect that botanists never collect specimens from cultivated plants. I know of no existing herbarium specimens which represent this Sumatran species.

HEDYCHIUM Koenig.

H. sumatranum Jack, Mal. Misc. 2 (7): 1. 1822; reimpr. Hook. Jour. Bot. **1:** 358. 1834; III. 6; IV. 6; V. 246. West coast of Sumatra at Salumah. As yet unplaced, being known only from Jack's description. Allied to *H. collinum* Ridl. of the Malay Peninsula?

HELOSPORA Jack, Trans. Linn. Soc. **14:** 127. 1823; reimpr. III. 16; IV. 16 = *Timonius* (Rumph.) DC., 1830, nom. conserv.

H. flavescens Jack, l.c. *pl. 4, fig. 3*; reimpr. ll.cc. Sumatra = *Timonius flavescens*; (Jack) Baker, Fl. Maurit. 144. 1877. Malay Peninsula, Sumatra, Borneo, many collections. *Timonius peduncularis* Ridl. (1923) is a synonym. See Boerl. Bull. Dép. Agr. Ind. Néerl. **26:** 34. 1909.

HOYA Linnaeus.

H. *gracilis Jack ex Burkill, Jour. Straits Br. Roy. As. Soc. **73:** *222, 225, fig. 2.* 1916. Pulo Nias. This species was never described.

H. *grandiflora Jack ex Burkill, op. cit. 223, 225. Sumatra, west coast. Never technically described, but the notes indicating that the flowers are two inches in diameter, red shading into white, the whole plant hirsute, is probably sufficient to place the species if one has access to Sumatran material. The name is invalidated by the earlier *H. grandiflora* Blume. It must be closely allied to *Hoya imperialis* Lindl. of the Malay Peninsula and Borneo.

HYDNOPHYTUM Jack, Trans. Linn. Soc. **14:** 124. 1823; reimpr. Calc. Jour. Nat. Hist. **4:** 21. 1843; IV. 21.

H. formicarum Jack, l.c.; reimpr. ll.cc. Sumatra; Griffith in 1843 added Malacca. Its range is now given as Indo-China, Malay Peninsula, Sumatra, Java, Borneo, and the Philippines.

***HYPSAGYNE** Jack ex Burkill, Jour. Straits Br. Roy. As. Soc. **73:** 219, 221, 247. 1916, *nom.* = *Salacia* Linnaeus.

INGA Scopoli.

I. bubalina Jack, Mal. Misc. 2 (7): 77. 1822; reimpr. Hook. Comp. Bot. Mag. **1:** 224. 1836; III. 162; IV. 66; V. 285. Sumatra = *Pithecellobium* (*Pithecolobium*) *bubalinum* (Jack) Benth. Malay Peninsula.

I. clypearia Jack, op. cit. 78; reimpr. ll.cc. Sumatra, at Bencoolen = *Pithecellobium* (*Pithecolobium*) *clypearia* (Jack) Benth. Malay Peninsula and Sumatra through Malaysia to the Philippines and the Moluccas.

IXONANTHES Jack, Mal. Misc. 2 (7): 51. 1822; reimpr. Hook. Comp. Bot. Mag. **1:** 154. 1835; III. 211; IV. 115; V. 272.

I. icosandra Jack, op. cit. 53; reimpr. ll.cc. Bencoolen, Sumatra. Throughout the Malay Peninsula; see King, Jour. As. Soc. Beng. **62** (2): 191. 1893 (Mater. Fl. Mal. Pen. **2:** 433) for synonymy and an amplified description.

I. reticulata Jack, op. cit. 51; reimpr. Hook. l.c.; III. 211; IV. 115; V. 272. West coast of Sumatra at Tapanuly. See King, op. cit. 192, 434, for an amplified description and synonymy. Most or all parts of the Malay Peninsula.

IXORA Linnaeus.

I. neriifolia Jack, Mal. Misc. **2** (7): 82. 1822; reimpr. Hook. Comp. Bot. Mag. **1:** 254. 1836; III. 26; IV. 26; V. 288. West coast of Sumatra. Bremekamp, Bull. Jard. Bot. Buitenz. III. **14:** 241. 1937, limited the species to Sumatra, citing various Sumatran collections, and indicated a Korthals specimen as the lectotype.

I. pendula Jack, op. cit. **1** (5): 11. 1820; reimpr. Hook. Bot. Misc. **2:** 66. 1830; III. 25; IV. 25; V. 228. Penang. See Bremek. Bull. Jard. Bot. Buitenz. III. **14:** 292. 1937, and Corner, Gard. Bull. Straits Settl. **11:** 226. 1941 (*I. opaca* Don, *I. montana* Ridl., *I. candida* Ridl., *I. pendula* Jack var. *opaca* Ridl., *I. parkinsoniana* Craib). Common in the Malay Peninsula, extending to Siam and Sumatra.

JOHNIA Roxburgh = *Salacia* Linnaeus.

J. *sumatrana Jack ex Burkill, Jour. Straits Br. Roy. As. Soc. **73:** 221. 1916, *nom.* West coast of Sumatra. This name unquestionably belongs with the named but undescribed *Salacia* of Jack, of which there is a specimen in the Rijksherbarium, Leiden, as its specific name is the same as that of this *Johnia.* The species is very similar to *Salacia prinoides* (Willd.) DC.

JONESIA Roxburgh.

J. declinata Jack, Mal. Misc. **2** (7): 74. 1822; reimpr. Hook. Comp. Bot. Mag. **1:** 223. 1836; III. 161; IV. 64; V. 283. Sumatra = *Saraca declinata* (Jack) Miq. Malay Peninsula, Sumatra, Java.

KNEMA Loureiro.

K. glaucescens Jack, Mal. Misc. **2** (7) : 35. 1822; reimpr. Hook. Comp. Bot. Mag. **1:** 148. 1835; III. 357; IV. 213; V. 263. West coast of Sumatra at Bencoolen (*Knema glauca* Warb., 1897; *Myristica glauca* Blume, 1825; *M. sumatrana* Blume, 1835). After an attentive comparison of Jack's description with Warburg's excellent description and with herbarium material, I see no reason for not accepting Jack's earlier name for this widely distributed species. Warburg placed Jack's species as a doubtful synonym of *Knema glauca* (Blume) Warb. Nova Acta Acad. Leop.-Carol. Nat. Cur. **68:** 594. 1897 (Monog. Myrist. 594), but was apparently loath to displace Blume's binomial by the earlier one of Jack. At the end of his treatment he added a compiled description of Jack's species, p. 616, under the heading "species negligenda." His hesitancy in adopting Jack's binomial was due to the fact that, as with many of Jack's Sumatran species, there is no extant type. But he cited the following Sumatran collections, *Forbes 2466, Beccari 532, Beccari s.n., Korthals, Teysmann, Junghuhn;* there are many more modern Sumatran collections now available. I do not hesitate in accepting what is manifestly the oldest binomial for this widely distributed Malaysian species. Malay Peninsula, the Nicobar and Andaman Islands, Sumatra, Banka, Java, Borneo.

LAGERSTROEMIA Linnaeus.

L. floribunda Jack, Mal. Misc. **1** (5): 38. 1820; reimpr. Hook. Bot. Misc. **2:**

82. 1830; III. 333; IV. 189; V. 241. Penang. Recorded from Burma, Siam, Indo-China, and the Malay Peninsula.

LANSIUM (Rumph.) Correa, Ann. Mus. Hist. Nat. Paris **10:** 157. *pl. 10, fig. 1.* 1807; Jack, Trans. Linn. Soc. **14:** 115. 1823; reimpr. Calc. Jour. Nat. Hist. **4:** 187. 1843; IV. 91.

L. aqueum Jack, op. cit. 116; reimpr. op. cit. 189; IV. 92. The round-fruited form of the next species, indicated by Jack as "Var. β L. aqueum," its Malay name *ayer ayer*.

L. *domesticum Correa, l.c.; Jack. op. cit. 115. *pl. 4, fig. 1.* 1823; reimpr. Calc. Jour. Nat. Hist. **4:** 188. *pl. 4, fig. 2;* IV. 92. Malay Islands. The commonly cultivated fruit tree known as *langsat*, *lanseh*, *lansone*, *duku*, etc.

The Correa publication of the binomial *Lansium domesticum* (1807) is not admitted in Index Kewensis. He depended on Rumphius for his generic characters, as did Poiret when he accepted *Lansium domesticum* Correa in Lam. Encyl. Suppl. **3:** 299. 1813. If one wishes an older specific name it is supplied by the validly published *Melia parasitica* Osbeck, Dagbok Ostind. Resa 278. 1757, as his extant type at Stockholm has been examined and it is an inflorescence of *Lansium domesticum* Correa.

LASIANTHUS Jack, Trans. Linn. Soc. **14:** 125. 1823; reimpr. Calc. Jour. Nat. Hist. **4:** 23. 1843; IV. 23.

L. attenuatus Jack, l.c.; reimpr. ll.cc. Inland from Bencoolen, Sumatra. Jack's actual type is preserved in the Rijksherbarium, Leiden, this specimen, labeled in his own handwriting, agreeing absolutely with his description, having been acquired by Hasskarl in 1829. It is well matched by *Rahmat Si Boea* (*Toroes*) *1369*, *6728*, *7420* from Asahan, Sumatra. It strongly resembles *L. cyanocarpus* Jack (*L. inaequalis* Blume) except in having very different bracts. Its range, other than Sumatra, is uncertain.

L. cyanocarpus Jack, l.c.; reimpr. ll.cc. Tapanuly on the west coast of Sumatra (*L. inaequalis* Blume, Bijdr. 996. 1826). This is Bakhuizen van den Brink's interpretation of the species, and I agree that the Javan *L. inaequalis* Blume cannot be distinguished from the Sumatran one as described a few years earlier by Jack. *Rahmat si Boea 7042*, *9466*, *9992*, *10020*, all from Asahan, Sumatra, agree with Jack's excellent description. Malay Peninsula, Sumatra, Java, Borneo.

Lasianthus cyanocarpus auctt. plur. (non Jack) is a very different species, which has been given a range from northern India to southern China and Formosa, southward through Malaysia and the Philippines to New Guinea. One of its rather numerous synonyms is *L. oculus-cati* Miq. Miquel himself has cleared up the mystery, for he clearly states, Fl. Ind. Bat. **2:** 315. 1857, that *Lasianthus oculus-cati* Miq. was based on *L. cyanocarpus* Blume, Bijdr. 996. 1826, non Jack. In other words, Blume merely misinterpreted Jack's description and based his description of *L. cyanocarpus* on Javan material. For this widely distributed *Lasianthus cyanocarpus* Blume, non Jack, I propose **Lasianthus hirsutus** (Roxb.) comb. nov., typified by *Triosteum hirsutum* Roxb. Hort. Beng. 68. 1814, *nom. nud.*, Fl. Ind. **2:** 180. 1824, *descr.*, ed. 2, **1:** 539. 1832, type from Chittagong. One might hesitate to accept this name because of Roxburgh's very short description but for the fact that when *Lasianthus roxburghii* Wight, Calc. Jour. Nat. Hist. **6:** 501. 1846, was proposed as a new name for *Triosteum hirsutum* Roxb., Wight provided additional descriptive data. Furthermore, Roxburgh's species is represented in the

British Museum herbarium by two excellent sheets, the type collection. Britten, Jour. Bot. **47:** 43. 1909, cleared up the confusion which had existed up to that date. I have examined the Roxburgh specimens. They do not represent *Lasianthus cyanocarpus* Jack as Britten thought, but rather *L. cyanocarpus* sensu Blume et auctt. plur. (*L. oculus-cati* Miq.). The characteristic bracts are larger than in specimens from the Malay Archipelago, the largest ones being 5 cm. long and 2.5 cm. wide. Other synonyms are *L. bracteatus* Wight (1846), type from the Malay Peninsula, *L. oculus-cati* Miq. (1857), a new name for *L. cyanocarpus* sensu Blume, non Jack, type from Java, *L. laevicaulis* Kurz (1875), type from the Nicobar Islands, and *L. everettii* Merr. (1908), type from the Philippines. Eastern India to Indo-China and Hainan, through the Malay Archipelago and the Philippines to the Moluccas and New Guinea.

LAURUS Linnaeus.

L. incrassata Jack, Mal. Misc. **2** (7): 33. 1822; reimpr. Hook. Comp. Bot. Mag. **1:** 147. 1835; III. 355; IV. 211; V. 262. Sumatra, west coast, at Natal = **Dehaasia incrassata** (Jack) comb. nov. (*Dehaasia microcarpa* Blume, Rumphia **1:** 162. *pl.* 44. 1835; *Haasia microcarpa* Nees; *H. incrassata* Nees; *Persea incrassata* Nees; *Machilus incrassatus* Nees). Malay Peninsula, Sumatra, Java, Borneo.

L. parthenoxylon Jack, Mal. Misc. **1** (5): 28. 1820; reimpr. Hook. Bot. Misc. **2:** 76. 1830; III. 354; IV. 210; V. 236. Sumatra = *Cinnamomum parthenoxylon* (Jack) Meisn. in DC. Prodr **15** (1): 26. 1864; Gamble, Jour. As. Soc. Beng. **75** (1): 87. 1912 (Mater. Fl. Mal. Pen. **5:** 87), cum syn. Burma to southeastern China southward through the Malay Peninsula to Sumatra, Java, Borneo, and Celebes.

LECANANTHUS Jack, Mal. Misc. **2** (7): 83. 1822; reimpr. Roxb. Fl. Ind. **2:** 319. 1824; reimpr. Hook. Comp. Bot. Mag. **1:** 254. 1836; III. 28; IV. 28; V. 288.

L. erubescens Jack, l.c.; reimpr. ll.cc. Inland from Bencoolen, Sumatra. Represented by many collections from the Malay Peninsula, Sumatra, and Borneo.

LEUCONOTIS Jack, Trans. Linn. Soc. **14:** 121. 1823; reimpr. Calc. Jour. Nat. Hist. **4:** 30. 1843; IV. 30.

L. anceps Jack, l.c. *pl. 4, fig. 2*; reimpr. ll.cc. *pl. 4, fig. 2*. Sumatra (*L. eugenifolia* A. DC., 1844; *L. cuspidata* Blume, 1849; *Melodinus eugenifolius* Wall. list no. 1616. 1829, *nom. nud.*). Malay Peninsula, Sumatra, Borneo. The cited Sumatra collections are *Teysmann 4053*, *Beccari 844*, *Curtis 3551*, *Forbes 1586*, *2725*, with at least a half dozen additional modern ones from that island. It is interesting to note that when Griffith reprinted Jack's original description in 1844, he added Malacca to the range of the species. I do not hesitate in accepting Jack's binomial, the type of the genus, to replace the later and currently used *L. eugenifolia* A. DC., in spite of the fact that Jack's type is apparently not extant.

LEUCOPOGON R. Brown (1810) = **Styphelia** Smith (1793).

L. malayanum Jack, Mal. Misc. **1** (5): 20. 1820; reimpr. Roxb. Fl. Ind. **2:** 301. 1824; reimpr. Hook. Bot. Misc. **2:** 71. 1830; III. 37; IV. 37; V. 232. Singapore = *Styphelia malayana* (Jack) J. J. Sm. (*S. malaica* Spreng.; *S.*

malayica Druce). Common in various parts of the Malay Peninsula, occurring also in Banca and Borneo.

LIMONIA Linnaeus.

L. *leptostachya Jack ex Wall. List no. 8585. 1848, *nom.* sub *Bennettia* R. Br., et Hook. f. Fl. Brit. Ind. **1**: 492. 1875, nom. in syn. Penang = *Galearia jackiana* (R. Br.) Miq. = *G. fulva* (Tul.) Miq. fide Ridley. Jack's Penang specimen was distributed as *Wallich 8585A*. I suspect that Ridley is correct in accepting the binomial *Galearia fulva* (Tul.) Miq. *Cremostachys fulva* Tul. was published in 1851; *Bennettia jackiana* R. Br. in 1852. Malay Peninsula, Penang, and Singapore.

LINOCIERA Swartz.

L. odorata Jack, Mal. Misc. **2** (7): 96. 1822; reimpr. Hook. Comp. Bot. Mag. **1**: 259. 1836; III. 33; IV. 33; V. 295. West coast of Sumatra at Natal, and on Pulo Mosella. Known only from Jack's description. One suspects from the localities cited that this was a low altitude species, perhaps from near the seashore. *Chionanthus litoreus* Miq. Fl. Ind. Bot. Suppl. 559. 1862 = *Linociera litorea* Knobl. (1894), type a *Teysmann* specimen from Siboga on the west coast of Sumatra north of Natal, from its description is almost certainly Jack's species; but Miquel had only a fruiting specimen, and Jack's lucid description was based on a flowering one. It is certainly not *Linociera purpurea* Vahl nor *L. dichotoma* Wall., to both of which it has been reduced.

LORANTHUS Linnaeus.

L. coccineus Jack, Mal. Misc. **1** (1): 8. 1820; reimpr. Roxb. Fl. Ind. **2**: 215. 1824; reimpr. Hook. Bot. Misc. **1**: 278. *pl. 58*. 1830; III. 347; IV. 203; V. 213. Singapore = *Helixanthera coccinea* (Jack) Danser, Bull. Jard. Bot. Buitenz. III. **11**: 374. 1931, cum syn. Indo-China to Burma, the Malay Peninsula, Sumatra and Borneo. I suspect that the cited Horsfield "Java" specimen actually came from Sumatra, as Horsfield botanized in Sumatra in 1818. There are no actual Java specimens known.

L. cylindricus Jack ex Roxb. Fl. Ind. **2**: 213. 1824; reimpr. Calc. Jour. Nat. Hist. **4**: 349. 1843; IV. 205. Sumatra = *Helixanthera cylindrica* (Jack) Danser, op. cit. 377, cum syn. Burma to Indo-China, the Malay Peninsula, Sumatra, Java, Borneo, and Celebes.

L. ferrugineus Roxb. Hort. Beng. 87. 1814, *nom.*; Roxb. ex Jack, Misc. **1** (1): 9. 1820; reimpr. Roxb. Fl. Ind. **2**: 208. 1824; reimpr. Hook. Bot. Misc. **1**: 279. *pl. 59*. 1830; III. 348; IV. 204; V. 213; Roxb. Fl. Ind. **2**: 207. 1824. Roxburgh's very short description was based on a Penang specimen; Jack's ample and excellent one, reproduced by Wallich following that of Roxburgh in 1824, was based on Sumatran material. As Danser noted, Jack's description antedated that of Roxburgh, but Jack correctly credited the binomial to Roxburgh = *Scurrula ferruginea* (Roxb.) Danser, op. cit. 432, cum syn. Malay Peninsula to Sumatra, Borneo, Java, and Palawan.

L. incarnatus Jack ex Roxb. Fl. Ind. **2**: 213. 1824; reimpr. Calc. Jour. Nat. Hist. **4**: 350. 1843; IV. 206. Pulo Nias = *Dendrophthoë incarnata* (Jack) Miq.; Danser, op. cit. 411, cum syn. Known only from Sumatra and some of the west coast islands.

L. patulus Jack ex Roxb. op. cit. 214; reimpr. III. 351; IV. 207. Inland from Bencoolen, Sumatra = *Macrosolen cochinchinensis* (Lour.) Danser, op. cit. 279, cum syn. Northern India to southeastern China southward through the Malay Peninsula to Sumatra, Java, Borneo, the Philippines, and Celebes.

L. retusus Jack ex Roxb. op. cit. 212; reimpr. III. 349; IV. 205. Singapore = *Macrosolen retusus* (Jack) Danser, op. cit. 296. Malay Peninsula, Sumatra, and Borneo. The Java record, based solely on a *Lobb* collection, is surely erroneous, as this specimen came from either the Malay Peninsula or Borneo; see Merrill, Philip. Jour. Sci. **10**: Bot. 184. 1915, Enum. Philip. Pl. **4**: 76. 1926.

LOXONIA Jack, Trans. Linn. Soc. **14**: 40. 1823; reimpr. Calc. Jour. Nat. Hist. **4**: 59. 1843; IV. 59.

L. discolor Jack, l.c.; reimpr. ll.cc. Inland from Bencoolen, Sumatra (*Loxophyllum racemosum* Blume, Bijdr. 751. 1826; *Loxonia acuminata* R. Br. in Benn. Pl. Jav. Rar. 105. *pl. 25*. 1838). Sumatra, Java. I note in passing that Robert Brown's description and illustration of 1838 were based on material collected by Horsfield in Sumatra in 1818 when he accompanied Sir Stamford Raffles on a trip from Padang to the Menangaboo country. The account closes with the statement: "He did not observe it in Java."

L. hirsuta Jack, op. cit. 41; reimpr. III. 60; IV. 60. Inland from Bencoolen, Sumatra = praec., fide C. B. Clarke in DC. Monog. Phan. **5**: 158. 1883. Jack apparently separated this from his *L. discolor* chiefly by its hirsute leaves and branched inflorescences.

MANGIFERA Linnaeus.

M. caesia Jack in Roxb. Fl. Ind. **2**: 441. 1824; reimpr. Calc. Jour. Nat. Hist. **4**: 174. 1843; IV. 78. Sumatra. A species in part man-distributed (Java, Philippines). Apparently a native of the Malay Peninsula, Sumatra, and Borneo, although in these regions sometimes also planted.

M. foetida Lour.; Jack ex Roxb. l.c.; reimpr. III. 174; IV. 78. Penang and Singapore. Loureiro's species was correctly interpreted by Jack, and Wallich List 8488A is an actual Jack specimen. This is, in part, a man-distributed species, now extending from Burma to Indo-China southward through the Malay Peninsula to Sumatra, Java, Borneo, Celebes, the Moluccas, and New Guinea.

M. quadrifida Jack ex Roxb. op. cit. 440; reimpr. III. 173; IV. 77. Sumatra "and other islands of the eastern Archipelago." Wallich List no. 8489 is a Jack specimen from Penang. Now known from the Malay Peninsula, Sumatra, and Borneo.

M. *rubicunda Jack ex Burkill, Jour. Straits Br. Roy. As. Soc. **73**: 152. 1916, descr. abbr. Penang = *M. foetida* Lour., supra.

MELASTOMA Linnaeus.

M. alpestre Jack, Trans. Linn. Soc. **14**: 20. *pl. 1, fig. 3*. 1823 (*alpestris*); reimpr. Calc. Jour. Nat. Hist. **4**: 330. *pl. 1, fig. 3*. 1844; IV. 186. On the summit of Gunong Bunko or Sugarloaf Mountain, inland from Bencoolen, Sumatra = *Medinilla alpestris* (Jack) Blume, Flora **14**: 514. 1831. Bakhuizen van den Brink f., Rec. Trav. Bot. Néerl. **40**: 182. 1943, placed this as a doubtful synonym of *Medinilla javanensis* (Blume) Blume, which dates from 1826. Should this prove to be correct, and I think it is, then Jack's specific name will replace that of Blume. It should be noted that the type of *Medinilla verrucosa* Baker f., which Bakhuizen van den Brink f. reduced to Blume's species without discussion, was from Mount Dempo a short distance south of Gunong Bunko. Sumatra, various collections; Java, many collections; Bali.

M. bracteatum Jack op. cit. 9 (*bracteata*); reimpr. IV. 320; V. 176. Penang =

Dissochaeta bracteata (Jack) Blume, Flora **14**: 495. 1831; Bakh. f., Rec. Trav. Bot. Néerl. **40**: 225. 1943, cum syn. Malay Peninsula, Sumatra, Borneo, and perhaps Java.

M. decemfidum Roxb. Hort. Beng. 90. 1814, *nom. nud.*; Roxb. ex Jack, Trans. Linn. Soc. **14**: 6. 1823, descr.; reimpr. III. 317; IV. 173; Roxb. Fl. Ind. ed. 2, **2**: 405 [406]. 1832. Penang = *Melastoma sanguineum* Sims, Bot. Mag. **48**: *pl. 2241.* 1821. Burma to southeastern China southward to the Malay Peninsula, Sumatra, Borneo, and Java.

M. erectum Jack, op. cit. 5 (*erecta*); reimpr. III. 316; IV. 172. Sumatra, west coast at Tapanuly. This has been placed as a doubtful synonym of *Melastoma polyanthum* Blume (1831). Bakhuizen van den Brink f., op. cit. 103, left it as a species unknown to him, perhaps a villose form of *M. polyanthum* Blume. Whenever collections from near the type locality become available, it will probably be possible to place this species. *Melastoma polyanthum* Blume, *sensu lat.*, is credited with extending from India to southern China and throughout Malaysia to northeastern Australia.

M. exiguum Jack, op. cit. 10. *pl. 1, fig. 2, a–b* (*exigua*); reimpr. III. 321. *pl. 2, fig. 2, a–b*; IV, 177. Penang = *Allomorphia exigua* (Jack) Blume, Flora **14**: 523. 1831. See King, Jour. As. Soc. Beng. **69** (2): 10. 1900. Malay Peninsula and, fide King, also in Sumatra (*Forbes 3062*); but Bakhuizen van den Brink f., Rec. Trav. Bot. Néerl. **40**: 290. 1943, cites *Forbes 3062* under *A. magnifica* (Miq.) Guill. (*Sonerila magnifica* Miq.) of Sumatra, from which one surmises that the latter may prove to be a synonym of *Allomorphia exigua* (Jack) Blume, as is also *Melastoma impuber* Roxb. Fl. Ind. ed. 2, **2**: 405. 1832, according to King. One should not be misled by Roxburgh's statement, "native of Moluccas," as he applied this term to material from parts of the Malay Archipelago. *Rahmat Si Boea 8620* from Asahan, Sumatra, matches our Penang specimen (*Henderson 35358*) rather closely.

M. eximium Jack, op. cit. 17 (*eximia*); reimpr. III. 327; IV. 183. Gunong Bunko or Sugarloaf Mountain, inland from Bencoolen = *Medinilla eximia* (Jack) Blume, Flora **14**: 515. 1831. A species known only from Jack's distinctly good description.

M. fallax Jack, op. cit. 13: reimpr. III. 323; IV. 179. Sumatra = *Omphalopus fallax* (Jack) Naud. Ann. Sci. Nat. III. Bot. **15**: 277. 1851. Sumatra, Java, Bali, a variety reported from New Guinea. For its extensive synonymy see Bakhuizen van den Brink f., op. cit. 118.

M. glaucum Jack, op. cit. 15 (*glauca*); reimpr. III. 325; IV. 181. Penang = *Anplectrum glaucum* Triana = *Melastoma divaricatum* Willd. = *Anplectrum divaricatum* Triana = *Diplectria divaricata* (Willd.) O. Kuntze, Rev. Gen. Pl. 246. 1891; Bakh. f. Rec. Trav. Bot. Néerl. **40**: 200. 1943, cum syn. Siam, Malay Peninsula, Sumatra, Java, Borneo, Celebes, Moluccas, and New Guinea.

M. gracile Jack, op. cit. 18 (*gracilis*); reimpr. III. 324; IV. 180. Sumatra = *Dissochaeta gracilis* (Jack) Blume in Flora **14**: 498. 1831 = *Neodissochaeta gracilis* (Jack) Bakh. f. Rec. Trav. Bot. Néerl. **40**: 137. 1943, cum syn. Siam to the Malay Peninsula, Sumatra, Borneo, Java.

M. malabathricum sensu Jack, op. cit. 4. *pl. 1, fig. 1, a–g* (*malabathrica*); reimpr. III. 315, *pl. 8, fig. 1*; IV. 171, non Linn. "Abundant throughout Sumatra and the Malay Islands" = *Melastoma polyanthum* Blume. As currently interpreted a collective species extending from India to southern China, through Malaysia and the Philippines to New Guinea and Australia; see Bakhuizen van den Brink f., Rec. Trav. Bot. Néerl. **40**: 64. 1943, for its extraordinary synonymy.

M. nemorosum Jack, op. cit. 8 (*nemorosa*); reimpr. III. 319; IV. 175. Sumatra, Pulo Nias = *Marumia nemorosa* (Jack) Blume, Flora **14:** 505. 1831 = *Macrolenes nemorosa* (Jack) Bakh. f. Rec. Trav. Bot. Néerl. **40:** 206. 1943, cum syn. Malay Peninsula, Sumatra, Borneo. Bakhuizen van den Brink f., op. cit. 26, 203, correctly, I believe, accepted *Macrolenes* Naudin as the proper generic name for this group, because *Marumia* Blume (1831) is invalidated by the earlier and totally different *Marumia* Reinwardt (1823, 1827), a synonym of *Saurauia* Willdenow.

M. obvolutum Jack, op. cit. 3 (*obvoluta*); reimpr. III. 314; IV. 170. West coast of Sumatra at Tapanuly. Cogniaux, in DC. Monog. Phan. **7:** 349. 1891, on the basis of an examination of Jack's type, which is preserved in the Delessert Herbarium at Geneva, recognized this as a valid species, extending its range to the Philippines (*M. homostegium* Naud.). Pending a re-examination of this extant type, I accept his conclusions rather than Bakhuizen van den Brink's reduction of it, op. cit. 80, to a variety of *M. malabathricum* Linn. Sumatra, Borneo, Philippines.

M. pallidum Jack, op. cit. 12 (*pallida*); reimpr. III. 322; IV. 178. Malay Islands, no definite locality indicated but probably Penang or Singapore = *Dissochaeta pallida* (Jack) Blume, Flora **14:** 500. 1831. Malay Peninsula, Banca; see Bakhuizen van den Brink f. op. cit. 229 for synonymy and a complete description.

M. pulverulentum Jack, op. cit. 19 (*pulverulenta*); reimpr. III. 329; IV. 185. Singapore, Sumatra, and islands on the west coast of Sumatra = *Pogonathera pulverulenta* (Jack) Blume, Flora **14:** 521. 1831; Bakh. f. Rec. Trav. Bot. Néerl. **40:** 128. 1943, cum syn. Malay Peninsula, Sumatra, Java, Borneo, Philippine Islands, southward to New Guinea.

M. rotundifolium Jack, op. cit. 11 (*rotundifolia*); reimpr. III. 321; IV. 177. Musi region, inland from Bencoolen, Sumatra = *Phyllagathis rotundifolia* (Jack) Blume, Flora **14:** 507. 1831; Bakh. f., op. cit. 267. Siam, Malay Peninsula, Sumatra.

M. rubicundum Jack, op. cit. 18 (*rubicunda*); reimpr. III. 328 IV. 184. Singapore = *Medinilla rubicunda* (Jack) Blume, Flora **14:** 512. 1831; Merrill, Brittonia **4:** 128. 1941 (*M. hasseltii* Blume, op. cit. 513). Malay Peninsula, Sumatra, Borneo, Java, Bali, central and southern Philippines, and Celebes. Bakhuizen van den Brink f. Rec. Trav. Bot. Néerl. **40:** 197. 1943, failed to place Jack's species (type from Singapore) probably because the species had been confused with the distinctly different *M. erythrophylla* (Wall.) Lindl. of India and Upper Burma. He made *Medinilla hasseltii* Blume a variety of the older *M. crassifolia* (Blume) Blume, which dates from 1826. But Jack's specific name is the oldest one for this group.

M. stellulatum Jack, op. cit. 6 (*stellulata*); reimpr. **4:** 318; IV. 174. West coast of Sumatra, at Saloomah = *Marumia stellulata* (Jack) Blume, Flora **14:** 505. 1831 = *Macrolenes stellulata* (Jack) Bakh. f. op. cit. 216, cum syn. Sumatra, Borneo.

M. viminale Jack, Trans. Linn. Soc. **14:** 16. 1823 (*viminalis*); reimpr. III. 327; IV. 183. Sumatra, no definite locality indicated = *Anplectrum viminale* (Jack) Triana, Trans. Linn. Soc. **28:** 84. *pl. 7, fig. 90 a.* 1871 (*Aplectrum viminale* Blume; *Backeria viminalis* Bakh. f. Rec. Trav. Bot. Néerl. **40:** 133. 1943,[14]

[14] **Aplectrum* Blume, Flora **14:** 502. 1831, is invalidated by *Aplectrum* (Nutt.) Torr. (1826). For this reason A. Gray, Bot. Wilkes U. S. Explor. Exped. 597, 1854, correctly proposed the new generic name *Anplectrum* for this Malaysian group. He

cum syn.). Sumatra, Billiton, with a variety, fide Bakhuizen van den Brink (*Anplectrum rostratum* Blume), in Mentawi, Sumatra, Malay Peninsula, Java and Borneo.

MELIA Linnaeus.

M. excelsa Jack, Mal. Misc. **1** (1): 12. 1820; reimpr. Hook. Bot. Misc. **1**: 281. 1830; III. 190; IV. 94; V. 215. Penang. A valid species, but one not well understood until recently. For a critical consideration and a detailed description see Corner, Gard. Bull. Straits Settl. **10**: 263–267. *fig. 1–2.* 1939. A duplicate of Jack's type was distributed under Wallich List no. 1253, the entry being "Penang, b. Jack," but the specimen at Kew is very fragmentary, the flowers all fallen, fide Airy Shaw in lit. Corner expressed the opinion that the old trees observed by him at the Penang cemetery were the very ones from which Jack's material was taken, which may well be the case. I agree with Mr. Corner, and Mr. Airy Shaw confirms this, that *Azadirachta integrifoliola* Merr., type from Palawan, is the same as Jack's species. I have material from Sumatra (Bencoolen), *Neth. Ind. For. Serv. 31664*; Borneo, *Neth. Ind. For. Serv. 29263, 29414*; and from British Malaya, Penang, *Md. Haniff 7586*, Perak, *Corner 31642*, Selangor, *Corner 31698*, and various Palawan collections distributed as *Azadirachta integrifoliola* Merr. which, I believe, all represent Jack's species. The range, Malay Peninsula, Sumatra, Borneo, Palawan, Basilan, is a natural one. Because of its strictly pinnate leaves this species impresses me as being anomalous in *Melia*.

MEMECYLON Linnaeus.

M. coeruleum Jack, Mal. Misc. **1** (5): 26. 1820; reimpr. Hook. Bot. Misc. **2**: 75. 1830 (caeruleum); III. 310; IV. 166; V. 235. Penang. In all or most provinces of the Malay Peninsula; also in Sumatra. The credited Philippine range (*M. manillanum* Naud.) was due to an erroneously localized collection, Naudin's type, *Cuming 2322*, being from Malacca.

M. paniculatum Jack, op. cit. **2** (7): 62. 1822; reimpr. Hook. Comp. Bot. Mag. **1**: 219. 1836; III. 312; IV. 167; V. 277. Tapanuly and Pulo Bintangor (just south of Padang), west coast of Sumatra. I interpret this, from Jack's excellent description (he failed to indicate whether the branchlets were terete, subterete, or angled) as the same as *M. costatum* Miq. (1850), as interpreted by Bakhuizen van den Brink, Rec. Trav. Bot. Néerl. **40**: 345. 1943, cum syn., a very common, variable, and widely distributed species extending from the Malay Peninsula (possibly from Siam) throughout Malaysia to the

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gave no generic description, this being unnecessary as long as he cited *Aplectrum* Blume as the name-bringing synonym, as he did. Hence what Blume actually described fixed the type of *Anplectrum* A. Gray; the fact that Gray's single Fiji species proves to be a representative of another genus has no bearing on the case. Bakhuizen van den Brink f., Rec. Trav. Bot. Néerl. **40**: 130–146. 1943, apparently assuming that Gray prepared a new generic description, erroneously decided that the latter's new generic name was invalid, and in its place proposed a new generic name *Backeria* Bakh. f. to replace *Anplectrum* A. Gray. Unfortunately for the new generic name *Backeria* all three of the binomials proposed by Blume in 1831 under *Aplectrum* Blume, namely *A. rostratum* Blume, *A. viminale* Blume, and *A. stipulare* Blume, also form the entire basis of *Backeria* Bakh. f. At the same time he segregated from *Anplectrum* a certain group of species for which he proposed a new generic name *Neodissochaeta* Bakh. f. If he had assigned the new generic name *Backeria* to this group, it could have been maintained; as it is he merely added another generic synonym to *Anplectrum* A. Gray (*Aplectrum* Blume).

Moluccas and represented by very many collections. Bakhuizen van den Brink merely listed Jack's species as one unknown to him (there is no extant type). The Jack description is distinctly definite (except as to the branchlet characters), a plant with oblong-ovate, obtusely acuminate leaves 7 to 8 inches long, with distinct nerves which unite into a line near the margins. If we accept the definitely collective species as Bakhuizen van den Brink interprets it, I see no reason why we should not also accept its oldest published binomial.

MICROCOS Linnaeus.

M. glabra Jack, Mal. Misc. **1** (1): 14, 1820; reimpr. Hook. Bot. Misc. **1**: *282.* 1830; III. *222*; IV. 126; V. 216. Carnicobar [15] Island = ***Microcos paniculata*** Linn. India to the Nicobar Islands, Siam, Burma, and southern China southward to the Malay Peninsula and Java.

M. tomentosa Smith; Jack, op. cit. 13; reimpr. Hook. op. cit. 28. ***pl. 60***; III. *221*; IV. 126; V. 216. Penang. Jack apparently interpreted Smith's species correctly and correctly cited the very inadequately described and later *Grewia paniculata* Roxb. as a synonym (type also from Penang). Siam and Indo-China to the Malay Peninsula, Sumatra, and Java.

MILLINGTONIA Roxburgh (1820); Jack, Mal. Misc. **2** (7): 29. 1822; reimpr. Hook. Jour. Bot. **1**: 377. 1834; III. 180; IV. 84; V. 260, non Linn. f. (1781) = *Meliosma* Blume (1823).

M. sumatrana Jack, Mal. Misc. **2** (7): 30. 1822; reimpr. Hook. Jour. Bot. **1**: 378. 1834; III. 181; IV. 85; V. 261. Pulo Nias off the west coast of Sumatra = ***Meliosma sumatrana*** (Jack) Walp. (*M. nitida* Blume). Malay Peninsula, Sumatra, Java, Borneo. *Meliosma nitida* Blume, which is currently placed as a synonym of Jack's species, may prove to be distinct.

MILNEA Roxburgh = **Aglaia** Loureiro.

M. montana Jack, Trans. Linn. Soc. **14**: 118. 1823; reimpr. Calc. Jour. Nat. Hist. **4**: 180. 1843; IV. 94. Near Bencoolen, Sumatra. Clearly an *Aglaia*, but as yet not associated with any other described species. Jack's rather good description follows his consideration of *Lansium*, and at the very end his binomial appears thus: "if admitted as a separate genus, the above will constitute a second species . . . . and may be denominated M. montana."

MIMOSA Linnaeus.

M. jiringa Jack, Mal. Miscel. **1** (1): 14. 1820; reimpr. Hook. Bot. Misc. **1**: 282. 1830; III. 161; IV. 66; V. 285 = ***Pithecellobium*** (***Pithecolobium***) ****jiringa*** (Jack) Prain, Jour. As. Soc. Beng. **66** (2): 267. 1897 (Mater. Fl. Mal. Penin. **3**: 267), in obs. Penang, Malacca, Tenasserim and the Malay Peninsula, Sumatra, Borneo, Java (mostly planted). See Merr. Philip. Jour. Sci. **14**: 243. 1919; Contr. Arnold Arb. **8**: 72. 1934. The still earlier binomials *Mimosa koeringa* Roxb. Hort. Beng. 40. 1814 and *M. djiringa* Roxb. op. cit. 93 are *nomina nuda*.

[15] Car Nicobar is the most northern island of the Nicobar group, north of Sumatra, which Jack apparently visited either on his voyage from Calcutta to Penang, or on his one trip from Bencoolen to Calcutta and return. The basis of *Connarus ? jackianus* Wall. List no. 8552 = *Cupania jackiana* Hiern = *Lepidopetalum jackianum* Radlk. was a Jack specimen also collected on Car Nicobar. *Connarus jackianus* Schellenb. (1924) is a valid Bornean species, having nothing to do with the Wallichian binomial; and the latter, being a *nomen nudum*, does not, or course, invalidate Schellenberg's later name.

MONOCERA Jack, Mal. Misc. **1** (5): 42. 1820; reimpr. Hook. Bot. Misc. **2:** 85. 1830; III. *225*; IV. *129*; V. *243* = *Elaeocarpus* Linn. sect. *Monocera* (Jack) Benth.

M. ferruginea Jack, op. cit. 44; reimpr. Hook. op. cit. 86; III. *226*; IV. 130; V. 244. Singapore = *Elaeocarpus ferrugineus* (Jack) Steud. Nomencl. ed. 2, **1:** 545. 1840 (*E. jackianus* Wall.; *E. borneensis* Knuth). Malay Peninsula, Borneo. See Corner, Gard. Bull. Straits Settl. **10:** 319. 1939; Airy Shaw, Kew Bull. **1949:** 165. 1949; Merr. Jour. Arnold Arb. **32:** 180. 1951.

M. petiolata Jack, op. cit. 43; reimpr. Hook. op. cit. 86; III. 226; IV. 130; V. 243. Penang = *Elaeocarpus petiolatus* (Jack) Wall. List no. 2673. 1829; A. Gray, Bot. Wilkes U. S. Expl. Exped. **1:** 203. 1854. The Wallich List entry is merely "2673 Elaeocarpus (Monoceros) petiolata Jack — Hb. 1824 Penang 1822," so there is a possibility of a quibble as to whether or not this constitutes publication under *Elaeocarpus*. Malay Peninsula, Sumatra.

MORINDA Linnaeus.

M. polysperma Jack, Mal. Misc. **1** (5): 14. 1820; reimpr. Roxb. Fl. Ind. **2:** 204. 1824; reimpr. Hook. Bot. Misc. **2:** 68. 1830; III. 20; IV. 20; V. *229*. Singapore = *Lucinaea polysperma* (Jack) K. Schum. (*L. morindae* DC. Prodr. **4:** 368 (1830). Jack suggested that his new species of *Morinda* might represent a separate genus. It is the sole basis of the genus *Lucinaea* DC., described ten years later. Malay Peninsula, Sumatra, Borneo.

M. tetramera Jack, op. cit. 13; reimpr. Roxb. op. cit. 203; reimpr. Hook. op. cit. 67; III. 19; IV. 19; V. *229*. Native of the Malay Islands (probably Penang or Singapore) = *Morinda umbellata* Linn. *sensu lat.* India and Ceylon to southern China, through Malaysia and the Philippines to northeastern Australia (as a collective species).

MURRAYA Koenig ex Linnaeus, Mant. **2:** 558. 1771 (*Murraea*); Murr. Syst. ed. 13, 331. 1774, nom. conserv. (*Chalcas* Linn., 1767).

M. paniculata (Linn.) Jack, Mal. Misc. **1** (5): 31. 1820; reimpr. Hook. Bot. Misc. **2:** 79. 1830; III. 191; IV. 95; V. 238 (*Chalcas paniculata* Linn.). Jack's description was apparently based on material from Penang or Singapore, he citing *Chalcas paniculata* Lour. (which is *Chalcas paniculata* Linn.) and *Camunium* Rumph. Herb. Amb. **5:** 26. *pl. 17*. 1747, which also represents the Linnaean species. A common, variable, and widely distributed Malaysian species.

MYRMECODIA Jack, Trans. Linn. Soc. **14:** 122. 1823; reimpr. Calc. Jour. Nat. Hist. **4:** 20. 1843; IV. 20.

M. tuberosa Jack, op. cit. 123; reimpr. ll.cc. Pulu Nias, off the west coast of Sumatra. See Beccari, Malesia **2:** 99. *pl. 13, 14*. 1884. Malay Peninsula, Java, Borneo.

NEPENTHES Linnaeus; Jack [App. Descr. Mal. Pl. 20, 1820]; reimpr. Jack ex Hook. Comp. Bot. Mag. **1:** 269. 1836; III. 362; IV. *222*.

N. ampullaria Jack [App. Descr. Mal. Pl. 23 1820]; reimpr. Jack ex Hook. op. cit. 271; III. 366; IV. *222*. Singapore and on Bintang Island. See Danser, Bull. Jard. Bot. Buitenz. III. **9:** 265–270. 1938. Malay Peninsula, Sumatra, Borneo, New Guinea, very many collections. Bintang (Bintan) Island is in the Rhio Archipelago, southeast of Singapore. There are two sheets from

Jack in the type collection in the herbarium of the British Museum (Natural History).

N. distillatoria sensu Jack [App. Descr. Mal. Pl. 23. 1820]; reimpr. Jack ex Hook. l.c.; III. 368; IV. 224, non Linn. Singapore, Malacca = *N. gracilis* Korth. Malay Peninsula, Sumatra, Borneo, Celebes; see Danser, op. cit. 290 for details. The Linnaean species is confined to Ceylon. At the British Museum are two fragmentary specimens from Jack, one labeled "mixed with *distillateria*," which is *N. albomarginata* Lobb, the other (sterile) *L. gracilis* Korth.

N. phyllamphora Willd.; Jack [App. Descr. Mal. Pl. 23. 1820]; reimpr. Jack ex Hook. l.c.; III. 367; IV. 223. West coast of Sumatra at Bencoolen = *N. mirabilis* (Lour.) Druce, Rep. British Exch. Club **1916**: 637. 1917 (July); Merr. Interpret. Herb. Amb. 242. 1917 (August). Southeastern China and Indo-China through the Malay Peninsula to Sumatra, Borneo, Java, Mindanao, Celebes, and the Moluccas to Palau, New Guinea, and northeastern Australia.

N. rafflesiana Jack [App. Descr. Mal. Pl. 21. 1820]; reimpr. Jack ex Hook. op. cit. 270; III. 364; IV. 220. Singapore. See Danser, op. cit. 357–361. Malay Peninsula, Sumatra, Borneo, very many collections. There are two Jack sheets in the type collection, British Museum (Nat. Hist.) herbarium, inscribed "No. 3 Nepenthes si nova sit Rafflesiana from Singapore. Dr. Jack." These Jack Singapore *Nepenthes* specimens were manifestly sent by him to Robert Brown in London, supplementing a larger lot sent to him from Penang previous to Jack's departure for Singapore. The highest number noted in this sending of Singapore plants is four.

NEPHELIUM Linnaeus.

N. lappaceum Linn. Mant. **2**: 566. 1771; Jack, Mal. Misc. **1** (1): 10. 1820; reimpr. Hook. Bot. Misc. **1**: 279. 1830; III. 183; IV. 87; V. 214. "Frequent throughout the Malay countries and islands." Jack correctly interpreted the rambutan, which is the Linnaean species. It is one of the better of the cultivated fruit trees of Malaysia.

***NEUROPTERIS** Jack ex Burkill, Jour. Straits Br. Roy. As. Soc. **73**: 216. 1916, *nom.* = *Neuropeltis* Wall.

OCTAS Jack, Mal. Misc. **2** (7): 64. 1822; reimpr. Hook. Comp. Bot. Mag. **1**: 219. 1836; III. 340; IV. 196; V. 278 = *Ilex* Linn.; see Hallier f. Rec. Trav. Bot. Néerl. **15**: 66. 1918.

O. spicata Jack, l.c.; reimpr. ll.cc. West coast of Sumatra at Tapanuly = *Ilex spicata* Blume, Bijdr. 1149. 1826. Jack and Blume independently selected the same specific name, for Blume's binomial in *Ilex* was not based on Jack's earlier one. Jack's ample and lucid description agrees entirely with the characters of Blume's species, this being, in *Ilex*, an unusually sharply defined one. Malay Peninsula, Sumatra, Java, Borneo, New Guinea, many individual collections available.

OPHIORRHIZA Linnaeus.

O. heterophylla Jack, Mal. Misc. **2** (7): 85. 1822; reimpr. Roxb. Fl. Ind. **2**: 546. 1824; reimpr. Hook. Comp. Bot. Mag. **1**: 255. 1836; III. 17; IV. 17; V. 289. Sumatra, inland, probably from near Bencoolen. Known only from Jack's description.

O. tomentosa Jack in Roxb. Fl. Ind. **2**: 246. 1824. Penang and Sumatra; see

King, Jour. As. Soc. Beng. **72** (2): 176. 1903 (Mater. Fl. Mal. Pen. **4**: 66) for a more ample description. Malay Peninsula, Penang, Sumatra.

***PATISNA** Jack ex Burkill, Jour. Straits Br. Roy. As. Soc. **73**: 196, 218, 255, 1916, *nom.* = *Urophyllum* Wall. See p. 248.

P. *glabra Jack ex Burkill, l.c. *nom.* = *Urophyllum glabrum* Wall.

PERONEMA Jack, Mal. Misc. **2** (7): 46. 1822; reimpr. Hook. Comp. Bot. Mag. **1**: 152. 1835; III. 41; IV. 41; V. 269.

P. canescens Jack, op. cit. 47; reimpr. ll.cc. Sumatra. A monotypic genus. Malay Peninsula, Sumatra, Borneo, Java.

PETROCARYA Schreber (1789) = *Parinari* Aublet [16] (1775) (*Parinarium* Jussieu, 1789).

P. excelsa Jack, Mal. Misc. **2** (7): 66. 1822; reimpr. Hook. Comp. Bot. Mag. **1**: 220. 1836; III. 164; IV. 68; V. 279. No locality cited but probably from the west coast of Sumatra = *Parinari jackiana* Benth. (1849), as *Parinarium.* A species apparently known only from Jack's description.

P. sumatrana Jack. op. cit. 67; reimpr. Hook. op. cit. 221; III. 165; IV. 69; V. 280 [Sumatra] = *Parinari sumatrana* (Jack) Benth. in Hook. Niger Fl. 335. 1849, as *Parinarium.* For a very full description based wholly on Sumatra specimens see Blume, Mus. Bot. Lugd.-Bat. **2**: 97. 1856 (*P. costatum* Blume ex Miq. Fl. Ind. Bat. **1** (1): 254. 1855). Malay Peninsula, Sumatra, Borneo, and Java.

PHALERIA Jack, Mal. Misc. **2** (7): 59. 1822; reimpr. Hook. Comp. Bot. Mag. **1**: 156. 1835; III. 353; IV. 209; V. 276 (*Drymispermum* Reinw., 1828).

P. capitata Jack, l.c.; reimpr. Hook. l.c.; III. 354; IV. 209; V. 276. Sumatra. This is the type of the genus, *Drimyspermum phaleria* Meisn. in DC. Prodr. **14**: 604. 1867, being a synonym. I have no Sumatra specimens which I can definitely refer to Jack's species. See Koorders & Valeton, Meded. Dep. Landb. **18**: 41. 1914 (Bijdr. Boomsoort. Java **13**: 41) for a detailed description based largely on Java material.

PHYTEUMA Linnaeus.

P. begonifolium Roxb. Hort. Beng. 85. 1814, *nom.*; Roxb. ex Jack Malay Misc. **1** (1): 5. 1820; reimpr. Hook. Bot. Misc. **1**: 276. *pl. 57.* 1830; III. 34; IV. 34; V. 212; Roxb. Fl. Ind. **2**: 108. 1824 (descr. Jack reimpr. 109). Penang = *Pentaphragma begonifolium* Wall. List no. 1313. 1829, "Pentaphragma begonifolium Wall. Phyteuma Roxb. Penang. 1822;" G. Don, Gen. Syst. **3**: 731. 1834. A well-understood species of the Malay Peninsula occurring also in Sumatra, Siam, and Mergui. Jack strongly suggested that Roxburgh's generic designation was erroneous and that a new genus might be represented, which proved to be the case.

PIERARDIA Roxburgh, Hort. Beng. 28. 1814, *nom. nud.*; Roxb. ex Jack, Trans. Linn. Soc. **14**: 119. 1823, descr.; reimpr. Calc. Jour. Nat. Hist. **4**: 186. 1843; IV. 90; Roxb. Fl. Ind. ed. 2, **2**: 254. 1832 = *Baccaurea* Loureiro (1790).

P. dulcis Jack, Trans. Linn. Soc. **14**: 120. 1823, reimpr. III. 186; IV. 90. Sumatra, at Bencoolen, where Jack says it was known as *bua choopa,* and was

[16] The original *Parinari* Aublet (1775) must be accepted unless the Latinized form *Parinarium* Juss. (1789) be officially conserved.

abundant. J. J. Smith, Meded. Dep. Landbouw **10:** 21. 1910 (Koord. & Val. Bijdr. Boomsoort. Java **12:** 21) states that it is cultivated in Java, but no more complete description than the original one of Jack seems to have been published. This is apparently a planted fruit tree, and perhaps the practical non-existence of herbarium material is but a reflection of the often repeated statement that botanists (and often collectors) never bother to prepare specimens from cultivated plants. Jack expressed the opinion that Marsden's excellent figure of *rambeh* (Hist. Sumatra *pl. 6*; in ed. 3, 1811 it is *pl. 8*) was but a variety of his taxon. He noted that at the time (1819–22) the real *rambeh* occurred in the Malay Peninsula, but not in Bencoolen, while *choopa* was abundant at Bencoolen but was not found in the Peninsula.

PITTOSPORUM Banks.

P. serrulatum Jack ex Roxb. Fl. Ind. ed. 2, **2:** 401. 1824, "*Pittosporea serrulata*;" *P. ? serrulatum* Jack ex Griff, Calc. Jour. Nat. Hist. **4:** 195. 1843, reimpr. IV. 99. Penang = *Rinorea lanceolata* (Roxb.) O. Kuntze (*Vareca lanceolata* Roxb.; *Celastrus pauciflora* Wall.; *Pentaloba lanceolata* Wall.; *Alsodeia lanceolata* Oudem.). A species still known only from Penang.

POSOQUERIA Aublet.

P. *anisophylla Jack ex Burkill, Jour. Straits Br. Roy. As. Soc. **73:** 196, 220. 1916, *nom. nud.* Penang, Sumatra = *Gardenia anisophylla* Jack ex Roxb. supra, p. 226 = *Randia anisophylla* (Jack) Hook. f.

PSILOBIUM Jack, Mal. Misc. **2** (7): 84. 1822; reimpr. Roxb. Fl. Ind. **2:** 320. 1824; reimpr. Hook. Comp. Bot. Mag. **1:** 255. 1836; III. 27; IV. 27; V. 289 = *Acranthera* Arnott ex Meissner (1838).[17]

P. nutans Jack, op. cit. 84; reimpr. ll.cc. West coast of Sumatra, inland from Bencoolen. A species known from Jack's description, as yet not safely associated with any described species of *Acranthera*; Bremekamp suggests a species of his subgenus *Androtropis* (R. Br.) Bremek. It may well be that *Brooks 6681* from the vicinity of Bencoolen (not seen) really represents Jack's species, as Ridley thought, Kew Bull. **1925:** 84. 1925; see Bremekamp, Jour. Arnold Arb. **28:** 263. 1947.

P. tomentosum Jack, Mal. Misc. **2** (7): iii. 1822; reimpr. Roxb. Fl. Ind. **2:** 321. 1824; Calc. Jour. Nat. Hist. **4:** 28. 1843; IV. 28; V. 295. West coast of Sumatra at Kataun. As yet not associated with any described species of *Acranthera*. In any case Jack's specific name is preoccupied in that genus by the different *A. tomentosa* R. Br.

PSYCHOTRIA Linnaeus.

P. malayana Jack, Mal. Misc. **1** (1): 3. 1820; reimpr. Hook. Bot. Misc. **1:** 275. 1830 (excl. syn. *P. aurantiaca* Wall.); III. 26; IV. 26; V. 228. Penang. (*P. stipulacea* Wall. ex Roxb. Fl. Ind. **2:** 164. 1824). As explained by me in Webbia **7:** 321–324. 1950, what Jack actually described in 1820 was the species Wallich characterized four years later as *P. stipulacea* Wall. *Psychotria malayana* has been given a very wide range in Malaya by modern authors, but what is so named in all herbaria and described in all texts is not at all

[17] Bremekamp, Jour. Arnold Arb. **28:** 261–265. 1947, has shown that *Psilobium* Jack (1822), hitherto not properly understood, is the same as the later *Acranthera* Arnott ex Meissner (1838). As there are now 35 *Acranthera* species, he suggested that the latter name be conserved against that of Jack.

the species Jack characterized. This misinterpretation was due to Wallich's original error in reducing *P. malayana* Jack to *P. aurantiaca* Wall., which was unfortunately accepted by subsequent authors. The species is known from many parts of the Malay Peninsula and apparently occurs in Sumatra.

PTERNANDRA Jack, Mal. Misc. 2 (7): 60. 1822; reimpr. Hook. Comp. Bot. Mag. **1**: 157. 1835; III. 309; IV. 165; V. 276.

P. capitellata Jack, Mal. Misc. 2 (7): iii. 1822; reimpr. Calc. Jour. Nat. Hist. **4**: 310. 1843; IV. 166; V. 295. West coast of Sumatra at Moco Moco; see Bakhuizen van den Brink, f., Rec. Trav. Bot. Néerl. **40**: 326. 1943, who followed King in making this a variety of *P. coerulescens* Jack. Malay Peninsula, Sumatra, Lingga, Borneo, and fide Mansfeld, New Guinea.

P. coerulescens Jack, Mal. Misc. 2 (7): 61. 1822; reimpr. Hook. Comp. Bot. Mag. **1**: 157. 1835; III. 309; IV. 165; V. 277. Penang. See Bakhuizen van den Brink f., Rec. Trav. Bot. Néerl. **40**: 324. 1943. Burma and the Andaman Islands to Indo-China, the Malay Peninsula, Sumatra, Lingga, and Borneo.

P. echinata Jack, Mal. Misc. 2 (7): iii. 1822; reimpr. Calc. Jour. Nat. Hist. **4**: 310. 1843; IV. 166; V. 295. West coast of Sumatra at Kataun = *Kibessia echinata* (Jack) Cogn. in Pl. Monog. Phan. **7**: 1108. 1891. This may or may not be the same as *Kibessia azurea* (Blume) DC. of Sumatra and Java. King in 1900 followed Cogniaux. Jack's very inadequate description is merely "pedunculis axillaribus terminalibusque, calycibus ovariisque echinatis. A large tree found at Kataun. The leaves are 3-nerved in all species." In a footnote Griffith in his 1843 reproduction of Jack's descriptions indicates Kataun as being in Malacca, but it is a town on the coast north of Bencoolen, Sumatra, the modern Dutch spelling being Ketaoen. I suspect, but can scarcely prove, that this is *Kibessia azurea* (Blume) DC. as interpreted by Bakhuizen van den Brink f. in 1943, this binomial dating from 1826, four years later than that of Jack.

PYRRHANTHUS Jack, Mal. Misc. 2 (7): 57. 1822; reimpr. Hook. Comp. Bot. Mag. **1**: 156. 1835; III. 337; IV. 193; V. 274 = *Lumnitzera* Willd. (1803).

P. *flammeus Jack ex Burkill, Jour. Straits Br. Roy. As. Soc. **73**: 205. 1916, *nom.* = seq.

P. littoreus Jack, l.c.; reimpr. Hook. l.c.; III. 337; IV. 193; V. 275. Sumatra, Malay Peninsula = *Lumnitzera littorea* (Jack) Voigt (*L. coccinea* Wight & Arn.). Common within the influence of salt water. India through Malaysia to tropical Australia and Polynesia.

QUERCUS Linnaeus.

Q. racemosa Jack, Mal. Misc. 2 (7): 86. 1822; reimpr. Hook. Comp. Bot. Mag. **1**: 255. 1836; III. 370; IV. 226; V. 289, non Lam. (1785). Sumatra. Currently reduced to *Quercus spicata* Sm. = *Lithocarpus spicata* Rehd. & Wils. as that species is now interpreted, and it perhaps belongs here. In any case Jack's specific name is an invalid one. Smith's species, *sensu latiore*, ranges from the Himalayan region eastward to southern China and southward to Sumatra, Borneo, and Java.

Q. urceolaris Jack, l.c.; reimpr. Hook. op. cit. 255; III. 371; IV. 227; V. 290. Sumatra = **Lithocarpus urceolaris** (Jack) comb. nov. (*Quercus oligoneura* Korth., 1844; *Q. eichleri* Wenzig, 1886; *Synaedrys eichleri* Koidz., 1916; *Pasania eichleri* Gamble, 1914; *Lithocarpus eichleri*, A. Camus, 1931, et Les

Chênes **3**: 71. *pl. 395.* 1948). King mentioned Miquel's suggestion that this might be the same as *Quercus lamponga* Miq., but the descriptions do not agree. I find, however, that in all essentials the descriptions of *Q. urceolaris* Jack and *Q. eichleri* Wenzig do agree. All types involved were from Sumatra. The species occurs also in the Malay Peninsula and Borneo.

RAFFLESIA Jack [App. Descr. Mal. Pl. 1. 1820]; Jack ex Hook. Comp. Bot. Mag. **1**: 259. *pl. 14.* 1836; III. 260; IV. 216 = *Rafflesia* R. Brown (1821).

R. *elephantina Marsden ex Jack in Burkill, Jour. Straits Br. Roy. As. Soc. **73**: 203. 1916, *nom.* Sumatra = seq.

R. titan Jack [App. Descr. Mal. Pl. 1. 1820]; Jack ex Hook. l.c.; III. 260; IV. 216. Interior of Sumatra, particularly in the forests of Passummah Ulu Manna = *Rafflesia arnoldi* R. Br. (1821). A remarkable species known only from Sumatra. Jack's description was withdrawn because of R. Brown's treatment of the taxon in 1821, both descriptions having been based on the same collection, which was made by Sir Stamford Raffles.

RAUWOLFIA Linnaeus.

R. sumatrana Jack, Mal. Misc. **1** (5): 22. 1820; Roxb. Fl. Ind. **2**: 543, 1824; reimpr. Hook. Bot. Misc. **2**: 73. 1830; III. 31; IV. 31; V. 233. Sumatra, frequent near Bencoolen. A valid species amply described by King & Gamble, Jour. As. Soc. Beng. **74** (2): 424. 1907 (Mater. Fl. Mal. Pen. **4**: 634). Also in the Malay Peninsula; and to be compared is the Philippine-Borneo *R. samarensis* Merr.

RHIZOPHORA Linnaeus.

R. *caryophylloides Jack, Mal. Misc. **1** (5): 34. 1820; reimpr. Hook. Bot. Misc. **2**: 80. 1830; III. 334; IV. 190; V. 239. Singapore, Penang = *R. caryophylloides* Burm. f. Fl. Ind. 109. 1768 = *Bruguiera cylindrica* (Linn.) Blume. In tidal forests throughout the Indo-Malaysian region. Jack, in proposing his new binomial in 1820, overlooked Burman's earlier use of the same name in 1768 to represent the same species. *Mangium caryophylloides* Rumph. (1743), cited by both, provided the specific name.

RHODAMNIA Jack, Mal. Misc. **2** (7): 48. 1822; reimpr. Hook. Comp. Bot. Mag. **1**: 153. 1835; III. 307; IV. 163; V. 270.

R. cinerea Jack, l.c.; reimpr. ll.cc. West coast of Sumatra, frequent. *Rhodamnia* Jack is a small genus, its limits well understood, and probably Jack's specific name should be retained for the common Malaysian form (Malay Peninsula, Sumatra, Borneo, Java). Corner, Gard. Bull. Straits Settl. **10**: 272. 1939, took exception to my acceptance of *Myrtus trinervia* Lour. (1790) as a synonym for this species [*R. trinervia* (Sm.) Bl.], because Loureiro definitely described the inflorescences as racemose; yet *Clemens 3689*, from what must be the type locality, has racemes 2.5 cm. in length. Yet in other characters this closely approximates our rich series of Sumatran specimens. The oldest valid name for this is *Rhodamnia dumetorum* (Lour.) Merr. & Perry, Jour. Arnold Arb. **19**: 195. 1938, of which *R. siamensis* Craib is a synonym. But Corner overlooked C. T. White's conclusions, Blumea, Suppl. **1**: 215. 1937, that the Australian form is specifically distinct from the Malayan one. As Smith's species was based wholly on Australian specimens, *Rhodamnia trinervia* (Sm.) Blume is not the proper name for the species that Jack characterized; for this common form with axillary solitary or fascicled flowers, Jack's specific name is the earliest available one. The group is in need of a critical revision.

RHODODENDRON Linnaeus.

R. malayanum Jack, Mal. Misc. **2** (7): 17. 1822; reimpr. Hook. Jour. Bot. **1**: 369. 1834; III. 36; IV. 36; V. 254. Gunong Bunko or Sugarloaf Mountain inland from Bencoolen, Sumatra. This is a well-understood species extending from the Malay Peninsula and Sumatra to Borneo, Java, Ceram, and, including *R. apoanum* Stein, the Philippines.

RHOPALA Schreber (1789) = *Roupala* Aublet (1775).

R. attenuata Jack, Mal. Misc. **1** (5): 10. 1820; reimpr. Hook. Bot. Misc. **2**: 65. 1830; III. 352; IV. 208; V. 227. Penang = ***Helicia attenuata*** (Jack) Blume. Malay Peninsula, Sumatra, and possibly Java. This is correctly interpreted by the British botanists concerned with the flora of the Malay Peninsula; many collections available.

R. moluccana sensu Jack, Mal. Misc. **1** (5): 10. 1820; reimpr. Hook. Bot. Misc. **2**: 65. 1830; III. 352; IV. 208; V. 227, non R. Br. Penang (in a garden) = ***Helicia petiolaris*** Benn. The Jack collection forms a part of Wallich List no. 1041, Bennett's binomial being strictly a new one for Jack's misinterpretation of R. Brown's Moluccan species. Known only from the Malay Peninsula.

R. ovata Jack, op. cit. **2** (7): 95. 1822; reimpr. Hook. Comp. Bot. Mag. **1**: 259. 1836; Calc. Jour. Nat. Hist. **4**: 353. 1843; IV. 209; V. 294. West coast of Sumatra at Tapanuly = ***Helicia ovata*** (Jack) Benn. Known only from Jack's description. The large (25 by 15 cm.) entire sessile or subsessile leaves should render identification a simple matter once material is available from the west coast of Sumatra.

RONDELETIA Linnaeus.

R. corymbosa Jack, Mal. Misc. **1** (1): 4. 1820; reimpr. Hook. Bot. Misc. **1**: 276. 1830; III. 16; IV. 16; V. 211. Penang = ***Greenea corymbosa*** (Jack) K. Schum. (*G. jackii* Wight & Arn., 1834; *Rondeletia spicata* Wall. ex Roxb. 1824). Indo-China to the Malay Peninsula and Sumatra.

ROTTLERA Roxburgh (1798) = *Mallotus* Loureiro (1790).

R. alba Roxb. Hort. Beng. 73. 1814, *nom. nud.;* Roxb. ex Jack, Mal. Misc. **1** (1): 26. 1820, *descr.*; reimpr. Hook. Bot. Misc. **1**: 290. 1830; III. 227; IV. 131; V. 222; Roxb. Fl. Ind. ed. 2, **3**: 829. 1832. Penang, Sumatra = ***Mallotus albus*** (Roxb.) Muell.-Arg. (sed non *M. albus* sensu Pax & Hoffm., 1914) (*Mallotus macrostachys* (Miq.) Muell.-Arg.). Pax and Hoffmann misinterpreted Roxburgh's species in 1914, limiting it to India, Ceylon, and Chittagong. They apparently overlooked the fact that *Rottlera alba* Roxb. was based wholly on Penang (Prince of Wales' Island) specimens from a plant cultivated at Calcutta. The Roxburgh description is a very inadequate one; but that supplied by Jack in 1820 is excellent and validates the Roxburgh binomial twelve years in advance of Roxburgh's similar action; Jack's material was from Penang and Sumatra, and his Penang specimen was apparently named at Calcutta. *Mallotus macrostachys* (Miq.) Muell.-Arg., type from Sumatra, is in all respects this misunderstood *Mallotus albus*

(Roxb.) Muell.-Arg.[18] Malay Peninsula, Sumatra, Borneo, many collections.

SAGUS Gaertner (1788) = *Metroxylon* Rottboell (1783).

S. laevis Jack [App. Descr. Mal. Pl. 9. 1820]; reimpr. Jack ex Hook. Comp. Bot. Mag. **1**: 266. 1836; III. 13; IV. 13. Sumatra, Malacca (planted) = *Metroxylon sagus* Rottb. (1783). This smooth form is widely distributed in Malaysia, extending from the Malay Peninsula and Sumatra to New Guinea, usually planted. It is the source of sago, and man is probably responsible for much of its present geographic distribution.

SALACIA Linnaeus; Jack, Mal. Misc. **2** (7): 92. 1822; reimpr. Hook. Comp. Bot. Mag. **1**: 258. 1836; III. 101; IV. 197; V. 293. A general discussion, no new names involved. There is a specimen named by Jack in the Rijksherbarium, Leiden, under an unpublished binomial; the species is in the *S. prinoides* (Willd.) DC. group. See *Johnia sumatrana* Jack above.

SAPINDUS Linnaeus.

S. rubiginosus Roxb. Pl. Coromand. **1**: 44. *pl. 62.* 1795; Jack, Mal. Misc. **1** (1): 11. 1820; reimpr. Hook. Bot. Misc. **1**: 280. 1830; III. 184; IV. 88; V. 214. Penang = *Erioglossum rubiginosum* (Roxb.) Blume. India southward through Malaysia to New Guinea and tropical Australia.

SONERILA Roxburgh.

S. erecta Jack, Mal. Misc. **1** (5): 7. 1820; reimpr. Hook. Bot. Misc. **2**: 63. 1830; III. 331; IV. 187; V. 225. Penang. Undoubtedly represented by *Wallich 4092* and other collections from Penang. Malay Peninsula and reported from as far north as eastern Bengal.

S. heterophylla Jack, op. cit. **2** (7): 16. 1822; reimpr. Hook. Jour. Bot. **1**: 368. 1834; III. 333; IV. 189; V. 254 (*Sonerila pauciflora* Blume, Cat. Gew. Buitenz. 42. 1823). West coast of Sumatra at Tapanuly. A duplicate of the original Jack collection is in the Delessert herbarium at Geneva. Represented by various collections from Sumatra and Java.

S. moluccana Roxb. Fl. Ind. **1**: 182. 1820, ed. 2, **1**: 178. 1832; Roxb. ex Jack, Mal. Misc. **1** (2): 7. 1820; reimpr. Hook. Bot. Misc. **2**: 64. 1830; III. 332; IV. 188; V. 226. Penang. Of this *Sonerila begoniaefolia* Blume, Flora **14**: 490. 1831, is a synonym, as is *S. paradoxa* Naud. (1851). Roxburgh's description is very short and unsatisfactory, but that of Jack is excellent in all respects. The original author's statement that the species was a native of the Moluccas has confused the issue, for Roxburgh used the term "Moluccas" to cover other parts of the Malay Archipelago. It is certain that his type actually came from Penang; Jack's specimen was undoubtedly named at Calcutta, or by comparison with the description in his copy of Roxburgh's manuscript. Some have surmised that Roxburgh intended to write "malaccana" instead of "moluccana," but this is an unnecessary assumption. The latest to discuss the case was Bakhuizen van den Brink f., Rec. Trav. Bot. Néerl. **40**: 254. 1843,

[18] For *Mallotus albus* sensu Pax & Hoffm. Pflanzenreich **63** (IV. 147. VII): 168. 1914, non Muell.-Arg., the proper name is apparently *M. tetracoccus* [Roxb.] Kurz, For. Fl. Brit. Burma **2**: 382. 1877, provided one is permitted at a later date, to add what manifestly was its intended name-bringing synonym, *Rottlera tetracocca* Roxb. Fl. Ind. ed. 2, **3**: 826. 1832. This was Alston's selection, Trimen, Handb. Fl. Ceyl. **6**: 267. 1931, followed by Croizat, Jour. Arnold Arb. **21**: 503. 1940. Its type was a Silhet specimen, and Roxburgh's description is an ample one.

who preferred to retain Blume's name of 1831; but it is apparent from his references that he did not see Jack's excellent description of 1820. Malay Peninsula, Sumatra, Banka, Java. I accept Roxburgh's earlier name with confidence and reduce Blume's later one as a synonym of it. The species does not occur in the Moluccas.

SPHALANTHUS Jack, Mal. Misc. **2** (7): 55. 1822; reimpr. Hook. Comp. Bot. Mag. **1**: 155. 1835; III. 339; IV. 195; V. 274 = *Quisqualis* Linnaeus.

S. confertus Jack, l.c.; reimpr. ll.cc. Sumatra, without definite locality = *Quisqualis conferta* (Jack) Exell, Jour. Bot. **69**: 122. 1931 (*Q. densiflora* Wall. List no. 4011. 1831, *nom.*; Miq. Fl. Ind. Bat. **1** (1): 611. 1955, *descr.*; *Sphalanthus diversifolius* Jack ex Steud. Nomencl. ed. 2, **2**: 621. 1841, *nom.*). A specimen of the original Jack collection is in the Delessert herbarium at Geneva. Malay Peninsula, Sumatra.

SPHENODESME Jack, Mal. Misc. **1** (1): 19. 1820; reimpr. Hook. Bot. Misc. **1**: 285. 1830; III. 43; IV. 43; V. 219.

S. pentandra Jack, l.c.; reimpr. ll.cc. Penang. The type of the genus, the species extending from Assam to southern China, southward through Burma and Indo-China to the Malay Peninsula and Borneo. *Sphenodesme* Jack was a new name for *Roscoea* Roxb. *nom. nud.* (1814), non Smith (1804), and *S. pentandra* Jack is supposedly the same as *Roscoea pentandra* Roxb., *nom. nud.* (1814); but the first published descriptions are those of Jack.

STAGMARIA Jack [App. Descr. Mal. Pl. 12. 1820]; Jack ex G. Don, Gen. Syst. **2**: 76. 1832; Hook. Comp. Bot. Mag. **1**: 267. 1836; reimpr. III. 175; IV. 79 = *Gluta* Linnaeus.

S. verniciflua Jack, l.c.; reimpr. ll.cc.; G. Don l.c. Sumatra at Natal on the west coast = *Gluta benghas* Linn. Siam to the Malay Peninsula, Sumatra, Java, and Borneo. Engler changed the spelling of the specific name to *renghas*, as this is one of the Malay names of the species, and one may assume that Linnaeus adopted the spelling *benghas* through some kind of an error.

STERCULIA Linnaeus.

S. angustifolia Roxb. Hort. Beng. 50. 1814, *nom. nud.*; Roxb. ex Jack, Mal. Misc. **1** (1): 21. 1820; reimpr. Hook. Bot. Misc. **1**: 287. 1830; III. 223; IV. 127; V. 220; Roxb. Fl. Ind. ed. 2, **3**: 148. 1832. Penang = *S. rubiginosa* Vent. Hort. Malm. **2**: sub *pl. 91.* 1804 (*S. jackiana* Wall. List no. 1134. 1829, et in Hook. Bot. Misc. **1**: 287. 1830). Roxburgh's *nomen nudum* of 1814 and his very imperfect description of 1832 were based on specimens taken from a tree cultivated in the Calcutta Garden labeled as having come from Nepal. King in 1891 stated that Roxburgh's excellent colored drawing at Calcutta is unlike any *Sterculia* known from any part of the outer Himalayan region or the plain at its base. He concluded that Roxburgh's statement as to Nepal was due to a mislabeled tree. He retained *Sterculia angustifolia* Roxb., so well described by Jack, as a valid species allied to *S. rubiginosa* Vent., but separated by certain style characters which I have not been able to check. Ridley, however, Fl. Mal. Pen. **1**: 371. *fig. 27.* 1922, reduced *S. angustifolia* Roxb. ex Jack to *S. rubiginosa* Vent. In any case the Jack description validated Roxburgh's *nomen nudum* of 1814, and the species must be interpreted from this and from Penang specimens. Burma to Indo-China through the Malay Peninsula to Sumatra, Java, and Borneo.

S. coccinea Jack, Mal. Misc. **1** (1): 20. 1820; reimpr. Hook. Bot. Misc. **1:** 286. 1830; III. *222*; IV. 126; V. 219, non Roxb. (1832). Penang (*S. laevis* Wall. List no. 1138. 1829; Hook. Bot. Misc. **1:** 287. 1830, in obs.). Wallich definitely published *Sterculia laevis* in 1829 as a new name for *S. coccinea*, as described by Jack, but not *S. coccinea* Roxb. Hort. Beng. 50. 1814, *nom. nud.* (Fl. Ind. ed. 2, **3:** 151. 1832, *descr.*). But Jack's excellent description of 1820 antedates that of Roxburgh by twelve years. Adelbert in Backer, Beknopte Fl. Java IV. B (II) Sterc. *22*, 1944, correctly interpreted Jack's species. Burma and Siam, the Malay Peninsula, Sumatra, Borneo, and Java.

It is *Sterculia coccinea* Roxb. 1814, *nom. nud.*, Fl. Ind. ed. 2, **3:** 151. 1832, that needs to be renamed, and for this species, its type from India, I propose the name **Sterculia indica,** nom. nov. I have not been able to locate any other actually published name for this widely distributed species, which extends from Sikkim, Bhotan, and Assam to Burma and Indo-China (but is not as yet recorded from Siam). *Sterculia bracteata* Gagnep. of Indo-China is apparently a closely allied species.

STROPHANTHUS De Candolle.

S. *plicatus Jack ex Burkill, Jour. Straits Br. Roy. As. Soc. **73:** 218. 1916, *nom. nud.* Sumatra at Bencoolen, and Penang = *Scleranthera dubia* (Sims) Pichon, Not. Syst. **14:** 90. 1951. Synonyms are *Cameraria dubia* Sims (1814), *Wrightia dubia* Spreng. (1825), and *Strophanthus jackianus* Wall. List no. 1643. 1828, *nom. nud.*, Wall. ex G. Don, Gen. Syst. **4:** 85. 1838, *descr.* Some modern authors place the species in *Wrightia*, others in *Strophanthus*. I believe Pichon is correct in proposing the new generic name *Scleranthera* to take this Jack species and an allied, perhaps even an identical one, of Siam and Indo-China. The species is closer to *Wrightia* than to *Strophanthus*, but I am convinced that it cannot properly be referred to either of these genera. Malay Peninsula and Sumatra.

TABERNAEMONTANA Linnaeus.

T. macrocarpa Jack, Mal. Misc. **2** (7): 80. 1822; reimpr. Hook. Comp. Bot. Mag. **1:** 253. 1836; III. 32; IV. 32; V. 286. Sumatra, inland from Bencoolen = **Ervatamia macrocarpa** (Jack) comb. nov. (*Pagiantha macrocarpa* Markgr. Notizbl. Bot. Gart. Berlin **12:** 546. 1935). Additional synonyms are: *Orchipeda sumatrana* Miq. Fl. Ind. Bat. Suppl. 553. 1863; Hallier f. Ann. Jard. Bot. Buitenz. **13:** 285. 1896, Bull. Herb. Boiss. **6:** 615. 1898; *Neuburgia *sumatrana* Boerl. Handl. Fl. Nederl. Ind. **2:** 392. 1899; *Tabernaemontana monocarpa* Steud. Nom. ed. 2, **2:** 658. 1841, *sphalm*; *Tabernaemontana plumeriaefolia* Elm. Leafl. Philip. Bot. **1:** 333. 1908; *Tabernaemontana plumeriaefolia* Merr. Enum. Philip. Fl. Pl. **3:** 326. 1923. Sumatra, Borneo, Philippines, and apparently in the Malay Peninsula and Java. I have seen Miquel's type of *Orchipeda sumatrana*, a Teysmann specimen from Sumatra, and also *Achmad 110* from Simaloer Island near Sumatra, while *Krukoff 4190* a sterile specimen, may belong here; also from Borneo *Hallier 1363*, *Wood 927*, *1802*, *Clemens 9809*, *21210*, *26195*, *Ramos 1304*, *Haviland & Hose 3501*, and *Neth. Ind. For. Serv. 16316*; and from the Philippines *Elmer 7502*, *7754*, and *Bur. Sci. 33826 Ramos & Edano*.

I strongly suspect that *T. sphaerocarpa* Blume, Bijdr. 1028. 1826, as described in detail by Koorders & Valeton, Meded. Lands Plant. **11:** 103. 1894 (Bijdr. Boomsoort. Java **1:** 103), and as well illustrated by them, Atlas Baumart. Java **4:** *pl. 623*, *624*. 1916 = *Pagiantha sphaerocarpa* Markgr.

Notizbl. Bot. Gart. Berlin **12:** 546. 1935 = *Ervatamia sphaerocarpa* Burkill, Kew Bull. **1935:** 317. 1935, may well belong here, and *Tabernaemontana megacarpa* Merr. Philip. Jour. Sci. **4:** Bot. 318. 1909 = *Pagiantha megacarpa* Markgr. l.c., of which no specimens are actually available to me at this time, may also represent a form of Jack's species. In view of the discordant elements placed in *Pagiantha*, particularly as to the shape, size, and general characters of the fruits (compare those of *T. pandacaqui* Poir. with those of *T. macrocarpa* Jack and *T. sphaerocarpa* Blume, all supposed to belong in *Pagiantha*), I see nothing to be gained by recognizing a distinct genus here. At the Rijksherbarium, Leiden, where I made numerous notes on various species in this difficult group, *Tabernaemontana plumeriaefolia* Elm. had been referred to *Rejoua*, where I believe it does not belong, while *Tabernaemontana sumatrana* Merr. Contr. Arnold Arb. **8:** 139. *pl. 13.* 1934 had been placed with one of Miquel's species. It is not the same as Jack's species but is an *Ervatamia*. *Pseudixora sumatrana* Miq. Fl. Ind. Bot. **2:** 209. 1857 = *Randia sumatrana* Miq. Ann. Mus. Bot. Lugd.-Bat. **4:** 235. 1869, should be compared. Note the slender elongated corolla tubes, which are very different from those of *T. macrocarpa* Jack.

Under suspicion are various collections from the Malay Peninsula and Java, distributed as representing *Tabernaemontana sphaerocarpa* Blume. Two Johore collections, neither with good flowers, *Corner 20696* and *Ngadiman 34741*, are suspiciously similar to Sumatra specimens which I refer to Jack's species. On the whole, the few flowers I have seen of Java material seem to be more slender than are those of Jack's species as I here interpret it.

Jack described the fruits as being subglobose and as large as citrons. The fruit characters of the various species above reduced conform, as is also the case with the other characters in Jack's distinctly good description. I do not hesitate in accepting what is, in my judgment, the oldest specific name for the form which has large subglobose, not ridged or keeled fruits, large and prominently nerved leaves, and fairly large flowers with relatively thick corolla tubes. Here is a case where it seems to be apparent that an early-named and well-described species has been rather consistently ignored, largely, it is suspected, because there is no extant type of Jack's species. Here it is not at all difficult, now that modern collections from Sumatra are available, to match Jack's original description with some of these collections.

TACCA Linnaeus.

T. cristata Jack, Mal. Misc. 1 (5): 23. 1820; reimpr. Hook. Bot. Misc. **2:** 73. 1830; III. 9; IV. 9; V. 234. Singapore and Penang (*T. rafflesiana* Jack ex Wall. List no. 5172. 1832, *nom. nud.*). A characteristic well-known species. Malay Peninsula, Sumatra, Borneo.

TERNSTROEMIA Mutis ex Linnaeus.

T. acuminata Jack, Mal. Misc. 2 (7): 26. 1822; reimpr. Hook. Jour. Bot. **1:** 375. 1834; III. 204; IV. 108; V. 259. West coast of Sumatra at Tapanuly = *Saurauia* sp. aff. *S. tristyla* DC. Known only from Jack's description. Jack merely accepted Roxburgh's misinterpretation of the genus.

T. cuspidata Jack, op. cit. 2 (7): 28. 1822; reimpr. Hook. Jour. Bot. **1:** 377. 1834; III. 206; IV. 110; V. 260. Sumatra at Salumah, on the west coast = *Saurauia* sp. Like *T. serrata* Jack but with 5-celled ovaries and 5 styles. Known only from Jack's description.

T. pentapetala Jack, Mal. Misc. 1 (5): 40. 1820; reimpr. Hook. Bot. Misc. **2:**

84. 1830; III. 204; IV. 108; V. 242. Penang = *Saurauia* sp. Clearly in the group with *S. tristyla* DC. *Cleyera pentapetala* Spreng. Syst. 2: 596. 1825 is a synonym. Known only from Jack's description.

T. rubiginosa Jack, Mal. Misc. 1 (5): 38. 1820; reimpr. Hook. op. cit. 83: III. 203; IV. 107; V. 241. Sumatra = **Saurauia rubiginosa** (Jack) comb. nov. (*Cleyera rubiginosa* Spreng. Syst. 2: 596. 1825; *Saurauia jackiana* Korth. Verh. Nat. Gesch. Bot. 127. 1842, quoad syn. Jack). All Sumatra specimens that I have seen named as representing *Saurauia jackiana* Korth. (Korthals!, *Beccari 669*, *Lörzing 5689*, *Bünnemeyer 3463*), have pedicels up to 1.5 cm. long, somewhat appressed scaly below, but not setose, while the sepals are broadly ovate, coriaceous, glabrous, rugose when dry, up to 1 cm. long. They do not represent the species that Jack described. On the Korthals sheet is an unpublished binomial indicative of his original intention of describing his specimen as a new species. Fortunately there is an extant type of Jack's species in the Rijksherbarium, Leiden. It is a rather poor specimen, but the pedicels are up to 3 cm. long and rather densely setose, as are the sepals. This important specimen was filed under *S. cauliflora* DC., where it does not belong. The leaves are about 15 × 8 cm. with about 14 pairs of nerves. I have not succeeded in matching the Jack type with any other collection.

T. serrata Jack, Mal. Misc. 2 (7): 27. 1822; reimpr. Hook. Jour. Bot. 1: 376. 1834; III. 205; IV. 109; V. 259. Pulo Nias, off the west coast of Sumatra = *Saurauia media* Korth. Verh. Nat. Gesch. 125. 1842 (*S. camptodonta* Miq. and *S. inflexidens* Miq., 1862). A species in the group with *S. tristyla* DC., Jack's type which I have seen, being preserved in the Rijksherbarium, Leiden. The synonymy as above indicated is based on unpublished herbarium notes of C. B. Clarke, who actually examined Jack's and Miquel's types. Jack's specific name is invalidated in *Saurauia* by *S. serrata* DC. (1822). Known only from Sumatra.

TETRACERA Linnaeus.

T. arborescens Jack, Mal. Misc. 1 (5): 45. 1820; reimpr. Hook. Bot. Misc. 2: 87. 1830; III. 218; IV. 122; V. 244. West coast of Sumatra, Tapanuly Bay. A Jack specimen is preserved in the Rijksherbarium, Leiden. *Tetracera lucida* Wall. List 6631. 1832, *nom.*, validated by Ridley, Fl. Mal. Pen. 1: 5. 1922, is a synonym, fide Dr. Hoogland (*T. euryandra* sensu Hook. f. Fl. Brit. Ind. 1: 32. 1872, non Vahl). Malay Peninsula, Sumatra. There are doubtless botanical quibblers who might deny the correctness of this interpretation merely because Jack erred in describing this as a tree; it was corrected by him in one of his letters to Nathaniel Wallich; see Jour. Straits Br. Roy. As. Soc. 73: 229. 1916.

TETRANTHERA Jacq. (1797) = *Litsea* Lam. (1791), nom. conserv.

T. cordata Jack, Mal. Misc. 2 (7): 34. 1822; reimpr. Hook. Comp. Bot. Mag. 1: 148. 1835; III. 356; IV. 212; V. 263. West coast of Sumatra = *Litsea cordata* (Jack) Hook. f. (*L. cordifolia* Griff.). Malay Peninsula, Sumatra, Borneo.

UROPHYLLUM Wallich in Roxb. Fl. Ind. 2: 184. 1824; reimpr. Calc. Jour. Nat. Hist. 4: 17. 1844; IV. 17. This genus was first named *Patisna* Jack, but never published; see Burkill, Jour. Straits Br. Roy. As. Soc. 73: 196, footnotes 175, 218, 238, 1916. Jack also proposed the alternate name *Wallichia* for it, but Wallich, to whom Jack had extended certain discretionary powers, substituted his own name, *Urophyllum*, apparently being intrigued by Jack's reference to "those acuminate gentry the Patisnae." I therefore do not accept Griffith's correction of *Urophyllum* Wallich to *Urophyllum* Jack. Wallich did credit the copy to Jack, as also for the two species, but the published names are Wallich's. Burkill's suggestion that the name *Wallichia* Reinwardt (1823), non Roxb. (1819), may have been due to Jack's having mentioned the name to Reinwardt when he visited Buitenzorg in 1821, is probably correct. Blume, in publishing it, apparently thought that Reinwardt originated the name.

U. glabrum Wall. op. cit. 186; reimpr. Calc. Jour. Nat. Hist. **4**: 18. 1843; IV. 18. Penang = *Urophyllum arboreum* (Reinw. ex Blume) Korth. This was Wallich's own binomial, as he originated the generic name. He copied Jack's specific description. The species is common and widely distributed in the Malay Peninsula and the Sunda Islands; but *Wallichia arborea* Reinw. (1823) = *Urophyllum arboreum* (Reinw.) Korth. was published one year earlier than Jack's species. As I understand the species, some of the synonyms are *Wallichia arborea* Reinw., 1823; *Axanthes arborea* Blume, 1826; *Schwenkfeldia glabra* Spreng., 1827; *Urophyllum repandulum* Miq., 1857, and *Urophyllum hexandrum* O. Kuntze, 1891. Malay Peninsula, Sumatra, Java, Borneo, very many collections. The Philippine form referred here is the allied *U. memecyloides* (Presl) Rolfe.

U. villosum Jack ex Wall. in Roxb. op. cit. 185; reimpr. ll.cc. Penang. Two exact synonyms are *Schwenkfeldia malaccensis* Spreng. (1827) and *S. villosa* D. Dietr. (1839); others are *Axanthes tomentosa* Blume ex DC., 1830, and *Urophyllum tomentosum* Miq., type of both from Penang. I know this species only from Penang, Singapore, and various parts of the Malay Peninsula.

UVARIA Linnaeus.

U. hirsuta Jack, Mal. Misc. **1** (5): 46. 1820; reimpr. Hook. Bot. Misc. **2**: 87. 1830; III. 220; IV. 125; V. 245. Penang. One of the rather strongly characterized species of the genus. Malay Peninsula, Sumatra, Java; the Burma record perhaps doubtful as the species has not been recorded from Siam. The "Molucca" *Uvaria pilosa* Roxb. Fl. Ind. ed. 2, **2**: 665. 1832 is a synonym of Jack's species. Its type was undoubtedly from Penang or Sumatra. The strongly marked species does not occur in the Moluccas.

VACCINIUM Linnaeus.

V. sumatranum Jack, Mal. Misc. **2** (7): 18. 1822; reimpr. Hook. Jour. Bot. **1**: 370. 1834; III. 35; IV. 35; V. 255. Gunong Bunko (Sugarloaf Mountain), northeast of Bencoolen, Sumatra. Apparently not as yet associated with any other described species, but clearly in the group with *V. ellipticum* (Bl.) Miq. and *V. laurifolium* (Bl.) Miq. of Java, and probably the same as one of these.

VERATRUM Linnaeus.

V. malayanum Jack, Mal. Misc. **1** (2): 25. 1820; reimpr. Hook. Bot. Misc. **2**: 74. 1830; III. 9; IV. 9; V. 234. Penang = *Hanguana malayana* (Jack) Merr. Philip. Jour. Sci. **10**: Bot. 3. 1915. Synonyms are *Hanguana kassintu* Blume (1827), *Veratronia malayana* Miq. (1859), and *Susum malayanum* Planch. (1892). Malay Peninsula, Sumatra, Java, Borneo, and Palawan, Mindoro and Mindanao in the Philippines. *Hanguana* Blume dates from 1827, *Susum* Blume from 1830, and *Veratronia* Miq. from 1859.

VITEX Linnaeus.

V. arborea Roxb. Hort. Beng. 46. 1814, *nom.*; Roxb. ex Jack, Mal. Misc. **1** (1): 18. 1820; reimpr. Hook. Bot. Misc. **1:** 285. 1830; III. 40; IV. 40; V. 218; Roxb. Fl. Ind. ed. 2, **3:** 73. 1832. Sumatra = *V. pubescens* Vahl (1794). India to Indo-China southward through the Malay Peninsula to Sumatra, Borneo, Java, the Philippines, Celebes, and Timor. Some botanists have followed Hallier f. in accepting the older *V. latifolia* Lam. as the proper name for this species, but Lamarck's binomial of 1788 is invalidated by the earlier *V. latifolia* Mill. (1768).

VITIS Linnaeus.

V. racemifera Jack, Mal. Misc. **2** (7): 94. 1822; reimpr. Hook. Comp. Bot. Mag. **1:** 258. 1836; III. 194; IV. 98; V. 294. Sumatra, no definite locality, but surely from the west coast = *Ampelocissus racemifera* (Jack) Planch. in DC. Monog. Phan. **5:** 410. 1883. I feel certain that *Rahmat si Toroes* (*Boeea*) *107*, *1657*, *2180*, *3875*, *7158*, *9299*, *9548*, and *Yates 706*, all from Sumatra, represent Jack's species. Planchon, while recognizing the species and correctly transferring it to *Ampelocissus*, based his description entirely on Jack's excellent one. At the same time he described *A. korthalsii* Planch., type from Sumatra, as new, but expressed the opinion that it might not be distinct from Jack's species. Also to be compared here are the Sumatra collections referred to *A. thyrsiflora* (Blume) Planch. and *Vitis polystachya* Wall.

WALLICHIA Reinwardt ex Blume = *Urophyllum* Wallich.

W. *glabra Jack ex Burkill, Jour. Straits Br. Roy. As. Soc. **73:** 255. 1916, *nom. nud.* = *Urophyllum glabrum* Wall.; see p. 249.

WORMIA Rottboell.

W. excelsa Jack, Mal. Misc. **2** (7): 69. 1822; reimpr. Hook. Comp. Bot. Mag. **1:** 221. 1836; III. 219; IV. 123; V. 281. West coast of Sumatra at Bencoolen = *Dillenia excelsa* (Jack) Gilg in Engl. & Prantl, Nat. Pflanzenfam. **3** (6): 123. 1893. Hoogland, in his monograph of *Dillenia* L., Blumea **7:** 68. 1952, lists about 20 synonyms, among them *Capellia multiflora* Blume (1825), *Wormia oblonga* Wall. (1855), *W. grandifolia* Miq. (1863), and others. Malay Peninsula, Banka, Sumatra, Java, Borneo, and Balabac in the Philippines.

W. pulchella Jack, op. cit. 70; reimpr. ll.cc. West coast of Sumatra at Natal = *Dillenia pulchella* (Jack) Gilg in Engl. & Prantl, l.c. Malay Peninsula, Riouw and Lingga Archipelagos, Banka, Sumatra, and Borneo. Synonyms after the Hoogland treatment are *Dillenia micrantha* Martelli and *D. parvifolia* Martelli.

ZINGIBER Adanson.

Z. gracile Jack, Mal. Misc. **1** (1): 1. 1820; reimpr. Hook. Bot. Misc. **1:** 273. 1830; III. 3; IV. 3; V. 209. Penang. The latest critical consideration of the species is that of Holttum, Guard. Bull. Singapore **13:** 63. 1950. Widely distributed in the Malay Peninsula.

ARNOLD ARBORETUM,
HARVARD UNIVERSITY.

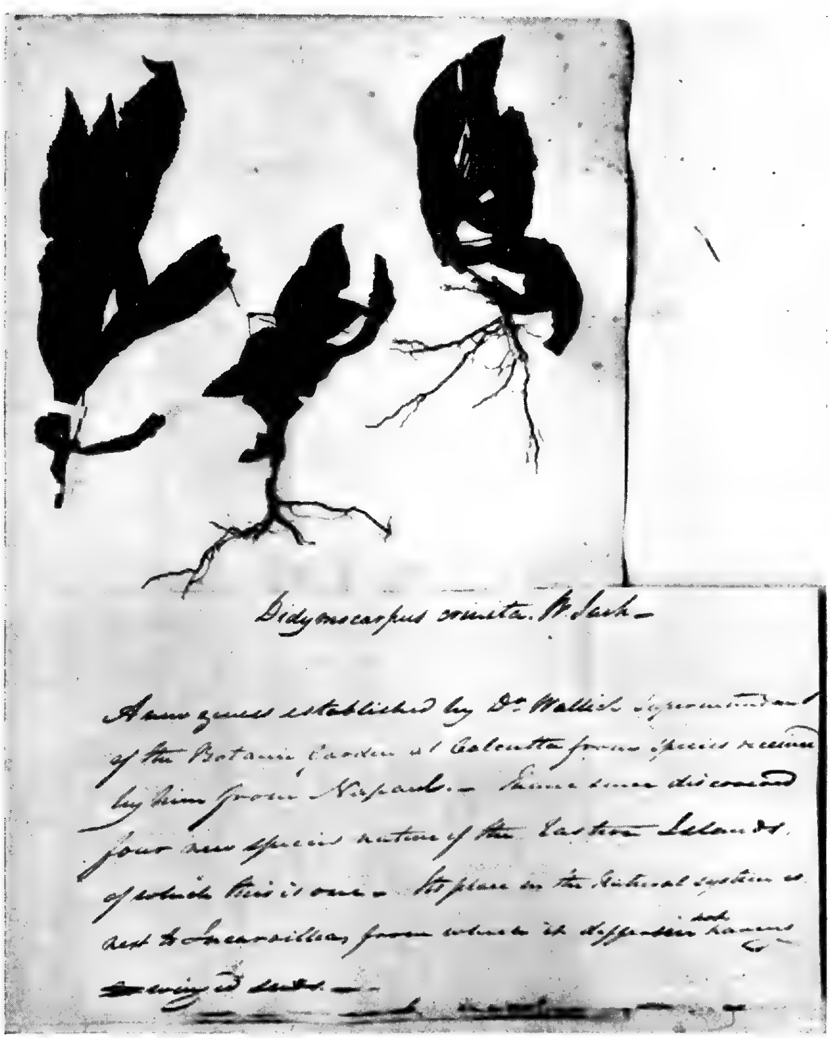

PLATE 1. TYPE COLLECTION OF DIDYMOCARPUS CRINITA JACK, THE LABEL IN WILLIAM JACK'S HANDWRITING (HERB. EDINBURGH)

THE COMPARATIVE MORPHOLOGY OF THE ICACINACEAE, VI. THE POLLEN

A. Orville Dahl

With nine plates

The Icacinaceae Miers is a dicotyledonous family made up of approximately 60 genera embracing, according to Sleumer (30), about 300 species largely confined to the tropics of both the old and new worlds. Most of the species are woody. The affinities of this family, as well as the specific and generic concepts within the group, have been variously interpreted. Engler (7) placed the family in the suborder *Icacinineae* following the suborder *Celastrineae* in the order Sapindales while Wettstein (31) and Hutchinson (24) included the *Icacinaceae* in the order Celastrales. Hallier (13) interpreted the family as having affinities with the Olacaceae and included it in the order Santalales. Recently, Howard (16–23) has discussed the systematic position of the family.

The *Icacinaceae* have been the subject of intensive anatomical, morphological, and taxonomic investigations initiated by I. W. Bailey and R. A. Howard in 1941 (1). These studies have provided a critical basis for the interpretation of old as well as recent researches in the family. In the latter category is the present study of pollen grain morphology of the *Icacinaceae*. Studies of comparative pollen morphology have been mentioned, not infrequently, as being capable of yielding a distinctive set of data advantageously utilizable in a variety of fields including those of systematics and phylogeny. However, it seems regrettable that detailed, comparative pollen studies of genera or families are rare in either the contemporary or older literature. Citations to extant studies will be found in Wodehouse (32) and Erdtman (8, 10). When considered along with data derived from other techniques, *i.e.* data concerning other plant parts, the information concerning pollen grain form is a definite aid in arriving at a more natural arrangement of species. This study of pollen in the *Icacinaceae* was pursued from this point of view.

MATERIALS AND METHODS

All observations are based upon pollen grains mounted from herbarium specimens. In general, two microscopical mounts were made from each specimen. One mount was prepared in lactic acid (ca. 85%) to present pollen in the expanded condition and the other in oil to illustrate the grains in the contracted or air-dry state. The hard, brittle anthers were softened in 10% alkali (NaOH or KOH) and then transferred to a drop of lactic acid on a slide. A number of duplicate specimens were prepared by quickly softening the material in hot 45% acetic acid. After dissecting out the pollen grains excess acetic acid and debris are removed followed by the addition of lactic acid and cover-glass. With this procedure, the degree of expansion of the pollen grains is occasionally less than with the above technique. The preparations were sealed either with paraffin-beeswax or ringing cement (Turtox) and stored in a horizontal position. All observations were made with an apochromatic, oil immersion objective (90x, N.A. 1.25) and a compensating ocular (12x). In general, data on size are based upon the measurement, by both camera lucida and ocular micrometer, of a minimum of 25 suitably oriented grains for each species. *Urandra scorpioides* and *U. Brassii* possess the smallest pollen grains observed in the family — respectively, ca. 7.6 (L) $\times$ 14μ (D) and ca. 9.4 (L) $\times$ 12.3μ (D) while *Nothapodytes pittosporoides* and *Demostachys Vogelii* produce the largest grains — respectively, ca. 102 (L) $\times$ 89.8μ (D) and ca. 92 (L) $\times$ 99.2μ (D).

An obvious source of error in this type of investigation is the inadequacy of material stemming from immaturity of the specimen and over- or under-expansion of the grains during preparation. Wherever possible such errors were reduced by replication of preparations and addition of specimens. However, in the case of some species of which only limited material was available, reference to encountered inadequacies will be found in the text.

All of the drawings are intended to be faithful records of all visible details. All evident structures were carefully mapped out with the aid of the camera lucida. Many of the drawings are semi-diagrammatic in the sense that only part of the surface, etc. is completed in essentially photographic form. The completed portion of the figure of any one grain is intended to emphasize the essential diagnostic features. Since several focal planes are presented in each drawing, it is essential to realize that features such as germinal apertures present in the lower hemisphere (lower side of the grain) are depicted by broken lines. Those features on the surface (in the upper hemisphere) are indicated by continuous or stippled lines. Frequently, the relative thickness of the exine (outer layer of pollen grain wall) as seen in optical section is represented in at least a portion of the drawing. Where the exine is foveate ("pitted"),* this is often indicated in both the surface and optical section views. The foveae ("pits") or lacunae of a foveate ("pitted") or reticulate exine are, in general, indicated by clear, unstippled areas of a form and size appropriate to the species. This rule has been abandoned in noted cases where the foveolae (very small "pits") are so small that it was necessary to depict the "pits" (foveolae) themselves as stipple dots. All drawings, with few exceptions, represent the same magnification (ca. 1800$\times$ in the original). For the final preparation of the great majority of these drawings, we are indebted to Mrs. John E. Rogerson of Milton, Massachusetts. Pollen material of some 130 species in 50 genera have been examined in this study.

* Since the terms: — *pit, pitting, pitted* have special significance in discussions of somatic cell wall structure (29) it would seem desirable to avoid application of these terms in a different sense to the pollen grain wall.

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OBSERVATIONS

From the standpoint of pollen grain morphology, the family *Icacinaceae* has proven to be one of great interest because of the marked variation in form of pollen within the group. Within the family there exists, on the basis of pollen morphology alone, differentiation between species, genera, and certain larger categories. As is frequently the case, this differentiation does not find uniform expression throughout all areas of the family. For example, a number of genera possess a basically similar pollen morphology which of course would favor their being grouped together on the basis of this character. Depending upon the plexus within the family that one is concerned with, such grouping may culminate in clusters of related species, *e.g.* a genus, or in clusters of allied genera. The following is a summary of the notable pollen grain forms extant in the family together with a grouping of genera based upon the differentiation finding expression in pollen grain structure. How this organization of species compares with that established on other grounds will receive attention in the *Discussion*.

Data discussed in the present communication pertain largely to the surface characters of essentially intact pollen grains in the sense that the preparational technique has preserved both exine and intine. In many instances, critical interpretation of the minutiae of pollen grain wall structure must await the analysis of thinly-sectional material (*cf.* 5).

In general, the pollen grain descriptions have been reduced to their simplest terms. Data were accumulated under four major headings: (A) shape of pollen grain; (B) character of germinal apertures; (C) character of pollen grain surface (exine); and (D) size of pollen grain.

In recording the size of the pollen grains in this paper the measurements are approximate and recorded as illustrated by the following: $50 \times 35\ \mu$. The first number always signifies the length of the axis terminated by the poles and the second number represents the diameter, the axis transverse with respect to the length. Thus the length is greater than the diameter in the case of ellipsoidal grains, equal to the diameter in spheroidal types, and less than the diameter in species having oblate pollen grains. Somewhat more elaborate schemes have been devised [*cf.* Erdtman (8, 9), Wodehouse (32), and Faegri and Iversen (12, 25)] but the above cover the characters of diagnostic value. In general, a minimum of highly specialized terms have been utilized. These are briefly defined where they first appear.

In citing the specimens studied, collector and number (where given) and herbarium (A = Arnold Arboretum, B = Berlin, Museum of Botany, C = University of California, F = Chicago Museum of Natural History [Field Museum], G = Gray Herbarium, NY = New York Botanical Gardens, US = United States National Herbarium) are given after the species name. Grateful acknowledgment is made to the curators of these herbaria for the contribution of research material.

In viewing the group broadly, one senses two extremes. The first of these is illustrated by species having essentially smooth (psilate) pollen grains while the other is seen in species having variously echinate (spinose) grains. The transitional area between these two extremes is largely populated by a variety of "pitted" (foveate), "pitted"-reticulate (foveate-reticulate), reticulate, and papillate types. In setting up a classification on the basis of pollen characters, the genera can be resolved into some 15 relatively small groups. This classification which represents, essentially, a table of contents for the family, may be presented as follows:

TYPES OF POLLEN OF THE ICACINACEAE

A. Exine psilate (smooth) to foveate ("pitted") to reticulate to lophate to areolate; colpate or, more commonly, colporate (having germinal furrows with pores).

1. Psilate; tricolporate (having three furrows with germ pores).

   1. Emmotum *2. Ottoschulzia* *3. Poraqueiba*

2. Foveolate (finely "pitted") to foveate to foveate-reticulate; tricolporate.

   4. Cassinopsis *9. Citronella* *14. Lavigeria*
   5. Pittosporopsis *10. Dendrobangia* *15. Leretia*
   6. Calatola *11. Platea* *16. Pleurisanthes*
   7. Pennantia *12. Humirianthera* *17. Apodytes*
   8. Oecopetalum *13. Icacina*

3. Foveate-reticulate; tricolpate (triaperturate).

   17. Apodytes *18. Anisomallon*

4. Foveolate with alignment of foveolae ("pits") in direction of fingerprinting or rugulation; bald "polar" zones, non-committally, triaperturate.

   19. Leptaulus

5. Reticulate; tricolpate (triaperturate).

   20. Rhaphiostylis

6. Lophate; tricolpate.

   21. Gonocaryum

7. Foveate-granular, in direction of an areolate exine; tricolpate.

   22. Merrilliodendron

8. Areolate; tetracolporate (four furrows with pores, stephanocolporate).

   23. Alsodeiopsis

B. Exine psilate to foveate-papillate to papillate to papillate-echinate; colpate or, more commonly, porate; if psilate not colpate.

1. Psilate; triporate.
   24. Irvingbaileya *25. Gastrolepis*
2. Foveolate-papillate to minutely papillate-echinate; triporate.
   26. Codiocarpus *28. Medusanthera* *30. Cantleya*
   27. Stemonurus *29. Urandra* *31. Lasianthera*
3. Foveolate-papillate; stephanoporate or periporate (respectively, 4 or more pores in either equatorial or scattered arrangement); rarely triporate.
   31. Lasianthera *32. Natsiatum*
4. Granular-papillate-echinate; tricolpate.
   33. Hosiea

C. Exine echinate; commonly with porate germinal apertures usually having annuli (differentiated pore margins), rarely stephanocolpate.

1. Stephanocolpate; echinate-foveolate.
   34. Mappia *35. Desmostachys* *36. Nothapodytes*
2. Triporate with annuli; echinate.
   37. Discophora *40. Polyporandra* *43. Polycephalium*
   38. Mappianthus *41. Miquelia* *44. Chlamydocarya*
   39. Iodes *42. Phytocrene*
3. Apparently triporate (or periporate) without annuli; echinate.
   45. Rhyticaryum *46. Sarcostigma* *47. Pyrenacantha*

The various genera will be briefly described in the same sequence seen in the preceding classification. Where no remarks are appended to the individual species listing, it is to be inferred that the generic description covers the diagnostic characteristics of that species. It is perhaps obvious that the generic descriptions are necessarily based upon the species available for analysis.

1. EMMOTUM Desv. ex Hamilton

Grains ellipsoidal; tricolporate, the furrows (colpi) elongate, rather deeply impressed, extending as seen in equatorial view to almost the full length of the grain; germ-pores well defined, of circular to rectangular outline; exine smooth (psilate) or essentially so.

Emmotum nitens (Benth.) Miers. — FIGS. 5, 5A. — 20.3 × 16.8 μ. — *Burchell 8233* (G).

Emmotum argenteum Gleason. — FIGS. 3, 3A. — 27.7 × 25.4 μ. — *Tate 564*, type (NY).

Conspicuous rectangular germ-pore; the structure of the pollen grain suggests a close alliance with *E. glabrum*, a relationship suggested by Howard (18) on the basis of both species possessing a two-celled ovary.

Emmotum nudum Howard. — FIGS. 2, 2A. — 26 × 19 μ. — *Spruce 3541* (G).

The germ-pore is circular to rectangular, with the polar margin slightly thickened. The exine is smooth except for delicate foveation ("pitting") faintly evident at the poles.

Emmotum glabrum Benth. ex Miers. — FIGS. 4, 4A. — 23.2 × 20.8 μ. — *Klug 3990* (G).
Well-defined circular germ-pore often showing a slight collar or rim with a somewhat ragged margin. Except for the shape of the germ-pore, this species is closely similar to *E. argenteum.*

Emmotum orbiculatum (Benth.) Miers. — 22 × 18 μ. — *Ducke 919* (G).

Emmotum affine Miers. — 21.6 × 17.4 μ. — *Pickel 3125* (G).

Emmotum fagifolium Desv. ex Hamilton. — FIGS. 1, 1A. — 26.4 × 20.8 μ. — *La Cruz 3375* (G); *Pinkus 193* (G).
In some grains there is a suggestion of two faint ridges lying parallel to the equator on either side of the germ-pore. The available material was only fair. In the specimen of Pinkus, pollen grain shape was commonly spheroidal with a diameter of ca. 22 μ.

2. OTTOSCHULZIA Urban

Grains ellipsoidal; tricolporate; germ-pore rectangular to circular, somewhat irregular in outline, delicate ridges oriented equatorially on either side of the pore visible in some grains; exine smooth.

Ottoschulzia cubensis (Wright) Urban. — FIGS. 6, 6A. — 31.2 × 28.4 μ. — *Wright 2639*, ISOTYPE (G).

3. PORAQUEIBA Aublet

Grains ellipsoidal; tricolporate; furrows usually with ragged and somewhat granular margins; conspicuous germ-pore of rectangular outline; the pore so elongate equatorially beyond the typical furrow region imparting a "double-belted" appearance (costae pori transversales) to the grain when equatorially oriented; exine smooth.

Poraqueiba sericea Tulasne. — FIGS. 7, 7A. — 57.8 × 41 μ. — *Ducke 25* (A); *Spruce 1748* (G).
It is evident, in expanded grains, that the poral region in the furrow floor is capable of marked expansion in the form of a circular area surrounded by a ragged collar or rim. The rim is somewhat reminiscent of that seen in *Emmotum glabrum.* The pollen of *Spruce 1748* was somewhat immature with the grains averaging ca. 41 μ in length.

4. CASSINOPSIS Sonder

Grains ellipsoidal to markedly oblate; characteristically tricolporate; furrows elongate, narrow; germ-pores circular to lenticular; exine smooth to foveolate (very finely "pitted").

Cassinopsis ilicifolia (Hochst.) O. Ktze. — FIGS. 10, 10A, 10B. — 20.6 × 19.6 μ. — *Burchell 5817* (G).

While most of the material (labelled "*C. capensis* Burchell") was somewhat immature, it is evident that the typically ellipsoidal grains are less sharply triangular in polar view than those of *C. tinifolia*. In the majority of the observed grains, the furrows were constricted at the equator, thus obscuring the germ pore. The pore is rarely visible as a lens-shaped opening. (Fig. 10A).

Cassinopsis tinifolia Harv. — FIGS. 11, 11A. — 16.5 × 20.2 μ. — *Wood 9428* (A).

In polar view, the oblately flattened grains are triangular as in *Anisomallon clusiaefolium*. The grains are diamond-shaped in exact equatorial view. The deeply embossed furrows broaden out markedly at the equator to form a rectangular area surrounding the circular germ-pore. In expanded grains the pore is bounded by a rim similar to that found in *Dendrobangia boliviana* and *Citronella*. The exine is foveolate rather than smooth as in *C. ilicifolia*.

5. PITTOSPOROPSIS Craib

Grains ellipsoidal; tricolporate; furrows not expanding in the available material; germ-pore circular; exine in polar regions showing foveolae which in other regions are so diminished in size that the effect of a finely stippled surface is obtained.

Pittosporopsis Kerrii Craib. — FIGS. 8, 8A. — 31.2 × 28.5 μ. — *Henry 11778* (A).

6. CALATOLA Standley

Grains oblately spheroidal; tricolporate, (one four-furrowed grain noted); furrows of relatively limited longitudinal extent and, in the material studied, do not open widely; the circular germ-pore is rendered distinctive by its irregularly toothed margin; exine foveolate as in *Cassinopsis tinifolia*.

Calatola laevigata Standley. — FIGS. 14, 14A. — 24.4 × 27 μ. — *Schipp 8–708* (F).

7. PENNANTIA Forst.

Grains ellipsoidal to oblately spheroidal; tricolporate; furrows elongate, extending almost to the poles, furrow-margin somewhat irregular; germ-pore circular to somewhat rectangular with ragged, irregular margin; frequently fragments of foveolate ("pitted") exine occur on the poral membrane; exine actually foveolate (very finely "pitted"), though the general effect is smooth.

Pennantia corymbosa Forst. — FIGS. 12, 12A. — 25.7 × 25.3 μ. — *T. Kirk* (G); *Raoul* (as *P. Endlicheri*) (G).

Pennantia Cunninghamii Miers. — FIGS. 13, 13A. — 22.5 × 20.9 μ. — *Moore* (G).

The exine is less foveolate in this species than in the preceding one.

8. OECOPETALUM Greenman & Thompson

Grains ellipsoidal; tricolporate; furrows prominent at equator, gradually disappearing poleward; germ-pore large and conspicuous, of elliptical outline; exine foveolate, the largest of the "pits" occurring at the poles.

Oecopetalum mexicanum Greenm. & Thomps. — FIGS. 9, 9A. — 36.3 × 31.8 μ. — *Purpus 6159,* ISOTYPE (G).

In its combination of pollen grain characters (furrow folds, foveolation, conspicuous germ-pore, and size), this species is distinctive within the group.

9. CITRONELLA D. Don

Grains ellipsoidal to oblate; tricolporate; commonly with germ-pore of circular outline; exine commonly finely and uniformly foveate ("pitted") but, in some species, varying to foveate-reticulate particularly in polar regions.

Pollen of the investigated species of the Old World is not differentiated from that of the American species (*cf.* Figs. 15, 16). The relatively uniform pollen morphology throughout the genus supports Howard's (20) recent treatment of the complex.

Citronella costaricensis (Donn. Sm.) Howard. — FIGS. 17, 17A. — 26.4 × 31.2 μ. — *Tonduz 11664* (G); *Austin Smith P2394* (A).

The shape of the pollen grain as well as the germ-pores and exine foveation are essentially as in *C. Gongonha.*

Citronella mucronata (Ruiz & Pavon) D. Don. — FIG. 18. — 36.7 × 34.2 μ. — *Muños & Coronel 1394* (G).

Citronella Gongonha (Mart.) Howard. — FIGS. 16, 16A. — 26.4 × 29.8 μ. — *Hoehne 385* (A).

The oblately spheroidal grains when expanded show large, gaping germ-pores bounded by low, collar-like rims.

Citronella incarum (Macb.) Howard. — FIGS. 21, 21A. — 23.4 × 24 μ. — *Weberbauer 7056* (F).

This species is distinctive in its comparatively small size. The germ-pore is bounded by a collar-like rim as in *C. Gongonha.*

Citronella ilicifolia (Sleumer) Howard. — FIGS. 19, 19A. — 25.5 × 24.9 μ. — *Weberbauer 6617* (F).

The pollen of *Weberbauer 6617* included a large number of shrivelled grains.

Citronella sarmentosa (Baill.) Howard. — 32.3 × 34 μ. — *Prony 1576–A* (A).

No distinct germ-pores were evident in the uniformly foveate ("pitted"), oblately spheroidal grains studied.

Citronella vitiensis Howard. — 29.7 × 25 μ. — *Degener & Ordonez 13773* (A).

This species is similar to *C. Smythii* in having ellipsoidal pollen grains with luminous granules in many lacunae of the foveate-reticulate exine.

Citronella Smythii (F. v. Muell.) Howard. — FIGS. 15, 15A. — 36 × 32.5 μ. — *Michael 203* (G); *Doggrell*, 14–12–29 (A); *Francis*, without number (A).

Pollen grains ellipsoidal as in *C. samoensis*; faintly outlined, circular germ-pore; foveae ("pits") of exine of variable size, the largest usually restricted to the poles thus giving that region a foveate-reticulate appearance; luminous granules occur in some of the larger foveae. Some immature grains were present in the available material.

Citronella philippinensis (Merr.) Howard. — FIGS. 20, 20A. — 33.7 × 32.9 μ. — *Ramos 33267* (A).

The exine is foveate essentially as in *C. Smythii*. In expanded grains, the exine bounding the larger foveae, particularly in polar regions, is fragmented thus imparting a somewhat beaded-reticulate appearance.

Citronella samoensis (A. Gray) Howard. — 29.6 × 27.7 μ. — *Christophersen 2721* (A).

The germ-pore is rarely evident as a circular area; the exine is finely and uniformly foveate. Many shrivelled grains were apparent in the material studied.

Citronella lucidula (Sleumer) Howard. — 27.5 μ (diameter). — *Franc 1282*, ISOTYPE (A).

The spheroidal pollen grains have a foveate-reticulate exine.

10. DENDROBANGIA Rusby

Grains oblately spheroidal to ellipsoidal; tricolporate; furrows elongate and smoothly outlined; germ-pore circular, in expanded grains, the pore bounded peripherally by a rim as in *Citronella Gongonha*; exine foveolate (finely "pitted").

Dendrobangia boliviana Rusby. — FIGS. 22, 22A. — 24.8 × 30.3 μ. — *Rusby 1694* (G); *Persaud 113* (NY).

11. PLATEA Blume

Grains ellipsoidal to oblately spheroidal; tricolporate; furrows elongate; germ-pore circular to lenticular; exine rather uniformly foveate except for immediate margin of the psilate furrow; foveation similar to that seen in *Citronella Gongonha* and *C. ilicifolia*.

Platea philippinensis Merr. — FIGS. 23, 23A. — 34.3 × 32.4 μ. — *Elmer* (Phil. Bur. Sci.) *9777*, ISOTYPE (A).

In the preparations studied, the furrows do not open widely but are constricted (i.e. unopened) in the equatorial region thus obscuring the germ-pore (see Fig. 23A).

Platea latifolia Bl. — 29 × 30 μ. — *Clemens 32396* (C).

While the furrows are not markedly constricted at the equator, this specimen resembles *P. philippinensis*. The exine differs somewhat from that of the last species in that many of the foveae are aligned thus imparting a somewhat striate appearance.

Platea parviflora Koord. & Valet. — 24 × 20.2 μ. — *Clemens 11163* (A).
In the limited material available for study, the deeply impressed furrows are constricted at the equator in the germ-pore region.

Platea hainanensis Howard. — 24 × 25.8 μ. — *Liang 64940* (A).
In some pollen grains, refractive, lenticular bodies are located in pairs on either side (either polar or meridional) of the germ-pores.

12. HUMIRIANTHERA Huber

Grains oblately spheroidal to ellipsoidal; tricolporate with germ-pore circular in outline; exine foveolate.

Humirianthera rupestris Ducke. — Figs. 29, 29A. — 30 × 25.7 μ. — *Ducke 25288, 342* (US).
The germinal furrows are usually constricted at the equatorial region as in *Icacina senegalensis*. Further, pollen grain shape and character of exine are as in *Icacina*. Not infrequently, luminous fragments are visible in the furrow regions. The specimen (*Ducke 342*) belongs here according to Howard (17) (cf. Figs. 30, 30A). Its pollen grains differ in being somewhat larger (38 × 36 μ). Abundant starch (diameter of starch grains up to ca. 4.5 μ) also occurred in some pollen grains of this specimen.

Humirianthera crispula Howard. — 29 × 30 μ. — *Haught 2619*, ISOTYPE (G).
The oblately spheroidal grains are foveolate as in *H. rupestris*. The available material was inadequate.

13. ICACINA Juss.

Grains ellipsoidal; tricolporate, the furrows elongate; germ-pore large, circular to elliptical, occasionally bridged by strands of exine (see Fig. 24). Frequently, that portion of the exine which is directly above the germ-pore is somewhat depressed (i.e. apparently rests upon the poral membrane) thus contributing to the "shouldering" effect evident at the polar margins of the germ-pore. Exine foveate to foveate-reticulate.

Icacina Mannii Oliv. — Fig. 24. — 63 × 56 μ. — *Zenker 475* (G).
The exine is similar to that seen in *Lavigeria, Pleurisanthes*, and *Leretia*. Partial dissociation of such a foveate-reticulate surface would theoretically yield the surface found in *Alsodeiopsis*.

Icacina senegalensis A. Juss. — 58.9 × 45.7 μ. — *Rea 1671* (A).
The material was rather inadequate. Many distorted grains were observed. However, the texture of the exine was essentially as in *I. Mannii*.

14. LAVIGERIA Pierre

Grains ellipsoidal; tricolporate; furrows elongate; equatorial germ-pore with irregular (ragged) margin; exine foveate.

Lavigeria salutaris Pierre. — FIGS. 25, 25A. — 52.5 × 46 μ. — *Mildbraed 10536* (A).

15. LERETIA Vellozo

Grains ellipsoidal; tricolporate; furrow elongate with irregular margin; occasionally the furrow bridged by slender strands of exine; germ-pore poorly defined, but when evident, circular with a ragged, fimbriate margin; exine foveate; foveae somewhat enlarged at the polar ends of the grain where the surface is essentially foveate-reticulate.

Leretia cordata Vell. — FIG. 26. — 60.7 × 52.3 μ. — *Klug 2967* (G), *641* (F); *La Cruz 4235* (G); *Blanchet 2347* (F); *Spruce 4492* (NY).

The character of the foveation as well as the absence of echination of the exine renders this species distinct from the genus *Mappia.*

16. PLEURISANTHES Baillon

Grains ellipsoidal to prolate; tricolporate; furrows elongate with irregular margins, occasionally bridged by strands of exine; germ-pore either not evident or infrequently, but poorly, defined in the equatorial region of the furrow; exine rather uniformly foveate.

Pleurisanthes parviflora (Ducke) Howard. — FIG. 27. — 65.2 × 34.4 μ. — *Krukoff 6954* (A).

The pollen grains are characteristically prolate in shape.

Pleurisanthes flava Sandwith. — FIG. 28. — 49.3 × 37.5 μ. — *Sandwith 590*, ISOTYPE (NY).

This species is differentiated from *P. parviflora* primarily on the basis of its size and ellipsoidal shape. Shrivelled grains, as well as one abnormally large grain (ca. 72 μ long), were present in the observed material.

17. APODYTES E. Meyer ex Bernh.

Grains oblate, triangular in polar view; three (rarely four, see Fig. 37B) germinal-pores which also represent the furrows. In this respect, note the remarks applying to *A. yunnanensis* and *A. dimidiata.* The germinal apertures are circular to lenticular in outline; exine varying from foveate-reticulate to reticulate.

Apodytes yunnanensis Hu. — 18.4 × 25.8 μ. — *Wang 74304* (A).

This species and *A. dimidiata* are of interest in possessing both furrows (colpi) and pores as individually visible structures. In *A. yunnanensis* the length of the slit-like colpus is somewhat greater than the diameter of the germ-pore.

Apodytes dimidiata E. Mey. — 22 × 29.6 μ. — Imperial Forestry Institute *42* (A).

In this species the germ-pore is almost, but not quite, coincidental with the separately visible colpus. Granular, refractive, lenticular bodies, sometimes three in number, are visible near the germinal apertures of occasional pollen grains.

Apodytes Gardneriana Miers. — FIGS. 35, 35A. — 27 × 31 μ. — *Silva 12* (A).

The foveate reticulation seems relatively massive for a grain of this size. The germ-pore margins are usually foveolate.

Apodytes cambodiana Pierre. — FIGS. 36, 36A. — 25.2 × 33.4 μ. — *Clemens 3891* (A).

In polar view, one side (representing one "hemisphere") is distinctly more massively reticulate than is the other side (see Fig. 36). Since there were no tetrads (quartets) present in the preparation, it is not possible to state which side is distal with reference to the tetrad.

Apodytes brachystylis F. v. Müll. — FIGS. 37, 37A, 37B. — 27 × 36.7 μ. — *Kajewski 1184, 1380* (A).

In the observed material, the germinal aperture as seen in equatorial view (see Fig. 37A) is rather constricted. The somewhat ragged margin of the aperture is suggestive of that seen in *A. cuminensis*. Occasional grains with four apertures were noted (Fig. 37B).

Apodytes beninense Hoch. — FIGS. 38, 38A. — 33.5 × 39 μ.— *Elliot 4712* (G).

Apodytes cuminensis Hook. f. — FIGS. 39, 39A. — 44.5 × 53.5 μ. — *Eala 1930* (F).

This species has the largest pollen grains of the seven examined. It is comparable in size to *Rhaphiostylis cordifolia*. The reticulate exine is very similar to that of *A. beninense*. Not infrequently, there are bright granules on the floor of the lacunae.

18. ANISOMALLON Baillon

Grains markedly flattened in equatorial view, distinctly triangular in polar view; pores three, circular to lenticular, apparently coincidental with the furrows (i.e. triaperturate); exine foveate-reticulate, the foveation relatively massive for a grain of this small size.

Anisomallon clusiaefolium Baill. — FIGS. 34, 34A. — 13.7 × 22.5 μ. — *Prony 1731* (A).

Anisomallon is well differentiated from the other genera having scalariform perforations in the vessels of the secondary xylem on the basis of its triangular, flattened, and foveate-reticulate pollen grain.

19. LEPTAULUS Benth.

Grains oblately spheroidal to spheroidal; triaperturate; characteristically, there are three conspicuous germinal openings (furrow and pore apparently coincidental). Grains with an additional germinal opening were noted in both *L. daphnoides* and *L. grandifolius*; exine varies from foveolate to foveolate-rugulate with the "polar" regions usually differentiated as essentially bald zones. This genus is rather sharply set off from other genera of the family in its distinctive pollen grain form.

Leptaulus daphnoides Benth. — FIG. 32. — 48 μ (diameter). — *Linder 872* (A); *Mann 806* (G).

The exine of this species is so finely foveolate that the general effect is almost smooth. As is evident in Fig. 32, the foveolae are so arranged that a semblance of finger printing or minute rugulation is attained. The "polar" regions are delicately differentiated by a smoother texture and thinner wall than in the balance of the grain. Infrequently the "polar" region is visible as a depression.

The three (rarely four) conspicuous germinal apertures have a roughly circular outline. In one specimen (Mann 806, labelled *L.* species), a fluting around the apertures derived from thickening plus alignment of foveolae is somewhat suggestive of *Gastrolepis austrocaledonica* and certain species of *Stemonurus*.

Leptaulus grandifolius Engler. — FIGS. 33, 33A. — 42.8 μ (diameter). — *Zenker 14* (G).

Approximately 19% of the grains have four germinal apertures. The aperture is indistinctly defined and while no definite pore is visible the equatorial region is conspicuously granular-foveolate.

In our preparations, a well-defined bald zone occurs at the "poles". The wall of this region lacks the rigidity of the heavier, foveolate wall. Consequently, the bald area is usually seen as a "polar" depression. In many grains, exine structure is not uniform, the most massive foveolation and granulation occurring at the periphery of the bald zone and the germinal openings. *Leptaulus daphnoides* is differentiated from this species in its finer foveolation, the clearly defined germinal apertures, and its less sharply defined "polar" zone.

20. RHAPHIOSTYLIS Planch. ex Benth.

Grains oblate; triangular in polar view; tricolpate; three germinal pores apparently coincidental with the furrows, usually of lenticular shape; exine reticulate, not infrequently with luminous granules on the floor of some lacunae, the reticulum beaded when viewed at lower focal planes.

Rhaphiostylis cordifolia Hutch. & Dalz. — FIG. 40. — 42.3 × 51 μ. — *Linder 1218* (A).

Rhaphiostylis ferruginea Engler. — FIGS. 41, 41A. — 32.5 × 43 μ. — *Zenker 65* (C).

Rhaphiostylis latifolia Pierre. — FIGS. 42, 42A. — 31.2 × 42.5 μ. — *Zenker 2242* (A).

Rhaphiostylis fusca (Pierre) Pierre. — 25.2 × 36.4 μ. — *Klaine 3348* (A).

21. GONOCARYUM Miquel

Grains oblately spheroidal; germinal furrows three, rarely four, without distinct pores, the furrow in at least one species bridged by strands of substance related to the contiguous reticulum; exine lophate-reticulate, appearing buttressed or somewhat beaded at sub-surface focal planes; luminous granules evident in many lacunae.

Gonocaryum longeracemosum King. — Figs. 44, 44A. — 31.7 × 39.5 μ. — *Sargent* (Singapore Bot. Gard.) (A).

The three (rarely four) germinal furrows are frequently bridged by strands (see Fig. 44). In polar views (see Fig. 44), the reticulum of the exine is composed of ca. 97 lacunae.

Gonocaryum cognatum Elmer. — Figs. 45, 45A. — 36.8 × 39.6 μ. — *Ramos & Edano 44073* (A).

The reticulum of the exine is more massive than in *G. longeracemosum.* In polar view, approximately 81 lacunae are visible in the reticulum. The usually lenticular furrow-regions are little differentiated from the rest of the exine and, as a consequence, are frequently difficult to delineate, in equatorial view.

Gonocaryum calleryanum (Baill.) Becc. — Figs. 46, 46A. — 31.6 × 33.2 μ. — Phil. Bur. Sci. *33* (A).

While the reticulum is less massive than in the previous two species, the basally buttressed or beaded nature of the reticulum is more evident in this species than in *G. cognatum* and *G. longeracemosum.* In pollen grains having polar orientation (see Fig. 46) there are approximately 48 lacunae visible in the exine reticulum. In this species, the lenticular, germinal furrows are quite distinctly differentiated from the adjacent reticulum.

Gonocaryum fuscum Hochr. — 26.4 × 31.3 μ. — *Sargent* (without number) (A).

Approximately 54 lacunae are visible in the reticulum of grains having polar orientation. The germinal furrow is similar to that in *G. calleryanum.*

22. MERRILLIODENDRON Kanehira

Grains oblately spheroidal; furrows three without visibly differentiated germ-pores; islands of foveolate-areolate exine within the furrow region somewhat as in *Alsodeiopsis;* exine foveolate to granular-foveolate-areolate.

Merrilliodendron rotense Kanehira. — 37 × 43 μ. — *Kanehira 1775,* type (NY); *Glassman 240* (A).

23. ALSODEIOPSIS Oliv.

Grains ellipsoidal; tetracolporate; characteristically four furrows which do not expand widely, the furrow margin irregular, a definite pore difficult to determine. However, in *A. Schumannii* and *A. Zenkeri* several grains with more or less rectangular pores were noted. The exine is provided with markings that seem best described in terms of either a reticulum or a foveate surface so incomplete that no intact lacunae are present, *i.e.* areolate. It is a surface characterized by interstices separating small areas of exine. Bounding the furrows is a finely granular-foveolate zone. Luminous islands of material occur both on the floor and along the margin of the furrow. Two thickened sub-surface rings (apparently *costae aequatoriales*) in the pollen wall encircle the pollen grain in the equatorial region, thus imparting an unusual "belted" appearance. In *A. Schumannii* the exine varies from foveolate to somewhat areolate.

Alsodeiopsis Schumannii Engler. — 65.9 × 60.5 μ. — *Braun 787* (A).

One germinated pollen grain showed the pollen tube emerging from the equatorial region (potential germ-pore) of the furrow.

Alsodeiopsis Staudtii Engler. — 52.2 × 47.6 μ. — *Schlechter 13071* (A).

The equatorial belting effect characteristic of *Alsodeiopsis* is especially prominent in this species. Occasional pentacolporate grains occur.

Alsodeiopsis Welwitschii Oliver. — FIGS. 43, 43A. — 68.3 × 62.5 μ. — *Zenker* (F, 765310).

Alsodeiopsis Zenkeri Engler. — 68.5 × 61.5 μ. — *Zenker 152* (G). Occasionally, grains with five furrows were observed. The equatorial region of the furrow, although somewhat irrégularly delineated, apparently represents the germ-pore.

Alsodeiopsis species. — 63.2 × 56.3 μ. — *Zenker* (F, 765317).

The exine and the furrows of this specimen agree in their characters with those seen in *A. Welwitschii*. However, the specimen differs from this species in having a somewhat smaller pollen grain. Two grains with five furrows were noted.

24. IRVINGBAILEYA Howard

Grains markedly oblate; typically triangular in polar view; commonly three pores, although our preparations included four-pored grains to the extent of 15.7%, the pore surrounded by a foveolate zone of rather limited extent; exine smooth.

Irvingbaileya australis (White) Howard. — FIGS. 60, 60A, 60B. — 15.3 × 23.4 μ. — *Tardent 259* (A).

This species was previously included in the genus *Tylecarpus* Engler, the components of which are now assigned to the genus *Medusanthera*. The pollen grains of *Medusanthera* are distinct from those of *I. australis* in being somewhat smaller and in typically having a minutely papillate exine with broader, foveolate zones (annuli) bounding the germ-pores.

25. GASTROLEPIS Van Tieghem

Grains oblate, triangular in polar view; three (rarely four) lenticular pores of somewhat irregular outline, a foveolate, thickened zone bounding the germ-pore; exine essentially smooth, although structurally foveolate.

Gastrolepis austro-caledonica (Baill.) Engler. — Figs. 49, 49A. — 18.2 × 21.2 μ. — *Franc 1791* (G).

26. CODIOCARPUS Howard

Grains oblately spheroidal; three conspicuous circular germ-pores surrounded by a delicately foveolate-granular zone; exine minutely papillate, giving the over-all general effect of a smooth surface; papillae rather widely spaced and occasionally taking on the nature of small, short spines.

Codiocarpus Merrittii (Merr.) Howard. — Figs. 47, 47A. — 24 × 27 μ. — *Ramos* (Phil. Bur. Sci. 40837, TOPOTYPE) (A); *Elmer 12622* (G).

Howard's (21) establishment of a distinct generic concept for this species is supported by data on pollen grain morphology. From this viewpoint the species is distinct from *Stemonurus* in which genus it was previously included. Likewise, the pollen grains of the genera *Lasianthera*, *Gastrolepis*, *Irvingbaileya*, *Urandra*, and *Discophora* are distinct from those of *C. Merrittii*. In the case of two species of *Medusanthera* (*M. laxiflora* and *M. papuana*), the exine is minutely papillate and the poral zones are foveolate, somewhat as in *C. Merrittii*. However, in each case the pollen grains are decidedly smaller than in this species.

Codiocarpus andamanicus (Kurz) Howard. — 10.4 × 14.6 μ. — *King's Collector* 3–28–94 (A).

Despite some immaturity of the limited material, this species appears to be closely similar to *C. Merrittii* in its exine and moderately developed annulus. The difference in size of pollen grain may not be as great in fully mature specimens.

27. STEMONURUS Blume

Grains markedly oblate; three, very rarely four, pores of circular outline, each surrounded by a relatively wide (averaging perhaps 2 μ in width) foveate zone, the annulus, which in face view resembles a lace collar; exine structurally foveolate-rugulate-papillate but usually giving an essentially smooth general effect. In some instances the papillae appear to be nearly baculiform. Despite this, the outline of the pollen grain is almost smooth. The highly distinctive rugulate (sense of Iversen and Troels-Smith, 25) character was most evident in *S. hainanensis* although delicate degrees of rugulation were also noted in other species (*e.g. S. axillaris*).

Throughout the complex of species studied there is a characteristic pollen morphology particularly with respect to the presence of the conspicuously foveate annuli (germ-pore margins). Different opinions are held with respect to the applications of the name *Stemonurus* (cf. 16, 28, 23). The generic concept utilized here includes species originally described as members of the genus *Gomphandra* Wallich ex Lindley.

Stemonurus affinis Miers. — 15 × 23 μ. — *Boeea 8028* (A).
The exine, which in general effect is almost smooth, is very minutely foveolate-rugulate-papillate. The remarkably conspicuous annulus may have a radius of as great as ca. 5 μ.

Stemonurus apoensis Elmer. — 14.3 × 18.4 μ. — *Elmer 15416* (A).

Stemonurus axillaris (Wall. ex Lindl.) Miers. — 19 × 24.2 μ. — *Anglade*, without number (A).
The exine is minutely papillate-rugulate in this species.

Stemonurus Chingianus Hand.-Mazz. — 19 × 23.6 μ. — *Ching 5226*, ISOTYPE (NY); *Pételot 5450* (A).

Stemonurus Cumingianus Miers. — FIGS. 50, 50A. — 16 × 19 μ. —*Wenzel 696* (A), *350* (A, G).

Stemonurus dolichocarpus (Merr.) Howard. — 16 × 21.3 μ. — *Toroes 844* (A).
In this species, the exine is quite smooth (psilate). The annulus is of comparatively limited extent.

Stemonurus flavicarpus Elmer. — 14 × 20.2 μ. — *Elmer*, Phil. Bur. Sci. 11330 (A).

Stemonurus hainanensis (Merr.) Hu. — 16 × 23 μ. — *Henry 10738* (A); *How 70388* (A).
The exine, while smooth in general effect, is noteworthy for its distinctive minutely rugulate character (*cf.* Fig. 1 of Plate II of Faegri and Iversen, 12).

Stemonurus javanicus Bl. (var. *lanceolata* K. & V.). — 16.3 × 21.7 μ. — Collector unknown *151* (NY).

Stemonurus luzoniensis (Merr.) Howard. — 18 × 27 μ. — *Elmer 13110* (G).
In grains having polar orientation, the annulus ascends abruptly to the pore. The exine is very faintly rugulate.

Stemonurus oppositifolius (Pierre ex Gagnep.) Howard. — 15.3 × 23 μ. — *Clemens 3861* (C).
The annuli are abruptly ascending.

Stemonurus polymorphus Miers. — 17.6 × 25.6 μ. — Herb. Wight, Pen. India Orient., *427* (G).

Stemonurus Yatesii (Merr.) Howard. — 11.2 × 16 μ. — *Yates 2637*, TYPE (C), *2248* (C).
The exine differs from the above species of the genus in being finely papillate with the diminutive papillae appearing spinose as in *Medusanthera glabra*. There is no suggestion of the distinctive, minutely rugulate character in this species. On the basis of pollen characters, this species seems more closely allied to *Medusanthera* than to other species of *Stemonurus*.

Stemonurus mollis (Merr.) Howard.* — 13.6 × 19.2 μ. — *Pételot 7949*, TYPE (A).

Stemonurus Petelotii (Merr.) Howard.** — 21.7 × 25 μ. — *Pételot 2647*, TYPE (A).

Stemonurus obscurinervis (Merr.) Howard.*** — 16 × 23.5 μ. — *Pételot 4359*, TYPE (A).

28. MEDUSANTHERA Seeman

Grains oblate. Germ-pores more or less circular, typically three, occasionally four, bounded by a foveolate and somewhat thickened zone, striate in appearance especially when seen in polar view (i.e. optical section). In general effect the exine is smooth. Structurally the surface is beset with minute papillae. Usually the papillae are so diminutive that it is difficult to determine whether their form is either that of exceedingly short spines or that of blunt pegs. It appears, however, that such species as *M. samoensis* and *M. carolinensis* have very short spinose papillae.

Medusanthera carolinensis (Kaneh.) Howard. — FIGS. 56, 56A. — 11.6 × 15.5 μ. — *Kanehira 1882* (NY).

Throughout, the pollen grain of this species is essentially identical with that of *M. glabra*.

Medusanthera glabra (Merr.) Howard. — FIGS. 55, 55A. — 9.4 × 15.3 μ. — *Wenzel 1029* (A).

The pollen grain of this species has the appearance of being a smaller edition of that of *M. samoensis*.

Medusanthera laxiflora (Miers) Howard. — FIGS. 53, 53A. — 17 × 20.2 μ. — *Brass 2724* (A); *Wenzel 3224* (A).

The pollen of the Wenzel specimen (labelled "*Stemonurus laxiflorus*"), while agreeing in its morphology with the Brass collection, differs in having a somewhat smaller pollen grain (14.6 × 18.3 μ).

Medusanthera papuana (Becc.) Howard. — FIG. 52. — 16.4 × 21.2 μ. — *Schlechter 17913* (C).

The available pollen material was largely immature.

Medusanthera samoensis (Reinecke) Howard. — FIGS. 54, 54A. — 14.6 × 19.4 μ. — *Christophersen 3061* (A).

The exine is minutely roughened by chiefly spinous papillae as in *M. carolinensis*.

Medusanthera vitiensis Seeman. — FIGS. 51, 51A. — 15 × 19.3 μ. — *Smith 578* (G); *Storck 877*, ISOTYPE (G).

The pollen of this species is quite similar to that of *M. laxiflora*.

* **Stemonurus mollis** (Merr.) Howard, comb. nov. *Gomphandra mollis* Merr., Jour. Arnold Arb. **23**: 175. 1942.

** **Stemonurus Petelotii** (Merr.) Howard, comb. nov. *Gomphandra Petelotii* Merr., Jour. Arnold Arb. **23**: 176. 1942.

*** **Stemonurus obscurinervis** (Merr.) Howard, comb. nov. *Gomphandra obscurinervis* Merr., Jour. Arnold Arb. **19**: 44. 1938.

29. URANDRA Thwaites

Grains oblate, more or less triangular in polar view; germinal apertures three, of circular or lenticular outline; pore margin ornamented by a thickened, foveolate, often sinuous zone (annulus); exine foveolate-papillate, frequently of smooth general effect.

Urandra Brassii Howard. — 9.4 × 12.3 μ. — *Brass 7421*, TYPE (A). The exine is minutely rugulate. The annulus and pore are typical for the genus, resembling those of *U. secundiflora*.

Urandra dolichophylla (Merr.) Howard. — 9 × 15.8 μ. — *Elmer 21415*, ISOTYPE (C, G).
The pollen of this species is very similar to that of *U. scorpioides*.

Urandra Hallieri Merr. — 11 × 15.4 μ. — *Hallier 497* (A).
The exine is finely papillate, having a smooth general effect (as in *U. dolichophylla*).

Urandra scorpioides (Becc.) O. Ktze. — FIGS. 58, 58A. — 7.6 × 14 μ. — *Toroes 4323* (A); *Wood 2392* (A).
The exine is so finely foveolate-papillate that in general effect it appears smooth.

Urandra secundiflora (Blume) O. Ktze. — FIGS. 57, 57A. — 9 × 14.6 μ. — *Haviland & Hose 1544* (G).
The exine is so finely foveolate that it seems almost smooth.

Urandra umbellata (Becc.) O. Ktze. — FIGS. 59, 59A. — 13.7 × 17.7 μ. — *Haviland 1782* (G); *Holttum 31267* (A).
The exine is quite distinct from that of the other species of the genus cited above. The surface is irregularly papillate-rugulate (somewhat like Fig. 2, Plate II of Faegri and Iversen, 12). The exine of *Cantleya corniculata* is of somewhat similar structure although the papillate foveation is of a much finer and more delicate order.

30. CANTLEYA Ridley

Grains markedly oblate, triangular in polar view; germ-pores three, the poral aperture peripherally differentiated by a remarkable foveate fretwork of rods representing the regions between the foveae in the locally thickened exine; exine minutely papillate-foveate-rugulate, the foveae so numerous that the surface appears as if it were faintly papillate.

Cantleya corniculata (Becc.) Howard. — FIGS. 61, 61A. — 11 × 17 μ. — Ex. Herb. Hort. Bog. 265770 (C).

31. LASIANTHERA P. Beauv.

Grains markedly oblate; pores commonly three or four, rarely five or six, rendered conspicuous by a thickened peripheral zone (annulus); exine very finely papillate giving an almost smooth general effect.

Lasianthera africana Beauv. — Figs. 48, 48A. — 14.6 × 21.2 μ. — *Conrau 41* (A, B); *Ghesginere 2910* (G).

The distinctive pollen grain of this species makes it clear that "*Lasianthera austrocaledonica*" of Baillon is best assigned elsewhere. Howard (16) has already advocated the assignment of this species to the genus *Gastrolepis* on the basis of other characters. Likewise, the pollen grains of *Medusanthera*, *Stemonurus*, and *Discophora* are each distinct from those of *L. africana*. The dimensions given apply to *Conrau 41*, the pollen of which generally has four pores or rarely three, five, or six pores. The Ghesginere specimen, consistently triporate, differs in having pollen grains which are about 30% smaller.

32. NATSIATUM Buch.-Ham.

Grains oblately spheroidal; germ-pores circular varying in number from 5 to 7 with 6 being the most frequent. Of these, four are usually located on the "equator" with the remainder occurring fairly close to the "equator" in either the upper or lower hemisphere; exine foveolate-papillate.

Natsiatum herpeticum Buch.-Ham. — Fig. 31. — 28.8 μ (diameter). *Parkinson 3927* (A); *Griffith 828* (G).

33. HOSIEA Hemsley & Wilson

Grains oblately spheroidal; tricolpate, rarely four-furrowed, the furrows elongate (see Fig. 63) with very ragged, torn margins; frequently with irregular bridges or fragments of exine in the equatorial region; germ-pore not distinct; exine irregularly ornamented with short spines and rather blunt papillae, the texture between the projections rather finely granular-foveolate.

Hosiea sinense (Oliver) Hemsl. — Fig. 63. — 45.5 × 56.2 μ. — *Wilson 960, 960a* (A); *Yü 1932* (A).

One dwarf pollen grain (diameter ca. 28.8 μ) was observed. *Hosiea sinense* is the only member of the tribe *Iodeae* having elongate furrows. A somewhat similar furrow is seen in the tribe *Sarcostigmateae*.

34. MAPPIA Jacquin

Grains ellipsoidal to oblately spheroidal; furrows three to five depending upon the species concerned; margins very ragged and not infrequently bridged by strands of exine material (see Fig. 64A) with small fragments of exine in the furrow region; germ-pore indistinct; exine foveate-punctate with very short, rather widely spaced spines, which appear in reduced light as luminous spots, some spines having the appearance of "reduced" (or little-developed) papillae.

Mappia angustifolia Griseb. — 55.7 × 51.2 μ. — *Wright 2638* (G). This species is characteristically tricolpate.

Mappia longipes Lundell. — 47 × 44.6 μ. — *Matuda 4798*, TYPE (A).
This species is tetracolpate (stephanocolpate). Many of the massive "spines" of the exine are blunt or baculiform. The longest of these have a length of ca. 1.4 μ.

Mappia mexicana Robins. and Greenm. — FIGS. 64, 64A. — 53.6 × 51 μ. — *Pringle 5094, 6645* (G).
Of the pollen grains examined, 56% were tetracolpate whereas 44% were pentacolpate. No tricolpate grains were observed. Despite the outward differences in the two specimens noted by Howard (17), the equivalent pollen form of the two collections justifies his assignment of them to a single species.

Mappia racemosa Jacq. var. **brachycarpa** Griseb. — 51.5 × 52.3 μ. — *Wright 1389* (G).
The pollen of this species is typically tetracolpate.

35. DESMOSTACHYS Planchon

Grains oblately spheroidal; furrows four to nine, about two-thirds the length of the pollen grain; germ-pores indistinct; exine, particularly in *D. Preussii*, foveolate with a minutely striate character (as seen in optical section) bearing conspicuous short spines.

Desmostachys Preussii Engler. — FIGS. 76, 76A. — 73.3 × 78.4 μ. — *Zenker 121* (G), *404* (A).
When closed, the germinal furrows are slit-like apertures bounded by massive spines. The largest of these are ca. 3.8 μ long and 2.8 μ wide at the base. Typically the number of furrows is four.

Desmostachys Vogelii Stapf. — FIG. 77. — 92 × 99.2 μ. — *Linder 1345* (A).
The pollen grains of this species possess 6 to 9 furrows. In our material, 47% of the grains had 7 furrows while 50% had 8 furrows. As seen in perfectly polar view, the furrows are symmetrically distributed around the equator and are essentially of the same length. However, there are occasional grains which deviate from the usual pattern in having either 6 or 7 normal furrows and an additional one whose length is only 1/6 to 1/2 that of the others.
The spines of the exine are of irregular size and distribution and are commonly shorter than in the previous species. The bald or relatively smooth zone bounding each furrow (see Fig. 77) is a striking feature of this pollen grain. Rather massive spines are found at the immediate margin of the furrow. Luminous flecks of material occur on the floor of the expanded furrow. The striate nature of the exine is less evident than in *D. Preussii*.
The above characters, as well as that of size, render this species quite distinct from. *D. Preussii*.

36. NOTHAPODYTES Blume

Grains ellipsoidal to spheroidal; tetracolpate or pentacolpate, the furrow margin ragged; germ-pore indistinct; exine foveolate, with rather short massive spines.

Nothapodytes foetida (Wight) Sleumer. — 59 × 55.6 μ. — *Gardner 99* (G); *Thwaites 492* (G).

In this species, the elongate furrow, of which there are four, is distinctive in possessing a comparatively massive island of exine. This island is differentiated from the balance of the exine in having a greater frequency of spines and foveolae. On the basis of furrow structure, this species is clearly distinct from *Mappia mexicana*.

Nothapodytes pittosporoides (Oliv.) Sleumer. — 102 × 89.8 μ. — *Wilson 3296* (G).

Most of the grains observed were pentacolpate (one tetracolpate grain was noted). The furrow membrane is papillate-echinate. The exine is foveolate with scattered very short spines appearing as luminous dots. This species differs strikingly from its close allies in its relatively gigantic size. It is also distinct from other species of *Nothapodytes* in type of hair in its pubescence (15).

37. DISCOPHORA Miers

Grains oblate; germ-pores circular, typically three, occasionally four, bounded by a thickened, foveate zone somewhat as in *Stemonurus Cumingianus*; exine finely echinate, typically with short, luminous spines.

Discophora guinanensis Miers. — 16.7 × 18.8 μ. — *Klug 3017* (A); *Krukoff 6789* (F).

Occasional four-pored grains were observed in the Krukoff collection.

Discophora montana Howard. — Figs. 62, 62A. — 15.3 × 19 μ. — *Lawrance 535* (G).

The pollen grains of this specimen were infrequently four-pored and, in addition, showed much variation in size. One giant grain (diameter, 30.2 μ) having nine germ-pores was noted. Pollen grain diameters varied from 15 to 32.5 μ.

Discophora panamensis Standley. — 17.3 × 19 μ. — *Cooper 12246* (F).

The exine of this species with its short, inconspicuous spines is distinct from that of *D. guianensis* and *D. montana* where the pollen grain surfaces are more evidently spiny.

38. MAPPIANTHUS Hand.-Mazz.

Grains approximately spheroidal; rounded, triangular in polar view; germ-pores nearly circular, commonly three, with four pores in 15% of grains observed; the distinctive central aperture surrounded by a thickened, echinate rim which in turn is set off from the surrounding exine, the floor of the central pore occasionally bearing spines and exine fragments;

exine conspicuously echinate with relatively smooth texture prevailing in regions between the numerous spines.

Mappianthus iodioides Hand.-Mazz. — FIGS. 69, 69A. — 30 × 32 μ. — *Henry 12063* (A).

One large grain, 41.4 μ in diameter, was noted.

39. IODES Blume

Grains spheroidal to slightly oblate; germ-pores typically three, more or less circular (varying from three to five in *I. liberica*), delineated by a rim of thickened exine whose inner margin is irregular; exine markedly echinate with comparatively large massive spines, the surface minutely foveolate between the spines. Sizes reported for this genus are diameters exclusive of the spines whose length is reported separately.

Iodes tomentella Miq. — 16.6 μ (diameter). — Ex Herb. Miquel, without number (G).

The longest of the numerous spines of the exine is ca. 1.6 μ in length.

Iodes floribunda Merr. — FIG. 65. — 24.8 μ (diameter). — *Toroes 77*, ISOTYPE (A).

Iodes africana Welw. — 25 μ (diameter). — *Zenker 303* (G).

The maximum length of the spines is ca. 2.4 μ.

Iodes ovalis Blume. — FIG. 66. — 26.2 μ (diameter). — *Parker 2770* (A).

This and the above three species are set off from the other investigated species of the genus by their comparatively small-sized pollen grains.

Iodes kamerunensis Engler. — 34 μ (diameter). — *Zenker 460* (G).

The conspicuous tapering spines of the exine may attain a length of ca. 7.3 μ.

Iodes vitiginea (Hance) Hemsley. — 34.6 μ (diameter). — *Liang 61578* (NY).

According to Howard (personal communication) this species should be referred to *I. ovalis*. However, this specimen is listed separately under the Hemsley combination since its pollen grains are of larger size and possess more massive spines than is the case in *I. ovalis*. In both species, the spines of the exine are ca. 3.3 μ in length. Until more abundant material is available it seems best to list these observations separately.

Iodes liberica Stapf. — FIG. 67. — 44.3 μ (diameter). — *Linder 1102* (A).

In this species germ-pore numbers vary from three to five with about 88% of the grains being four-pored. In the single five-pored grain observed, one of the germ-pores was approximately one-half the usual size. The spines of the exine are massive and relatively long (ca. 5.8 μ in length).

Iodes philippinensis Merr. — FIG. 68. — 53.8 μ (diameter). — *Ramos*, Phil. Bur. Sci. 42567 (A).

One four-pored grain was noted. The massive spines average about 2.8 μ in length.

40. POLYPORANDRA Becc.

Grains essentially spheroidal; germ-pores three, similar in form to *Iodes*; exine conspicuously echinate with massive, widely spaced spines, granular-foveolate between the spines.

Polyporandra scandens Becc. — FIG. 70. — 24 μ (diameter). — *Kajewski 2206* (A); *Schlechter 17835* (C).

The pollen of *Polyporandra* is similar to that of *Iodes floribunda*. It differs, however, in its more widely scattered spines and in its somewhat less conspicuous annulus.

41. MIQUELIA Meissner

Grains spheroidal; germ-pores three, circular with a thickened margin; exine echinate with prominent massive spines, the exine between the spines minutely foveolate-striate, particularly as seen in optical section.

Miquelia Cumingii Baill. — FIG. 74. — 30.2 μ (diameter). — Phil. Bur. Sci. 49997 (C).

42. PHYTOCRENE Wall.

Grains spheroidal; germ-pores three, of roughly circular outline, the poral margin only slightly thickened; exine minutely echinate with numerous short spines.

Phytocrene Blancoi (Azaola) Merr. — FIG. 75. — 22 μ (diameter). — *Loher 13821* (A); *Wenzel 44* (G).

Phytocrene bracteata Wall. — 19.5 μ (diameter). — *Wallich 4947* (G).

In this somewhat immature specimen, the exine was minutely echinate-foveolate.

Phytocrene dasycarpa Miq. — 18 μ (diameter). — *Warburg 16683* (A).

43. POLYCEPHALIUM Engler

Grains spheroidal to somewhat oblate; germ-pores three, infrequently four, characteristically circular, the region bounding the pore thickened as in *Miquelia Cumingii*, *Iodes floribunda*, and *Chlamydocarya capitata*; exine echinate with numerous diminutive spines.

In this genus, as well as in *Chlamydocarya*, the exine development is in the direction of a smooth general effect.

Polycephalium Poggei Engler. — FIG. 72. — 20 μ (diameter). — *Zenker 313* (A).

While the pollen of this species is in general similar to that of *Phytocrene Blancoi*, it is distinct in its smaller spines and in its germ-pore with a more markedly thickened margin

44. CHLAMYDOCARYA Baillon

Grains spheroidal; germ-pores three, circular with margins thickened as in *Polycephalium*; exine minutely echinate as in *Polycephalium*.

Chlamydocarya capitata Baill. — FIGS. 73, 73A. — 16.4 μ (diameter). — *Linder 1076* (A).

The only material available included a number of immature pollen grains.

45. RHYTICARYUM Beccari

Grains oblately spheroidal to spheroidal; germinal apertures obscure in this material, occasional suggestions of porate apertures without annuli; exine finely echinate with relatively short spines and occasional rather blunt papillae.

Rhyticaryum elegans Schellenberg. — 27.4 μ (diameter). — *Schlechter 18681* (C).

The present analysis is provisional in that it is based upon the only available material, which was poor and immature. Many of the grains were still adherent in collapsed tetrads.

46. SARCOSTIGMA Wight and Arnott

Grains spheroidal; germinal apertures three (*S. Wallichii*); exine echinate with numerous short to medium length spines, averaging ca. 1 μ long, foveolate between the spines.

The germinal apertures are obscure in the available material of the first three species. Some grains give the impression of being inaperturate whereas in others a single lenticular germinal aperture is evident. Rarely in these species there is a suggestion of three such apertures. However, in *S. Wallichii* it is clear that three germinal apertures are present (see below).

Sarcostigma philippinensis Merr. — FIG. 71. — 35 μ (diameter). — *Wenzel 987* (A).

The numerous spines of the exine are noticeably variable in size. In length, they vary from ca. 1.7 μ down to very short, still rather massive spines.

Sarcostigma Horsfieldii R. Brown. — 42.2 μ diameter (Warburg), 30 μ diameter (Sargent). — *Warburg 1929* (A); *Sargent* (without number) (A).

The spines of the exine are in general shorter, somewhat less conspicuous, and of more uniform size than in *S. philippinensis*. In the Sargent specimen, spines varied in length from ca. 0.8 to 1.3 μ.

Sarcostigma surigaoënse Elmer ex Merrill. — 30 μ (diameter). — *Elmer 13732* (G).

Sarcostigma Wallichii H. Brongn. — 28 μ (diameter). — *King's Collector* 2–17–94 (A).

It is clear from analysis of this specimen that there are three germinal apertures of lenticular outline. Aperture margins are unspecialized. The slender spines of the exine attain a length of ca. 2.2 μ.

47. PYRENACANTHA Wight

Grains spheroidal; germinal apertures obscure, varying from three to six in number; exine minutely papillate-echinate-foveolate, appearing relatively thick.

In *P. volubilis*, in infrequent pollen grains having apparently equatorial orientation, the germinal apertures are visible as tightly closed slits ca. 3 μ long, lying parallel to the equator. In consequence, these apertures are only slightly differentiated when seen in "polar" view. The typical number of apertures appears to be three in this species, although in the specimen examined, 20% were interpreted as having four pores. Germinal pores were more conspicuous in the specimen of *P. vitifolia*. Here the circular pores varied in number from three to six with ca. 56.5% of the grains having four pores. The pore membranes were flecked with granules. In the case of *P. scandens*, the very scanty material suggested a condition as in *P. volubilis*.

Pyrenacantha scandens Planch. ex Harv. — 39 μ (diameter). — *Burchell 5214* (G).

Pyrenacantha vitifolia Engler. — 19.7 μ (diameter). — *Scheffler 345* (A).

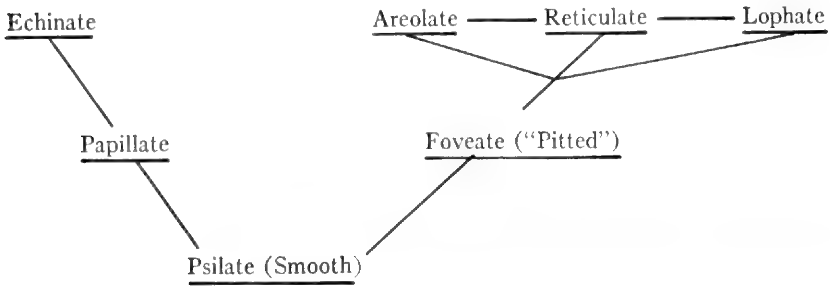
Periporate grains are usually "heteropolar."

Pyrenacantha volubilis Wight. — 27.4 μ (diameter) with occasional (ca. 14%) dwarf pollen grains 17 μ in diameter. — *Lau 214* (A).

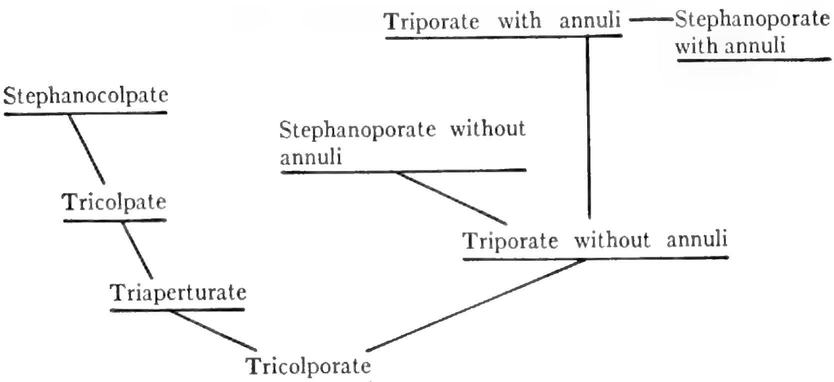
DISCUSSION

Within the Family *Icacinaceae*, as presently constituted, there is an impressive array of individually distinct combinations of characters pertaining to the exine (surface) and to the germinal apertures. Fifteen such combinations have been selected as "pollen types." It is obvious that pollen data, together with anatomical and exomorphic data, indicate that the family is a heterogeneous one. The extent to which genera can be separated on the basis of pollen morphology is unusual. It is also evident in some genera that interspecific differentiation with respect to pollen exists.

The list of pollen types of all investigated genera given earlier (pp. 255, 256) will suggest how the pollen characters have been utilized in segregating and arranging genera. The two *main* trends which were postulated and followed in this arrangement are given below. With respect to surface characteristics of the exine, a pattern may be established as follows: —



On the basis of germinal apertures the following array can be visualized within the *Icacinaceae*: —



What correlation, if any, exists between a system of genera devised with reference to these trends of pollen specialization and one based on anatomical characters (Bailey and Howard 1, 2, 3, 4)? An answer may be sought in the summary graph presented in Text-fig. 1. Anatomical Group I* is considered to be less specialized than anatomical Groups II and III. Pollen Type A1* (following the sequence enumerated in the listing on pp. 255, 256) is assumed, in this family, to be less specialized than Type C3. The following conclusions can be drawn from this analysis: —

A. The majority of the species having Type A pollen grains belong to the less advanced anatomical Group I.

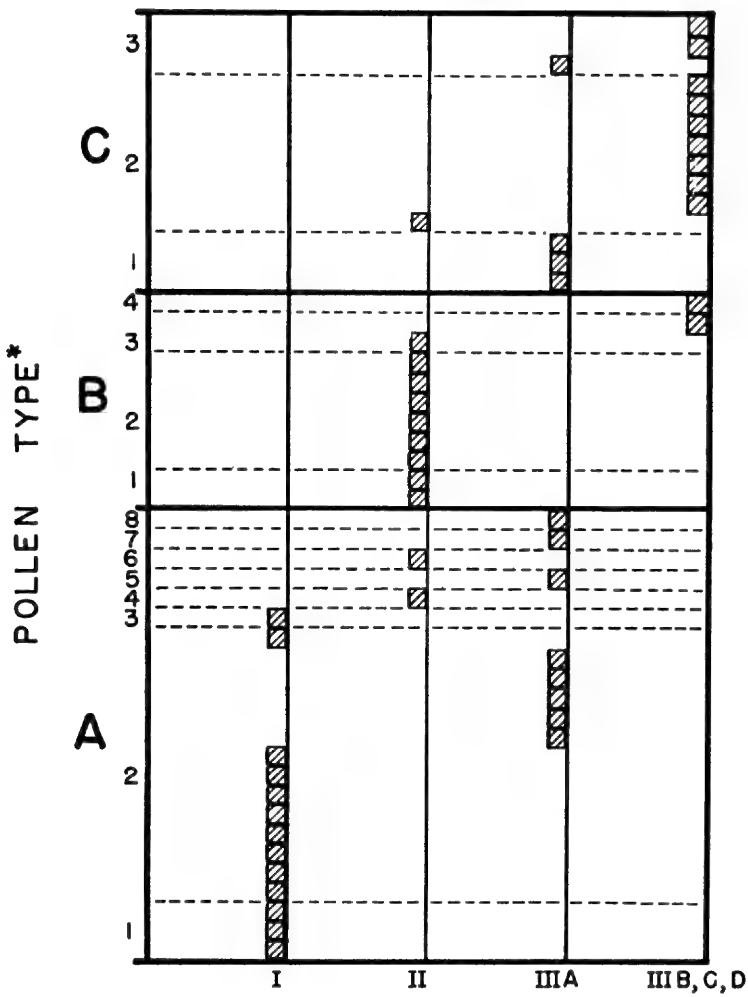
B. Most species of the anatomically intermediate Group II have Type B pollen.

C. The majority of species with Type C pollen grains are anatomically the most specialized in the family (anatomical Group III).

* In an attempt to avoid confusion, Roman numerals and the term "Group" apply to anatomical aggregations whereas capital letters, Arabic numerals, and the term "Type" refer to the pollen categories.

POLLEN MORPHOLOGY AND WOOD ANATOMY

FAMILY ICACINACEAE



ANATOMICAL GROUP (FROM I. W. Bailey & R. A. Howard)

(*– LETTERS REFER TO MAJOR TYPE; ARABIC NUMERALS REFER TO INDIVIDUAL EXAMPLES WITHIN THE TYPE.)

While the correlation is not perfect, the unusual degree of association between the pollen and anatomical spectra seems significant. This becomes more evident if such association is examined in greater detail. It is pertinent to point out that each of the so-called major pollen types represents an attainment series or complex. Further, it should be noted that species which appear "late" in each pollen type (see Text-fig. 1) are also anatomically more specialized than those which "initiate" the type. This is particularly true for pollen types A and C. Pollen type B proves to be characteristic of genera belonging to anatomical Group II with the exception of *Natsiatum* and *Hosiea*. In the case of type C pollen, all representatives are anatomically Group III with the exception of *Discophora*.

Of particular interest are the pollen spectra of anatomical Group II and Group III A, the latter of which is made up of unilacunar genera of the tribe *Icacineae*. These two groups include the widest range of pollen grain forms of the four anatomical categories, a condition which suggests that these groups include forms which are transitional between the less specialized and the more advanced complexes. This is consistent with the anatomical observations of Bailey and Howard (1, 2). *Leptaulus*, *Gonocaryum*, and a complex "beginning" with *Irvingbaileya* and "culminating" via pollen type B2 in *Discophora* represent, respectively, what may be considered to be the three distinct patterns of pollen grain form within Group II. Anatomically Group II, which is a complex of trilacunar *Icacineae*, exhibits a variety of transitional stages in the specialization of vessels, tracheids, wood parenchyma, and rays. *Leptaulus* is distinct in the origin of the simple porous perforations of its vessels while *Gonocaryum* is more or less unique in its possession of vessels with scalariform perforations of abnormal orientation. It is evident that the two genera just mentioned are differentiated from their associates in both pollen and anatomical features.

Group III A is a complex of genera which is anatomically transitional between the trilacunar *Icacineae* and the more specialized forms *Iodeae*, *Sarcostigmateae*, and *Phytocreneae*. In this group some six types of pollen occur. Genera having pollen of types A2, A5, and C3 also possess variously shortened, laterally enlarged vessels. This suggests that the trend to a foveate-reticulate exine in pollen type A2 more or less "culminates" in the reticulate exine of type A5. Very large, widely-spaced vessels characterize *Merrilliodendron* (pollen type A7) while vessels tend to be radially grouped in *Alsodeiopsis* (pollen type A8) and in *Mappia* and *Nothapodytes* (pollen type C1). The remaining genus (*Desmostachys*) in Group III A is anatomically differentiated in possessing vessels which tend to occur in tangential groups.

Finally, pollen of the specialized types C2 and C3 occur only in the remaining unilacunar tribes (*Iodeae*, *Sarcostigmateae*, and *Phytocreneae*) of anatomical Group III (B, C, D) with the exception of two genera, *Hosiea* and *Natsiatum* which produce, respectively, pollen of types B3 and B4. *Hosiea*, both in pollen and ray structure, is less specialized than the other components of these tribes. Anatomically, *Natsiatum* appears to be similar to *Hosiea*.

The taxonomic significance of some of these data has already been suggested. Unfortunately, there have been relatively few attempts to consider, intensively, the pollen morphology of groups of aggregated species (*cf.* Wodehouse, 32; Erdtman, 8, 10; Lindau, 26; Hedberg, 14; *et al*). Mrs. Lucy Cranwell Smith (6) has reported briefly on *Pennantia* of the *Icacinaceae* which occurs in New Zealand. In passing, it should be noted that Sleumer's (30, p. 337) paragraph on pollen of the *Icacinaceae* is best disregarded. In his summary statement, the descriptions of eleven genera out of the fifteen included are either partially or completely in error.

Engler's (7) four tribes, *Icacineae, Iodeae, Sarcostigmateae*, and *Phytocreneae* are not rendered individually distinct on the basis of either pollen morphology or anatomy. In the tribe *Icacineae*, pollen grains with echinate exine and annuli (*sen. lat.*) are very infrequent while all but two genera of the last three tribes have echinate pollen grains with annuli.

In the arrangement of genera with reference to pollen grain type it is seen that in general those genera which appear early in the taxonomic sequence also produce less modified (type A) pollen grains while genera terminating the sequence possess more specialized types of pollen grains (type C).

Most of the New World genera are characterized by type A pollen. Only two genera (*Discophora* and *Mappia*) of the New World have echinate (type C) pollen grains. In its pollen grain characters, *Discophora* finds its closest allies in Old World genera which is also true on the basis of wood structure and pubescence (15). *Mappia* resembles certain Old World genera in possessing cylindrical hairs and radial groups of vessels.

Speculation concerning interfamily relationships seems best delayed until detailed information derived from intensive studies of the pollen morphology in other groups is available. Mauritzon (27) and Fagerlind (11) conclude on the basis of examining some members of the family that in structure of the gynoecium, including the ovules, the affinities of the *Icacinaceae* are with the order Celastrales.

In conclusion, it must be emphasized that from statements concerning major patterns and trends of pollen grain structure the existence of a relatively simple, continuous, unidirectional series is not to be inferred. The striking and seemingly sudden appearance of a notable variety of pollen types within the family argues against a single, connected evolutionary series. Indeed, in various attempts to organize these genera into an unrandomized array one cannot escape the impression that the resultant scheme is reminiscent of a bird's-eye view of a shrubbery and not of just one shrub. In the *Icacinaceae*, the aggregations of *species* into genera on the basis of largely exomorphic data are on the whole supported by pollen data. However, clusters of *genera* represent levels of attainment (specialization) with respect to the guiding character and are not, invariably, indicators of intimately related or recently derived genera. The oft-repeated remark concerning differential rates of development with respect to different characters applies here. It follows therefore that the most dependable clues concerning phylogenetic relationships are to be expected when information concerning levels of attainment or specialization for all possible characters is available for comprehensive study. Pollen characters represent an important element in the *total* complex of characters which is available for analysis in the very difficult task of achieving "Phylogeny, resolved."

SUMMARY

1. A detailed study of pollen of the family *Icacinaceae*, as presently constituted, has revealed an impressive assortment of individually distinct combinations of pollen characters, particularly those which apply to the exine (surface) and germinal apertures. Fifteen such combinations have been selected as "pollen types."

2. Utilization of these types in segregating and arranging genera has suggested two main trends *within the family*. First, with respect to surface characteristics of the exine, the following array may be established: — psilate (smooth) — foveate ("pitted") — reticulate — lophate — areolate; psilate — papillate — echinate. Secondly, on the basis of germinal apertures, the following array can be visualized within the *Icacinaceae*: — tricolporate — triaperturate — tricolpate — stephanocolpate; tricolporate — triporate without annuli — stephanoporate without annuli — triporate with annuli — stephanoporate with annuli.

3. In the above text, genera have been arranged with reference to these trends.

4. A comparison has been made between a system of genera devised with reference to the above trends of pollen specialization and one devised independently for the *Icacinaceae* by I. W. Bailey and R. A. Howard on anatomical grounds. Such analysis demonstrates that the majority of species having the least specialized (psilate, tricolporate) pollen grains belong to the least advanced anatomical group. Most of the species characterized by specialized (echinate, porate) types of pollen grains are anatomically the most specialized in the family.

5. The unusual degree of association between the pollen and anatomical spectra in this family, made up of approximately 300 species distributed among 60 genera, is indicative of the significance of intensive morphological studies of pollen in ultimately phylogenetic problems.

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DESCRIPTION OF PLATES

All figures represent camera lucida drawings of unstained, expanded pollen grains mounted in lactic acid. The original drawings represent a magnification of ca. 1800 × *except* in the cases of FIG. 10B (magnification of ca. 2200 ×) and FIGS. 76, 76A, and 77 (magnification of ca. 1000 ×). The illustrations are reduced by approximately one-half in the present publication.

PLATE I

FIG. 1. *Emmotum fagifolium* (*La Cruz 3375*, G), polar view. FIG. 1A. ditto, equatorial view. FIG. 2. *E. nudum* (*Spruce 3541*, G), polar view. FIG. 2A. ditto, equatorial view. FIG. 3. *E. argenteum* (*Tate 564*, TYPE, NY), polar view. FIG. 3A. ditto, equatorial view. FIG. 4. *E. glabrum* (*Klug 3990*, G), polar view. FIG. 4A. ditto, equatorial view. FIG. 5. *E. nitens* (*Burchell 8233*, G), polar view. FIG. 5A. ditto, equatorial view. FIG. 6. *Ottoschulzia cubensis* (*Wright 2639*, COTYPE, G), polar view. FIG. 6A. *O. cubensis*, equatorial view. FIG. 7. *Poraqueiba sericea* (*Ducke 25*, A), polar view. FIG. 7A. ditto, equatorial view. FIG. 8. *Pittosporopsis Kerrii* (*Henry 11778*, A), polar view. FIG. 8A. ditto, equatorial view. FIG. 9. *Oecopetalum mexicanum* (*Purpus 6159*, G), polar view. FIG. 9A. ditto, equatorial view.

PLATE II

FIG. 10. *Cassinopsis ilicifolia* (*Burchell 5817*, G), polar view. FIG. 10A. ditto, equatorial view. FIG. 10B. ditto, equatorial view. FIG. 11. *C. tinifolia* (*Wood 9428*, A), polar view. FIG. 11A. ditto, equatorial view. FIG. 12. *Pennantia corymbosa* (*Kirk*, G), polar view. FIG. 12A. ditto, oblique view. FIG. 13. *Pennantia Cunninghamii* (*Moore*, G), polar view. FIG. 13A. ditto, equatorial view. FIG. 14. *Calatola laevigata* (*Schipp 8–708*, F), polar view. FIG. 14A. ditto, equatorial view. FIG. 15. *Citronella Smythii* (*Michael 203*, G), polar view. FIG. 15A. ditto, equatorial view. FIG. 16. *C. Gongonha* (*Hoehne 385*, A), polar view. FIG. 16A. ditto, equatorial view. FIG. 17. *C. costaricensis* (*Tonduz 11664*, G), polar view. FIG. 17A. ditto, equatorial view. FIG. 18. *C. mucronata* (*Muños & Coronel 1394*, G), polar view.

PLATE III

FIG. 19. *C. ilicifolia* (*Weberbauer 6617*, F), polar view. FIG. 19A. ditto, equatorial view. FIG. 20. *C. philippinensis* (*Ramos 33267*, A), polar view. FIG. 20A. ditto, equatorial view. FIG. 21. *C. incarum* (*Weberbauer 7056*, F), polar view. FIG. 21A. ditto, equatorial view. FIG. 22. *Dendrobangia boliviana* (*Rusby 1694*, G), polar view. FIG. 22A. ditto, equatorial view. FIG. 23. *Platea philippinensis* (*Elmer 9777*, ISOTYPE, A), polar view. FIG. 23A. ditto, equatorial view. FIG. 24. *Icacina Mannii* (*Zenker 475*, G), equatorial view. FIG. 25. *Lavigeria salutaris* (*Mildbraed 10536*, A), polar view. FIG. 25A. ditto, equatorial view.

PLATE IV

FIG. 26. *Leretia cordata* (*Klug 2967*, G), equatorial view. FIG. 27. *Pleurisanthes parviflora* (*Krukoff 6954*, A), equatorial view. FIG. 28. *P. flava* (*Sandwith 590*, ISOTYPE, NY), equatorial view. FIG. 29. *Humirianthera rupestris* (*Ducke 25288*, US), polar view. FIG. 29A. ditto, equatorial view. FIG. 30. *H. rupestris* (*Ducke 342*, US), polar view. FIG. 30A. ditto, equatorial view. FIG. 31. *Natsiatum herpeticum* (*Parkinson 3927*, A). FIG. 32. *Leptaulus daphnoides* (*Linder 872*, A), oblique view. FIG. 33. *L. grandifolius* (*Zenker 14*, G), polar view. FIG. 33A. ditto, equatorial view.

PLATE V

FIG. 34. *Anisomallon clusiaefolium* (*Prony 1731*, A), polar view. FIG. 34A. ditto, equatorial view. FIG. 35. *Apodytes Gardneriana* (*Silva 12*, A), polar view. FIG. 35A. ditto, equatorial view. FIG. 36. *A. cambodiana* (*Clemens 3891*, A), polar view. FIG. 36A. ditto, equatorial view. FIG. 37. *A. brachystylis* (*Kajewski 1184*, A), polar view. FIG. 37A. ditto, equatorial view. FIG. 37B. ditto, polar view. FIG. 38. *A. beninense* (*Elliot 4712*, G), polar view. FIG. 38A. ditto, equatorial view. FIG. 39. *A. cuminensis* (*Eala 1930*, F), polar view. FIG. 39A. ditto, equatorial view. FIG. 40. *Rhaphiostylis cordifolia* (*Linder 1218*, A), polar view.

PLATE VI

FIG. 41. *Rhaphiostylis ferruginea* (*Zenker 65*, C), polar view. FIG. 41A. ditto, equatorial view. FIG. 42. *R. latifolia* (*Zenker 2242*, A), polar view. FIG. 42A. ditto, equatorial view. FIG. 43. *Alsodeiopsis Welwitschii* (*Zenker* F, 765310), polar view. FIG. 43A. ditto, equatorial view. FIG. 44. *Gonocaryum longeracemosum* (*Sargent*, A), polar view. FIG. 44A. ditto, equatorial view.

PLATE VII

FIG. 45. *Gonocaryum cognatum* (*Ramos* and *Edano* 44073, A), polar view. FIG. 45A. ditto, equatorial view. FIG. 46. *G. calleryanum* (Phil. Bur. Sci. 33, A), polar view. FIG. 46A. ditto, equatorial view. FIG. 47. *Codiocarpus Merrittii* (*Ramos* 40837, TOPOTYPE, A), oblique view. FIG. 47A. ditto, equatorial view. FIG. 48. *Lasianthera africana* (*Conrau 41*, A), polar view. FIG. 48A. ditto, equatorial view. FIG. 49. *Gastrolepis austro-caledonica* (*Franc 1791*, G), polar view. FIG. 49A. ditto, equatorial view. FIG. 50. *Stemonurus cumingianus* (*Wenzel 350*, G), polar view. FIG. 50A. ditto, equatorial view. FIG. 51. *Medusanthera vitiensis* (*Smith 578*, G), polar view. FIG. 51A. ditto, equatorial view. FIG. 52. *M. papuana* (*Schlechter 17913*, C), oblique view. FIG. 53. *M. laxiflora* (*Brass 2724*, A), polar view. FIG. 53A. ditto, equatorial view. FIG. 54.

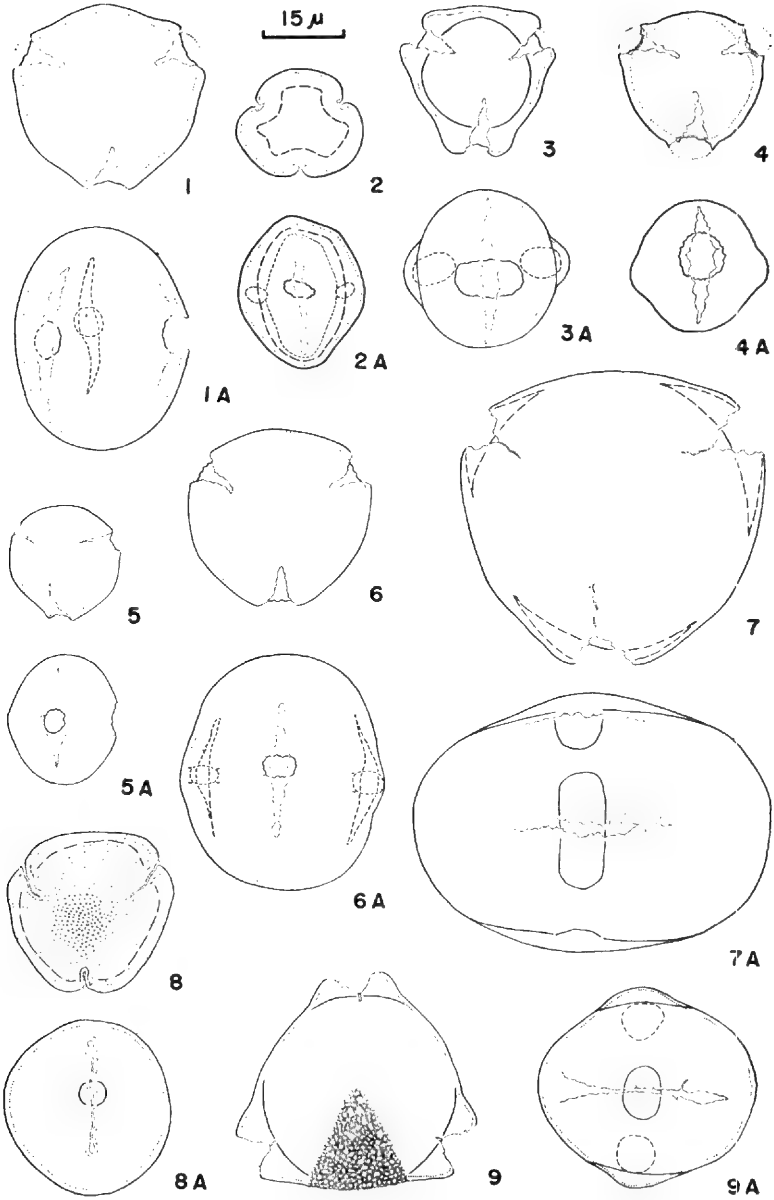
M. samoensis (*Christophersen 3061*, A), polar view. FIG. 54A. ditto, equatorial view. FIG. 55. *M. glabra* (*Wenzel 1029*, A), polar view. FIG. 55A. ditto, equatorial view. FIG. 56. *M. carolinensis* (*Kanehira 1882*, NY), polar view. FIG. 56A. ditto, equatorial view. FIG. 57. *Urandra secundiflora* (*Haviland & Hose 1544*, G), polar view. FIG. 57A. ditto, equatorial view.

PLATE VIII

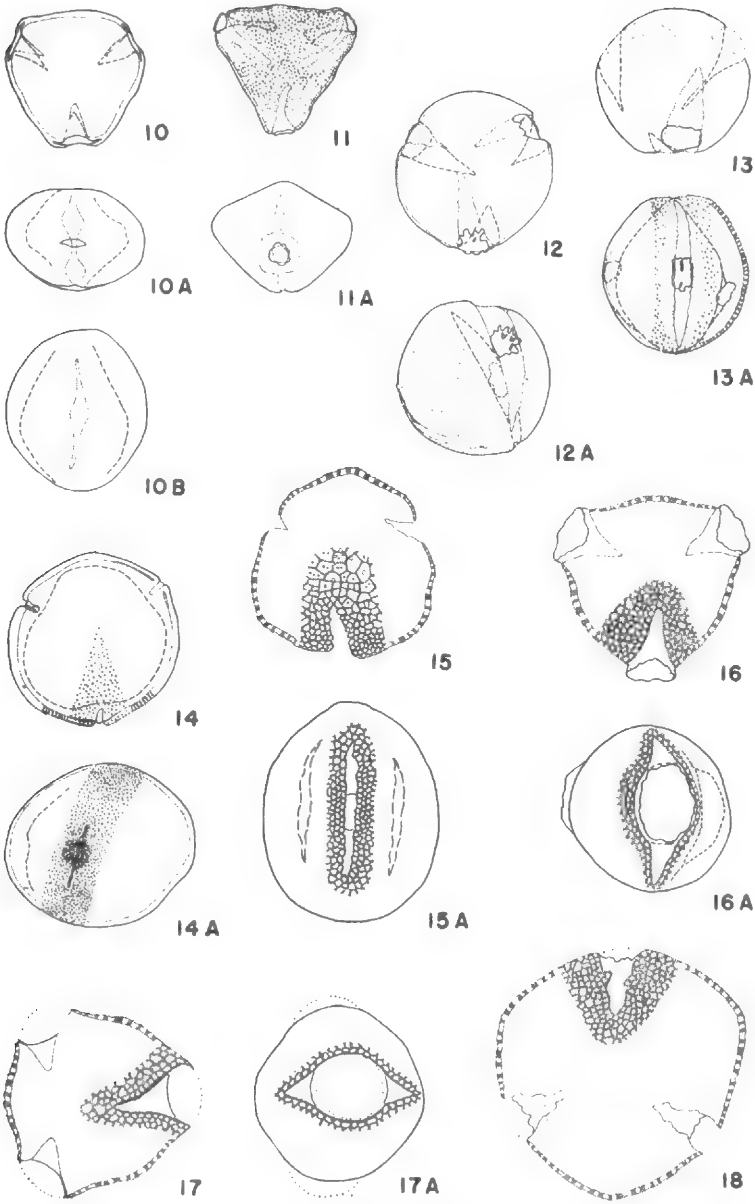
FIG. 58. *Urandra scorpioides* (*Toroes 4323*, A), polar view. FIG. 58A. ditto, equatorial view. FIG. 59. *U. umbellata* (*Haviland 1782*, G), polar view. FIG. 59A. ditto, equatorial view. FIG. 60. *Irvingbaileya australis* (*Tardent 259*, A), polar view. FIG. 60A. ditto, equatorial view. FIG. 60B. ditto, polar view. FIG. 61. *Cantleya corniculata* (ex Herb. Hort. Bog. 265770, C), polar view. FIG. 61A. ditto, equatorial view. FIG. 62. *Discophora montana* (*Lawrance 535*, G), polar view. FIG. 62A. ditto, equatorial view. FIG. 63. *Hosiea sinensis* (*Wilson 960a*, A), polar view. FIG. 64. *Mappia mexicana* (*Pringle 6645*, G), polar view. FIG. 64A. ditto, equatorial view. FIG. 65. *Iodes floribunda* (*Toroes 77*, ISOTYPE, A). FIG. 66. *I. ovalis* (*Parker 2770*, A). FIG. 67. *I. liberica* (*Linder 1102*, A).

PLATE IX

FIG. 68. *Iodes philippinensis* (*Ramos 42567*, A). FIG. 69. *Mappianthus iodioides* (*Henry 12063*, A), polar view. FIG. 69A. ditto, equatorial view. FIG. 70. *Polyporandra scandens* (*Kajewski 2206*, A). FIG. 71. *Sarcostigma philippinensis* (*Wenzel 987*, A). FIG. 72. *Polycephalium Poggei* (*Zenker 313*, A). FIG. 73. *Chlamydocarya capitata* (*Linder 1076*, A). FIG. 73A. ditto, germinal apertures in optical section. FIG. 74. *Miquelia Cumingii* (Phil. Bur. Sci. 49997, C). FIG. 75. *Phytocrene Blancoi* (*Loher 13821*, A). FIG. 76. *Desmostachys Preussii* (*Zenker 121*, G), polar view. FIG. 76A. ditto, equatorial view. FIG. 77. *D. Vogelii* (*Linder 1345*, A), equatorial view.



DAHL, POLLEN OF THE ICACINACEAE



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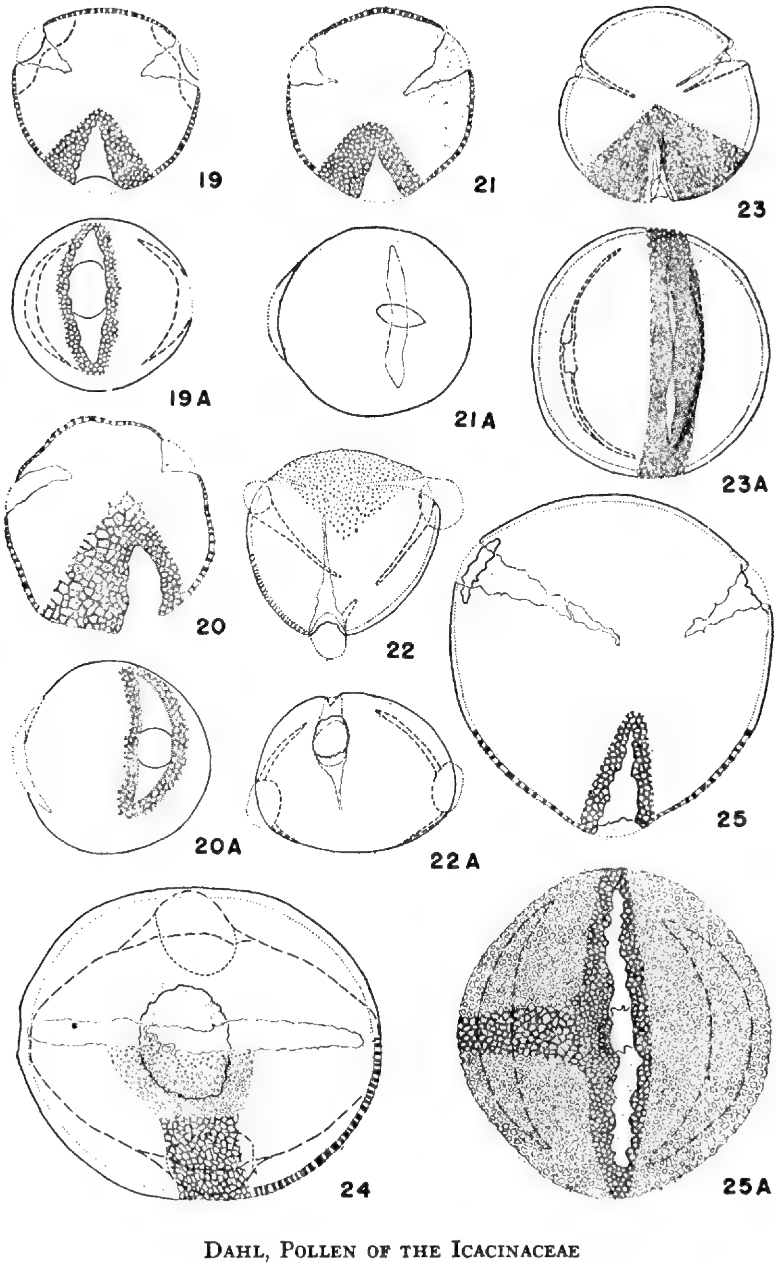

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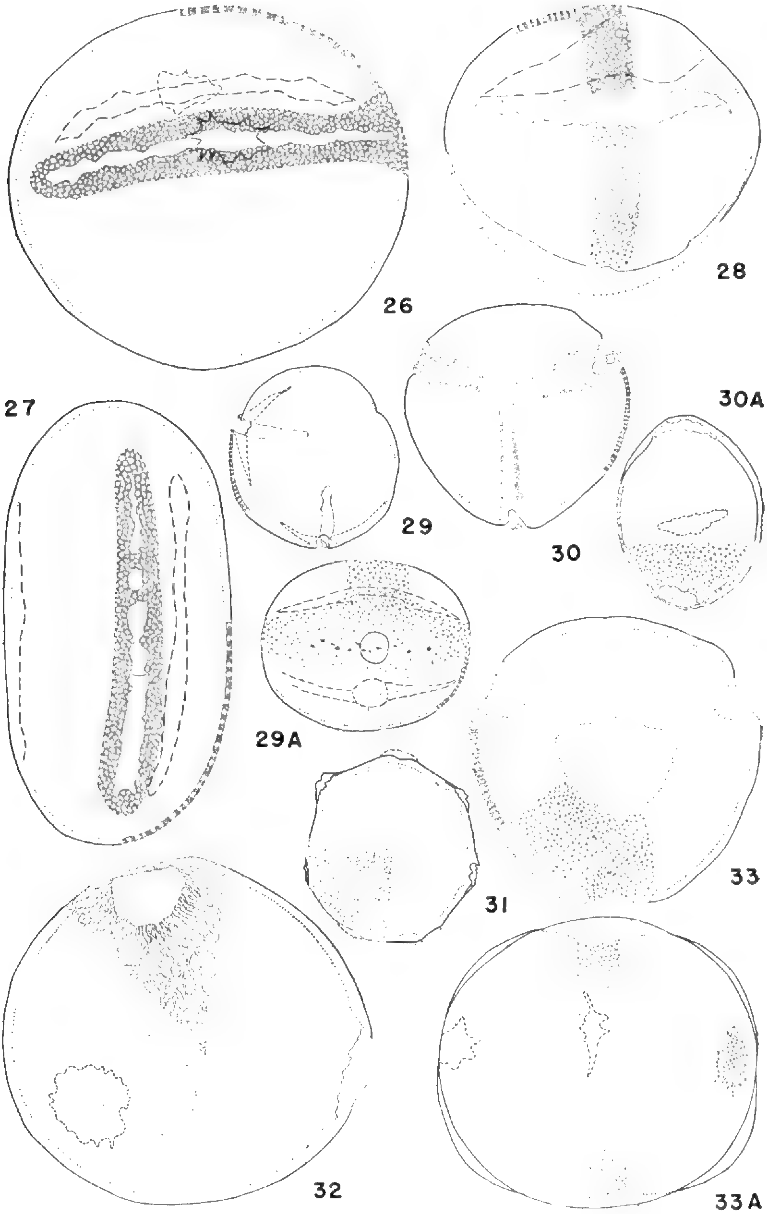

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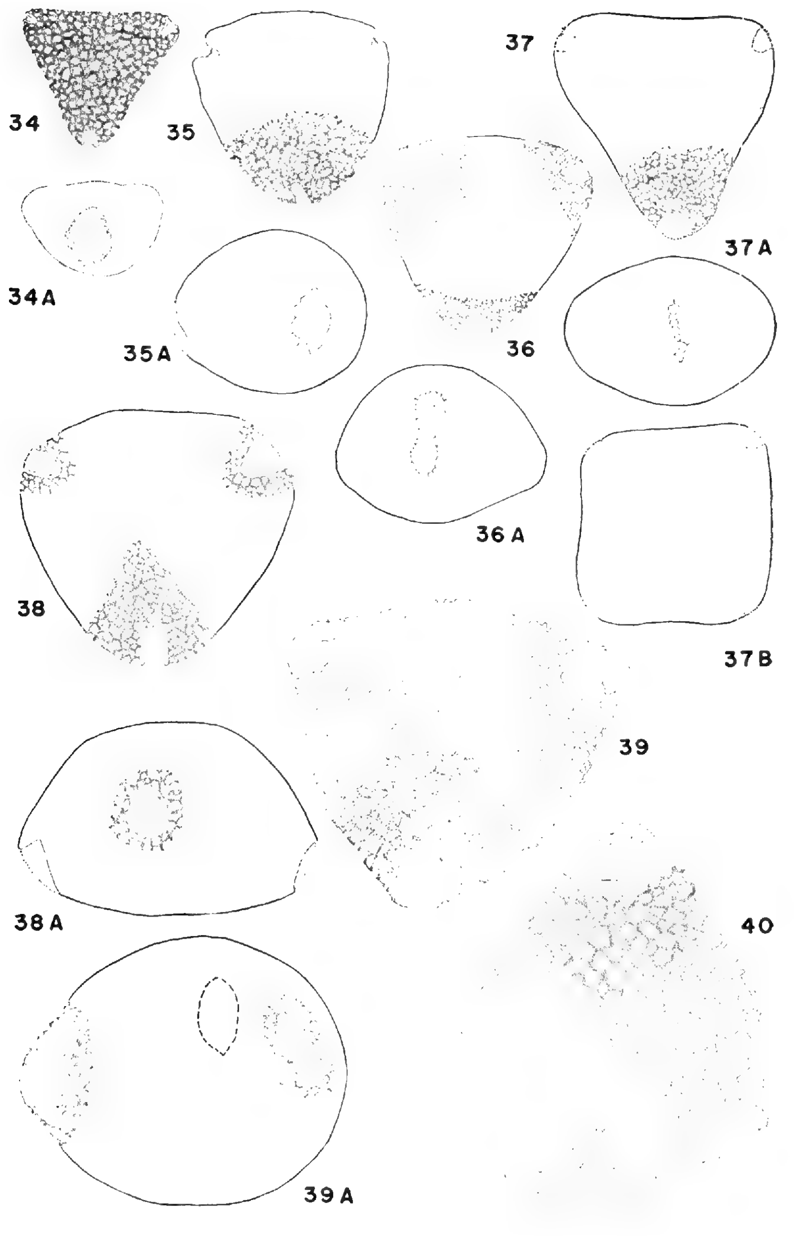

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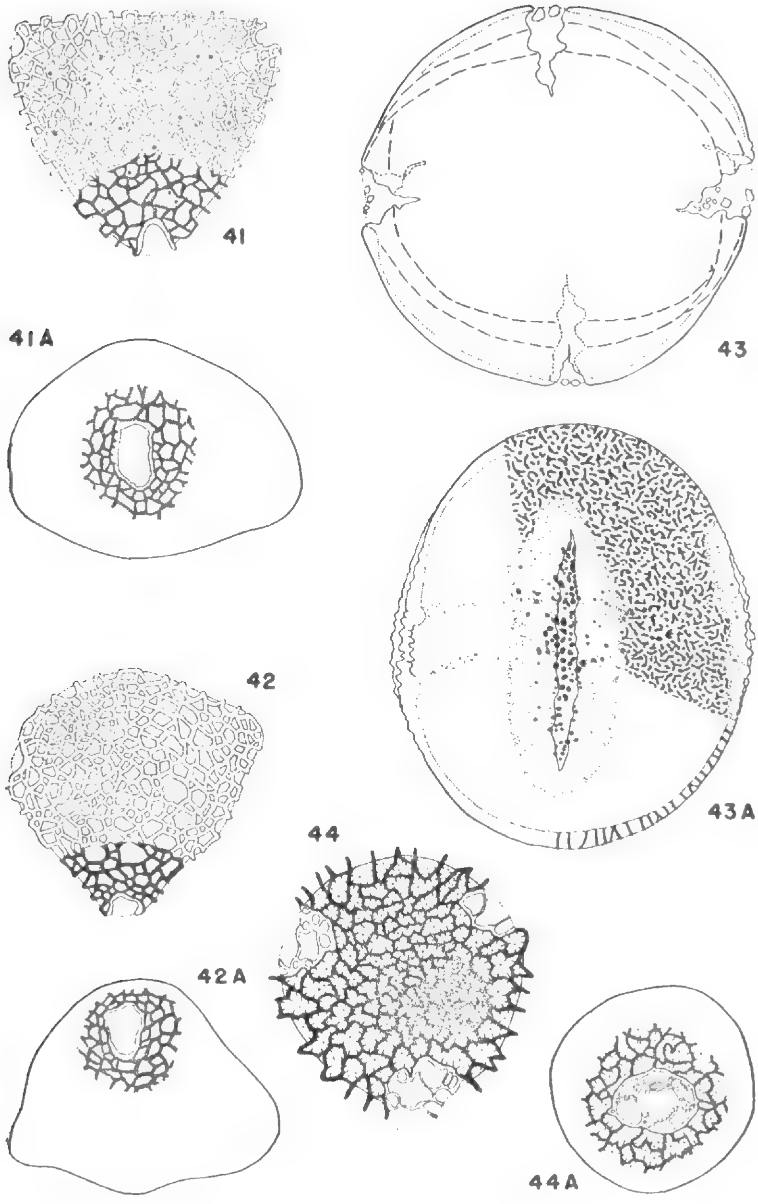

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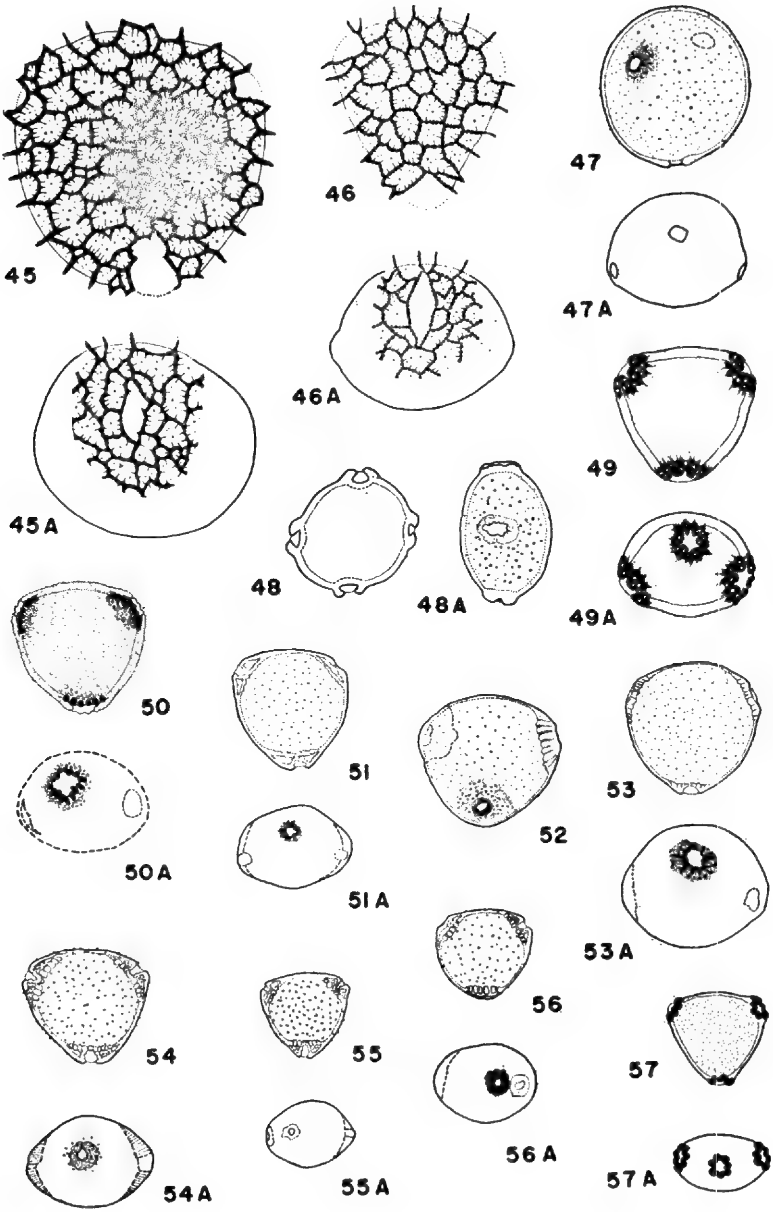

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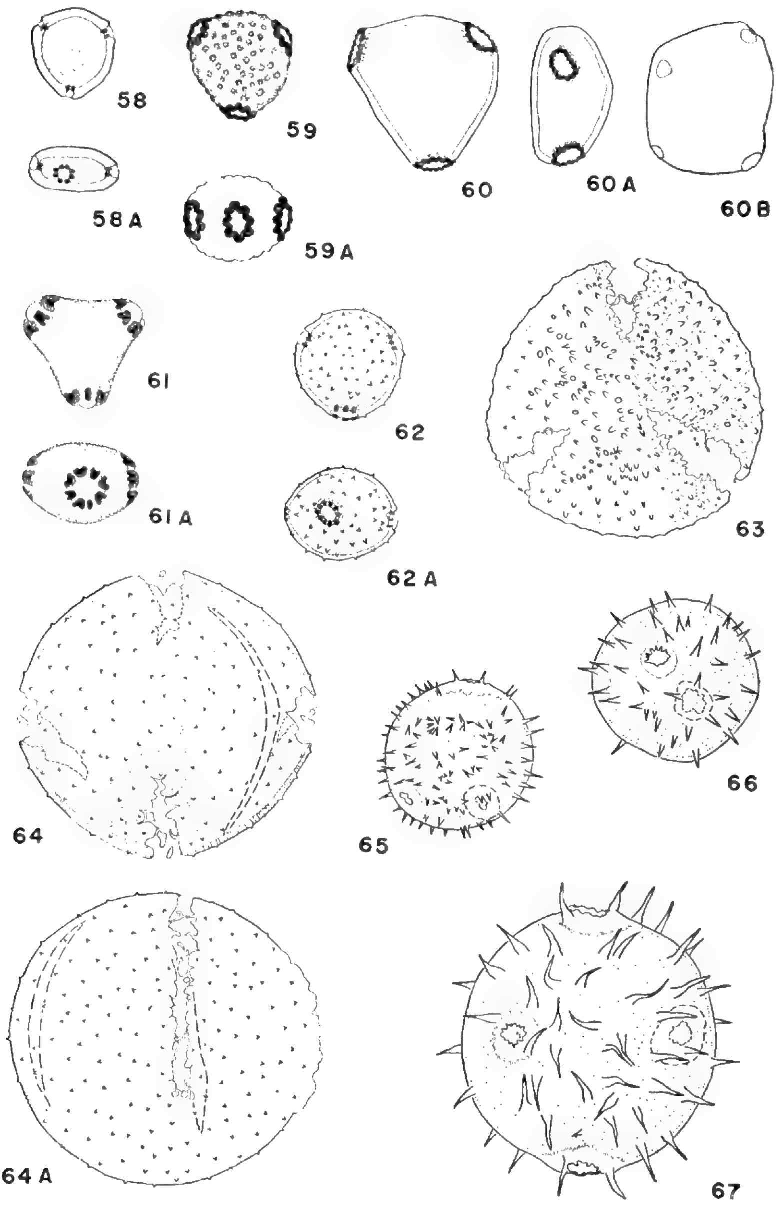

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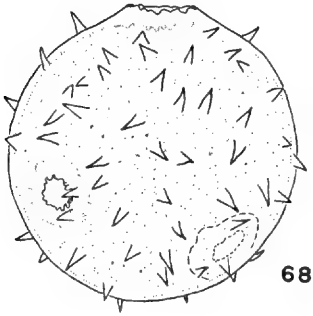
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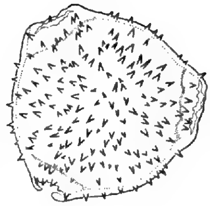
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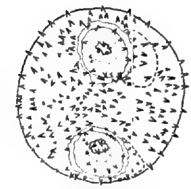
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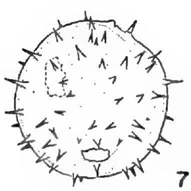
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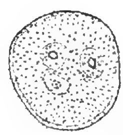
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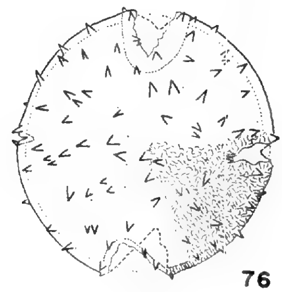
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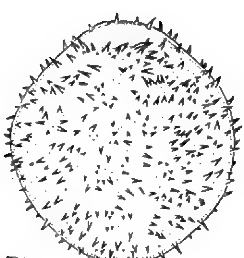
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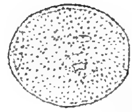
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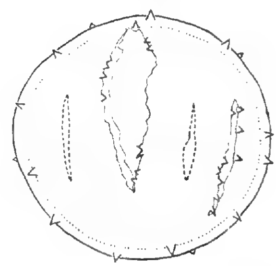
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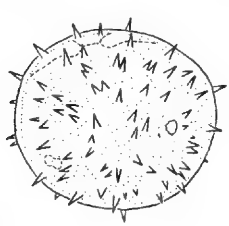
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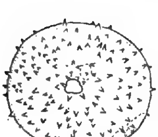
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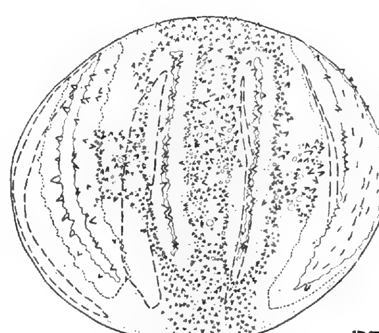
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Dahl, Pollen of the Icacinaceae

ABERRANT SILVER MAPLES

SCOTT S. PAULEY and ALBERT JOHNSON

With one plate

ABERRANT FORMS OF THE SILVER MAPLE, *Acer saccharinum L.*, have long been known in Europe and the United States. As early as 1893 Schwerin (1) described five varieties and 23 forms, including most, if not all, of the forms known today. Most of these forms differ from the normal species in shape or color of the leaf, but they include also columnar and pendulous growth habits. Rehder (2) lists the varieties *pendulum, pyramidale, lutescens, tripartitum* and *laciniatum*. The last of these varieties includes the cultivated "Skinner" maple and "Wier" maple. The Wier maple has dissected leaves, but the lobes are not abnormally slender, while Skinner's maple has leaves with extremely slender lobes. These extreme forms of the silver maple have been described in the American Nurseryman (3) with an even more extreme form from the Willis Nursery Company of Ottawa, Kansas. The Skinner variety seems to have originated independently in several widely separated areas.

Our experience with silver maple variants began in 1947 when we grafted a very young, apparently normal, seedling on to a normal one-year old seedling. The grafted seedling soon began to show what appeared to be a mosaic infection, with abnormal leaf development and a mottled appearance. Eventually a sucker developed from the rootstock which was normal in every respect even at the end of two-year's growth. Grafts between branches of the scion into shoots from the rootstock showed no apparent transmission of a virus to the normal stock.

In 1950 seed was collected from an isolated atypical silver maple at the Arboretum's Case Estate in Weston, Mass. This tree had abnormal mosaic leaves, but was not nearly as aberrant as some of its seedlings. From approximately one hundred seedlings four distinct types of segregates were obtained. In addition to the normal segregates there was one resembling the variety *laciniata*, two of which were similar to Wier's maple, and nine similar to Skinner's variety. The latter two types not only had small leaves with narrow lobes, but were also mottled and deficient in chlorophyll. Photographs of the four different types are shown in PLATE 1.

The leaf aberrations in these segregates are correlated with growth habit as is the case in the Wier and Skinner maples. The *laciniata* type of segregate, with little or no evidence of abnormal chlorophyll development, is perhaps more spreading in growth habit than the normal silver maple and is not as vigorous. The Wier type has somewhat pendulous branches and grows slowly, while the Skinner type of segregate is very spreading in growth habit and is even less vigorous.

In 1950 and again in 1951 buds from several different normal silver maples were budded on these mosaic segregates and in no case was there any evidence of mosaic transmission. The budding in 1951 was done in early August, and as soon as the bud had set, the branch above the bud was cut back, to force the growth of the bud. Thus it was possible to get several months growth of the normal branch. The buds inserted in 1950 made a complete season's growth without showing any evidence of mosaic.

The symptoms of these abnormal silver maples certainly suggest virus infection, but the failure to transmit the mosaic by either budding or grafting, and the fact that at least two different mosaic types of segregates were among the progeny of a single tree, throw some doubt on the virus origin of these variants. In the case of prunus virus (3), however, the virus transmission by grafting requires two full seasons of growth (4). It is possible that these aberrant seedlings had a virus which was slow to develop symptoms when transmitted to a normal host.

Blakeslee (5) has found a mutation in *Datura* which resembles the effect of a virus disease. Both the virus infected and the mutant type showed modified leaves, capsules and flowers. In view of the failure to transmit the mosaic by budding or grafting, and the segregation of four distinct types of progeny from a single parental tree, it appears that the aberrant silver maples described are of genetic origin.

Recently John and Wilson (6) have described a somewhat similar genetically conditioned leaf character in the cucumber, *Cucumis sativus* L. They found what was termed a "ginkgo leaf" variation to be inherited as a simple Mendelian recessive factor. No variation in degree of expression such as observed in the *Acer* mutants was reported.

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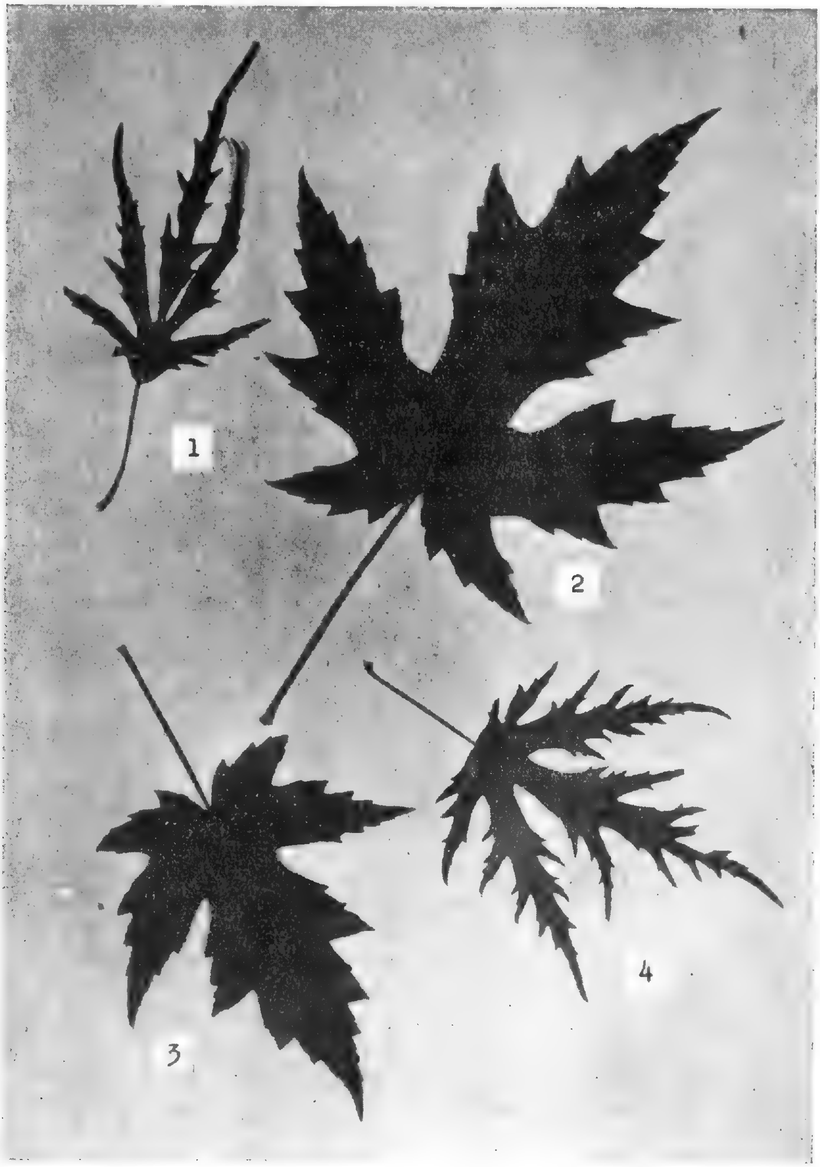
DESCRIPTION OF PLATE

Typical leaves of silver maple segregates from a single parental tree.

1. Leaf of extreme variant similar to those of a variant described by the Willis Nursery Co. The leaves have extremely narrow lobes and have chlorophyll deficiencies characteristic of a virus infection.
2. Leaf of a normal segregate.
3. Leaf of a segregate with small leaves similar to those of "Wierii." These leaves show little or no mosaic characteristics.
4. Leaf of a segregate resembling "Skinners" silver maple. Chlorophyll aberrations resemble those caused by mosaic virus.



Pauley and Johnson, Aberrant Silver Maples

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STUDIES IN THE BORAGINACEAE, XXIII
A SURVEY OF THE GENUS LITHOSPERMUM

IVAN M. JOHNSTON

With three plates

SOME MONTHS AGO I began a study of the genus *Arnebia* for the purpose of determining whether or not the eastern Asiatic species *A. Hancockiana* (Oliver) Johnston had been properly assigned to that genus. As the study progressed questions arose as to precisely how *Arnebia* could be distinguished from *Lithospermum*. As a basis for the solution of this problem dissections were made of representative species of *Lithospermum*. This gave me reasons for doubting the naturalness of that genus as currently defined. Methodical study of all the species of *Lithospermum* was then commenced, and the investigation eventually extended to members of other obviously related genera. From an examination of a few Asiatic species my study has gradually widened into a critical re-examination and redefinition of *Lithospermum* and all the other genera of the Lithospermeae characterized by coarsely bracted inflorescence.

The present paper is concerned only with *Lithospermum*. The species of the genus are enumerated, their principal synonymy given, and a key for their identification provided. My chief concern, however, has not been with the details of species-classification, but rather with the over-all composition of the genus, and in its units only so far as they reveal morphological traits pertinent to the definition of the genus and the major grouping of its species. The observations given concerning the species are primarily those significant in establishing the relationship and the precise position of the species in a natural classification. They are mostly concerned with the inner structures of the corolla, for the most part described only imperfectly, if not completely ignored, by previous writers. The related genera will be given similar treatment in the next paper of this series. Their relationships with *Lithospermum* will there be discussed at length, and new generic descriptions, keys, and tabular synopses useful in evaluating and distinguishing them will be provided.

As here treated *Lithospermum* includes *Arnebia* and *Macrotomia*, but excludes *Lithodora*, *Moltkia* and *Stenosolenium*, as well as *Lithospermum* *apulum* L., *L. miscrospermum* Boiss., *L. cinerascens* (DC.) Johnston, *L. revolutum* Robins., and the species allied to *L. arvense* L. and *L. purpureo-coeruleum* L. The genus thus delimited is a very natural one, readily distinguished from its closest relatives by decisive characters of fundamental importance. Its species are many and diverse, and, though prevailingly well marked, exhibit in all degrees of expression and in many combinations the various evolutionary modifications that distinguish them. As a result of a wealth of intermediates, and the freedom with which characters are combined, there are no clear-cut large groupings of the species within the genus. The genus has great internal coherence. It is exasperatingly lacking in lines of cleavage. There are no sharply defined natural major divisions. Even artificial divisions useful in a key are difficult to find. The genus contains so many well-marked species that even the naming of species-groups (series) seems impractical, since the majority of them would be monotypic. Accordingly I have proposed no subgeneric divisions in *Lithospermum*. This is not because I have made no attempt to discern them, but only because I have been forced to the belief, reluctantly, that no useful, natural, definable ones are present.

The latest comprehensive study of *Lithospermum* and *Arnebia* is that published in 1846 in the 10th volume of De Candolle's Prodromus. Subsequent publications concerning the genera have been mostly regional, most of them relating to only a limited number of species. Four papers, however, have sufficiently broad scope to be especially useful to the student of *Lithospermum*. One by Helene Spengler, Oesterr. Bot. Zeitschr. **68**: 111–123, f. 1–41 (1919), is a study of the form and internal organization of the corollas of *Lithospermum*. Many species were examined and described, and the dissected corollas (and frequently also the nutlets) were illustrated. While her observations do not always conform with my findings, her paper is a stimulating and useful one. The many American Lithospermums have been treated by Johnston, Contr. Gray Herb. **70**: 18–31 (1924) and **78**: 6–11 (1927). The species are keyed and their synonymy given. Incidental to the publication of additional species, another key to the American species was later published by A. Brand, Fedde Repert, **28**: 10–17 (1930). The synonymy of the American species has been rather completely covered by Johnston and by Brand. Synonymy for the species of Eurasia and Africa is to be found in the purely bibliographic paper by G. Stroh, Beih. Bot. Centralbl. **58**B: 203–211 (1938).

The present study is based primarily on the material in the large and very representative world-wide collection of the Boraginaceae assembled at the Gray Herbarium by my efforts during the past twenty-five years. From that source suites of specimens representative of practically all species have been available for dissection and repeated examination and comparison. Supplementary material of great usefulness has also been received on loan from other institutions: Mexican and African collections from the Missouri Botanical Garden, Mexican and South American from the Chicago Museum of Natural History and from the United States National Museum; and Asiatic ("*Arnebia*") from the Natural History Museum, Stockholm, and from the Botanical Museum of the University of Lund. The type of *Arnebiola* was also sent for my examination from the Botanical Institute, Florence. Through the courtesy of the curators of the institutions mentioned I have had a very large and representative series of specimens for study. For this help I wish to express again, now publicly, my grateful appreciation.

GENERAL OBSERVATIONS ON THE FLOWER AND FRUIT

Most species of *Lithospermum* have yellow or orange, or at least yellowish corollas. Albino variants of these, if they exist, are apparently extremely rare. Pure white corollas, entirely so or yellow only in the throat, are characteristic of about seventeen species. Blue or pink or brownish corollas are characteristic of a few other species, mostly Asiatic. In general, closely related species agree in corolla-color. Among the Asiatic species formerly placed in *Arnebia* a number (*L. decumbens, L. Griffithii, L. Szechenyi, L. guttatum* and *L. Tournefortii*) have five black or blue spots on the yellow or orange corolla-limb. These decorative spots, one adjacent to the base of each sinus on the limb, are evanescent, being dark and conspicuous on the newly expanded corolla but soon fading after prolonged exposure to sunlight. They occur on the corollas of species sharing general relationships but no immediate affinity.

The corolla-lobes usually have entire margins. Erose or lobulate or lacerate margins, however, are characteristic of the Asiatic *L. fimbriatum, L. fimbriopetalum*, and *L. Bungei*, all former members of *Arnebia*, and also of the American species *L. incisum* and *L. calycosum*.

The throat of the corolla may bear five well-developed invaginate appendages, or these may be imperfectly developed or entirely lacking. The faucal invaginations may be trapeziform, gibbose, lunate, or mere convexities. They may be velvety, velvety with intermixed stipitate glands, or merely glanduliferous. When present their location is marked on the outside of the corolla by slits that open into pocket-like recesses or merely by convex depressions of varying depth. Minute stipitate glands are common features in and about the throat of the corolla. They may occur on the faucal appendages, when these are present, but are usually most abundant on the inner side of the appendages and especially just below their base. Frequently they are abundant on the walls of the corolla-tube as far down as the filament-attachments. In many species they decorate the decurrent base of the filaments. In some of the species lacking faucal appendages (*L. discolor, L. viride, L. californicum*) the glands are abundant and generally distributed in the throat, and in others (*L. multiflorum, L. obovatum*, and *L. calcicola*) they may form sharply circumscribed congregations that take the place of the appendages. The species which have the corolla-throat unappendaged and sparingly or not at all glanduliferous are mostly Asiatic. Most of them were formerly placed in *Arnebia*. Indeed, lack of such appendages and glands has been used as the crucial character in attempts to distinguish *Arnebia* from *Lithospermum*. It is to be noted, however, that among these Asiatic species glands are not completely absent in the corolla-throat. In species such as *L. Hancockianum*, *L. Sewerzowi*, *L. Szechenyi*, *L. guttatum*, *L. densiflorum*, and *L. Griffithii* the glands may occur only in very moderate quantity or be very sparse, but they are present and are evident when looked for.

The inner wall of the corolla-tube is glabrous in most species or at most has only very minute hairs on the basal nectary. The tube is distinctly hairy, however, in *L. hispidissimum*, *L. Tournefortii*, and *L. discolor*, as well as in the three related species *L. cobrense*, *L. obovatum*, and *L. tubuliflorum*. The development has diagnostic value but little importance as an indicator of relationship. The species with hairy corolla-tubes are all heterostylic. In some the hairs are more abundant in the short-styled flowers than in the long-styled ones. An extreme condition occurs in *L. obovatum*, in which only the long-styled flowers have hairs, the tube of the short-styled corollas being glabrous.

Another feature of the corolla of *Lithospermum* is the nectary located inside the tube 1–2 mm. above the base. This appears in a variety of forms and has various degrees of development. In some species the nectary appears to be undifferentiated (*L. Tournefortii*, *L. Benthami*, *L. euchromon*, *L. tetrastigma*) or marked only by minute hairs (*L. densiflorum*, *L. incisum*). In other species it is hardly more than a tumid band (*L. californicum*, *L. ruderale*) or a lineate ridge (*L. fimbriatum*). Frequently it becomes a prominent annulate ridge or flange (*L. officinale*) or even collar-like and as much as 1 mm. high (*L. guttatum*, *L. Aucherii*). Not uncommonly it is more or less lobulate. In some species (*L. multiflorum*, *L. cobrense*, *L. caroliniense*) it is divided into ten proximate quadrate lobes. Related species tend to have similar nectaries.

The anthers are oblong or narrowly oblong with obtuse or rarely somewhat acute or even apiculate tips. In non-heterostylic flowers they are borne near the summit of the corolla-tube or below it at a distance not exceeding their own length. When the tube is short, as in *L. officinale*, they may be attached near the middle of the tube, but in flowers with elongate tubes, such as are present in most species, they are always borne in the upper quarter of the tube. In corollas with faucal appendages the tip of the anther commonly reaches up to the appendage-base and is never more than an anther-length below it. This is the normal condition in the genus. Most departures from it are associated with heterostyly. In long-styled flowers the anthers are usually borne at or near the middle of the tube even when the latter is very elongate. In *L. obovatum*, *L. cobrense*, and *L. tubuliflorum* they are extremely low, being borne on the lower third of the tube. In short-styled flowers the anthers are found very high in the tube and frequently partially exserted from it. In this genus any corolla bearing anthers near the middle of its tube almost certainly belongs to a long-styled flower of a heterostylic species.

The filaments are usually short, less than one half and usually only a third or a quarter of the length of the anther. Two species show notable departure from this norm. The stamens on the short-styled flower of *L.*

hispidissimum have filaments nearly as long as the anther. In the long-styled flowers, however, the relation of filament to anther is normal. One of the most aberrant filaments, however, is that present in some of the plants I have referred to *L. tschimganicum.* This will be discussed under that species.

The attachment of the stamens in most species is whorled, i.e., within the individual corolla all are attached at the same level on the corolla-tube. In *L. Tournefortii,* however, although always confined within definite zones on the tube, the stamens are affixed at several differing levels. In *L. decumbens,* western forms have whorled stamens or may have one stamen borne slightly below the other four. In eastern forms, however, the stamens within a corolla are frequently borne at several loosely spaced superimposed levels, with two anthers at the mouth of the tube, another pair below, and a single anther lower down. In both *L. Tournefortii* and *L. decumbens,* accordingly, there is a departure from radial symmetry in the androecium. Such departures are present in a number of genera closely related to *Lithospermum.* Stamens attached at unequal heights in the tube are developed by species of *Stenosolenium, Lithodora,* and *Alkanna.* In *Moltkia* the filaments become unequal in length. Zygomorphy associated with stamens of various length and heights of attachment occurs in *Echium* and *Halacsya.* The sporadic appearance of aberrant stamen-attachments in *Lithospermum* is not surprising.

The behavior of the style in the non-heterostylic species deserves some comment, since its length relative to that of the corolla-tube may change between the time pollen is shed in the flower-bud just before opening and the time when the flower is completely expanded. In mature flower-buds the style is usually sufficiently long to carry the stigmas up between the dehiscent anthers or just above them. In species such as *L. officinale, L. distichum,* and *L. ruderale* the relative position of stigma and anthers remains similar in the expanded corolla. In some species there is evident elongation of the corolla-tube subsequent to anther-dehiscence. When this is accompanied by comparable elongation of the style, as in *L. calycosum,* the relative position of anthers and stigmas is maintained. In *L. Nelsonii* and *L. strictum,* however, the style elongates less, and although the stigmas are between the anthers at dehiscence, they assume a position below them when the corolla is completely expanded. In some of the Mexican species (*L. oblongifolium, L. viride, L. Muelleri,* and forms of *L. calcicola*) the style has become very elongate in the unopened bud. At the time the anthers dehisce the stigmas are held well above the anthers and the style itself is somewhat contorted in order to accommodate its length in its cramped quarters. When the corolla eventually opens the style straightens and the stigmas become exserted from the corolla-tube. Were the corolla-lobes of these species not strongly imbricate, but valvate as in *Onosmodium,* the style could force a way out through the tip of the unopened corolla and be precociously exserted in the manner characteristic of that related genus. A very different condition exists among the annual species of the Old World. In some plants of *L. detonsum* the stigmas and anthers are juxtaposed at the time pollen is shed, but by the time the corolla is fully expanded the stamens are carried high above the stigmas. The corolla-tube has apparently elongated more rapidly than the style. In *L. decumbens* and other plants of *L. detonsum,* even when pollen is shed, the stigmas are well below the anthers. Interestingly, they become even more widely separated by the time the corolla is fully expanded.

The style usually bears two stigmas; only in *L. tetrastigma* and *L. decumbens* is the number increased to four. Among some of the Asiatic species, particularly the annual ones, the style is apically forked and the stigmas terminate the short branches. In most species, however, the stigmas are sessile on the upper end of a simple style. Though usually terminal, in some American species they are distinctly subterminal, being affixed laterally slightly below a convex or conic, and sometimes notched sterile tip of the style. The latter condition is usually well developed in *L. Nelsonii, L. mediale,* and *L. oblongifolium.* The stigmas are usually distinct, but in such species as *L. strictum, L. Muelleri, L. fimbriatum* and *L. Szechenyi* they are crowded together on the tip of the style and their juxtaposed bases may become somewhat joined. Most stigmas are more or less globose, but in species such as *L. guttatum* and *L. multiflorum* they may become flattened and broadened and even obscurely lobed. Two species have the style more or less evidently twice forked and frequently bearing a stigma terminating each of the four ultimate branches. This remarkable condition, unique among the Boraginoideae, no doubt arose by division of stigmas borne on a simply forked style. Indeed, a suggestion of the condition is not infrequent in *L. guttatum.* In some individuals of that species the two stigmas may be very deeply bilobed and even nearly divided. With such evidence that an incipient stage actually exists, the further evolutionary steps for the formation of a bis-bifid style bearing four stigmas is not difficult to imagine. In any case the two species with this extreme development give indications in all other structures that they are not immediately related. The peculiarities they share are probably parallelisms and not the direct product of shared immediate ancestry. In this regard it is to be noted that the stigmas of *L. tetrastigma* are narrow and elongate, a form unique in this genus.

Heterostylic flowers are developed by at least eighteen species of *Lithospermum.* The two types of flowers in these species differ not only in position of stamens and length of style, but also in the size and frequently even in the shape of the pollen grains. Among most of these species the anthers in the long-styled flowers are borne near the middle of the corolla-tube. In *L. obovatum* and *L. tubuliflorum,* however, the anthers are in the lower third of the tube, while in *L. fimbriatum, L. densiflorum,* and *L. hispidissimum* they are borne in its upper third. The style in such flowers usually reaches the summit of the corolla-tube and may be even slightly exserted from it. In *L. densiflorum* long styles may be exserted as much as 5 mm. The anthers of short-styled flowers are borne near the summit of the tube, either entirely included or partially exserted from it. Their style reaches the middle of the tube or slightly beyond. Very short styles, less than a quarter of the length of the tube, are present only in *L. discolor* and *L. canescens.*

Associated with the major differences relating to style-length and stamen-height, there are also the correlated minor ones usually present in well-developed heterostyly. The anthers of long-styled flowers are usually smaller than those of short-styled flowers. In some species, e.g., *L. densiflorum*, the corollas with short styles are perceptibly larger than those with long styles. In most of the species the corolla-tube differs in form also. It is usually cylindric or very gradually ampliate in short-styled flowers. In the long-styled flowers there is usually a slight but abrupt increase in diameter at above the level of the stamen-attachments, with the result that the upper half of the tube is differentiated into an elongate cylindric throat. The corollas of *L. obovatum* present an unusual difference, perhaps unique among heterostylic flowers. The inner surface of the tube is hairy in the long-styled flowers but glabrous in those with short styles. The manifestations of heterostyly in *L. Tournefortii* are also unusual and perhaps unique. In that species the stamens in the individual corolla are not borne at one level, whorled, as is usual in most Lithospermums and other regular flowers. Rather, they are attached at several different heights on the corolla, and so occupy a zone rather than a single level on the tube. These staminiferous zones behave as do simple whorls of stamens. They have very different positions in the two types of flowers, being located below the middle of the tube in long-styled corollas and near its summit in the short-styled.

The pollen grains of the eighteen species with well-marked heterostyly have size-differences correlated with the two types of flower, those of the short-styled flowers always being the larger (Plates I and II). In nine of these species (*L. Griffithii*, *L. Tournefortii*, *L. densiflorum*, *L. discolor*, *L. canescens*, *L. multiflorum*, *L. cobrense*, *L. obovatum*, and *L. californicum*) the grains in the two floral types, though obviously different in size, are otherwise very similar. This is normal and is the condition present in all genera in which marked heterostyly has been studied. The pollen of the remaining nine heterostylic species is not of this conventional sort. The grains in the two types of flower differ not only in size but in shape as well. This is a most unusual condition. Indeed, it seems to be a type of pollen dimorphism previously unreported. The flowers of those species of *Lithospermum* in which it occurs present heterostyly in one of its most highly elaborated states. Two of the nine species having dimorphic pollen are American (*L. tubuliflorum* and *L. caroliniense*) and seven are Asiatic (*L. fimbriatum*, *L. Sewerzowi*, *L. Szechenyi*, *L. guttatum*, *L. Benthami*, *L. euchromon*, and *L. hispidissimum*). If classed according to the intimacy of their relationship, these nine species fall into eight groups as follows: 1. *L. tubuliflorum*; 2. *L. caroliniense*; 3. *L. fimbriatum*; 4. *L. Sewerzowi*; 5. *L. Szechenyi*; 6. *L. guttatum*; 7. *L. Benthami* and *L. euchromon*; and 8. *L. hispidissimum*. Most of these have their closest affinities not with each other but with species or species-groups having pollen little or not at all differentiated in shape. Furthermore, their closest relations are intra-continental, the American species having a basically different type of pollen than that of the Asiatic species. Heterostylic species with dimorphic pollen do not form a natural group.

With heterostyly so strongly developed in some species, it is surprising that the other members of the genus show so few tendencies of that nature. Some evidence of incipient heterostyly occurs among some of the many puzzling forms of *L. decumbens*. Throughout the wide range of that species plants within a collection may or may not show differences in style-length, and moderate differences in the distance below the corolla-lobes at which the stamens are attached. In some collections of the large-flowered forms of the species from Central Asia, the differences can be more marked and even involve the shape of the corolla-tube. In all these forms, however, pollen shows no variation in size or shape. If tendencies towards heterostyly do exist, they have only weak and uncertain expression.

Within the Boraginaceae heterostyly is known in *Lithodora*, *Pulmonaria*, *Anchusa*, *Symphytum*, *Amsinckia*, *Cryptantha*, *Oreocarya*, and *Paracaryum*. Of these genera only *Lithodora* is closely related to *Lithospermum*. Most of its species have dimorphic flowers differing in style-length and height of stamen-attachment, and in some, even in the form of the corolla-tube. Unlike *Lithospermum*, however, the two types of flowers in *Lithodora* show no differences in pollen.

Cleistogamy is present in *Lithospermum incisum*, *L. Parksii*, *L. confine*, and *L. mirabile*, all members of a closely intrarelated group, and also in *L. calycosum*. In *L. incisum* the plant first produces clusters of large, very attractive chasmogamic flowers, mostly infertile, and subsequently only large numbers of cleistogamic flowers which fruit prolifically. Chasmogamic flowers may be completely suppressed in *L. confine*. In the other species the cymes produce conspicuous chasmogamic flowers until late in the growing season, and then only minute cleistogamic ones. Both types of flowers appear to be equally fertile. In all of the five species mentioned the cleistogamic flowers are very similar. The corolla is calyptrate, usually 1–3 mm. long, and eventually falls without opening. Faucal appendages and stiped glands that may be present in the large open flowers are not developed in the corollas of the cleistogamic flowers. The pollen produced by open and closed flowers is indistinguishable, or at most very slightly smaller in the closed flowers. Since the style of the closed flowers is extremely short, the fruit produced by each of the two types of flowers is readily distinguished by the length of the persisting style associated with it.

It is surprising that cleistogamy is not a more common development in *Lithospermum*. Anyone seeking pollen in this genus for examination soon discovers that the anthers of expanded flowers are nearly always empty. Although the books report that *Lithospermum* is proterogynous, without exception I have found that normal anthers in this genus shed their pollen before the corolla opens. The pollen is dumped out and adheres in masses on the inner sides of the faucal appendages and on the glanduliferous wall of the throat. In some species masses of pollen adhere to the stigma, in the bud frequently surrounded by the anthers, and these masses are later carried up into the mouth of the corolla by stylar elongation. The physical conditions are extremely favorable for self-pollinization. Indeed, only if the flowers are self-sterile can it be prevented. Investigation of heterostyly in many other genera has indicated that the condition is usually accompanied by a high degree of self-sterility. Possibly this is also present in most of the non-heterostylic species of *Lithospermum*.

The nutlets of most species of *Lithospermum* are ellipsoidal or ovoid and usually have a smooth lustrous white surface. There are, however, many deviations from this common type. The surface may be smooth and porcelain-like or more or less pitted, or, particularly in Asiatic species, tuberculate, verrucose, or rugose. It may be white or stained with yellow-brown or brown, or, in Asiatic species, gray, brownish, or even olivaceous. Occasionally it is rubiginous (*L. tetrastigma*) or minutely mottled with purplish (*L. Tournefortii*). The prevailing shapes are ovoid or ovoid-ellipsoidal with rounded dorsum, rounded or obtusely angled venter, and blunted obtusish apex. Sharply pointed, subrostrate nutlets, however, occur in *L. euchromon* and *L. Sewerzowi*. In *L. tetrastigma* the nutlets are compressed, having a broad, flat or slightly concave back and convex venter. In *L. fimbriatum* and *L. detonsum* the broad nutlets have a wide depression down the middle of the lower half of the dorsum.

American species frequently have a well-developed ventral keel. This is commonly low and rounded, but in *L. strictum* it is narrow and acute. It may extend even over the apex of the nutlet and onto the dorsum. Among Mexican species the ridge down the middle of the venter is frequently made more prominent by a line of pits or slit-like depressions in the pericarp on either side of it. In most American species the ventral angle of the nutlet is traversed from top to bottom by a fine lineate sulcus representing the ventral suture. Among the Asiatic species other than *L. Tournefortii* and *L. tschamganicum* there is little or no evidence of this suture. The venter of their nutlets may be angled but is never obviously keeled, nor does it bear lines of pits and slits. In most species the nutlets are gradually narrowed to the base. In some, however, as the result of a lineate suprabasal constriction, the nutlet may develop a collar-like base (*L. matamorense*, *L. incisum*) and in others, because of a much broader suprabasal constriction (*L. ruderale*, *L. viride*) it may have a short stout neck just above a flaring base.

The nutlets have a basal attachment surface, commonly rounded and about as broad as long. It is usually flat or slightly concave or convex. In *L. incisum*, however, it is very deeply concave, almost excavated, and furthermore bears a spur-like projection. In *L. guttatum* the attachment has a broad lateral prolongation extending a short but evident distance up the venter of the nutlet-body and then outward under the truncate base of the ventral keel. A comparable upward prolongation of the attachment surface occurs also on the very aberrant nutlets of *L. tetrastigma*. The dorso-ventrally compressed nutlets of that species have a cordate base. The attachment is transversely elongate and depressed at the center and has a quadrate lobe extending upwards on the ventral side of the nutlet-body.

The gynobase in *Lithospermum*, traditionally described as flat, is, as a matter of fact, usually depressed pyramidal. When all four nutlets have been matured and shed, the gynobase usually bears four plane or somewhat concave and upcurved surfaces that slope towards the base of the style at angles of ten to forty-five degrees. In those species with nutlets that have a ventral upward extension of their attachment-scar (*L. guttatum*, *L. tetrastigma*, and to a less extent *L. Sewerzowi*) the gynobase may even take the form of a strongly truncated pyramid. Among most American species the surfaces on the gynobase (the scars or pads left by the fallen nutlets) usually have an upturned or thickened cartilaginous margin and tend to be joined laterally by cartilaginous tissue. In most Asiatic species, however, as well as in a very few American (*L. Nelsonii*, *L. Berlandieri*) the attachment pads on the gynobase are unmargined and, though juxtaposed, remain distinct. In *L. oblongifolium* and *L. strictum*, in which the pyramidal gynobase is about as high as broad, the cartilaginous tissue between the margined attachment-pads becomes very prominent and even continues upward to the base of the style as narrow wings along the angles of the gynobasic pyramid.

POLLEN

In this genus I first examined pollen for the purpose of determining if there were size-differences associated with heterostyly. When the surprising variety of forms was revealed, the pollen of *Lithospermum* and related genera was methodically examined. It proves to be an extremely good indicator of relationships, generic as well as specific, and hence of great usefulness in classification, particularly so in *Lithospermum*. Since my purpose has been to examine pollen from as many herbarium specimens as possible (about five hundred were sampled in *Lithospermum*) my technique has been a simple one. Dehiscent anthers with pollen, taken from the flower-bud just before the expansion of the corolla when possible, have been macerated on a slide in a drop of 85% lactic acid and then protected by a coverglass. The grains expand rapidly and reach permanent form in a minute or two. Labeled, unsealed mounts have been used repeatedly over a period of six months. Those which dried out have been quickly repaired by the addition of more lactic acid. Comparison of such old mounts with freshly made ones shows no difference in pollen size or form. The grains were studied and measured under 450 magnification. It is obvious that a refined technique, and especially the use of stains and higher magnifications, would reveal much more concerning the pollen than the gross features, the size and form, and the position and number of pores which I have observed. That, however, is left to a better microscopist than I. In the present study of *Lithospermum* a wide survey of pollen-types is more useful than one that is limited because it is detailed.

The pollen of *Lithospermum* is notable in several respects. In the heterostylic species the grains of long-styled and short-styled flowers differ not only in size but frequently in shape as well. Differences in size are not unexpected. They have been found associated with heterostyly in genera of many families. Darwin, indeed, was inclined to consider them as the ultimate proof that true heterostyly was present. Differences in shape, however, are a different matter. I have, in fact, been unable to discover any previous report of such a condition. This pollen dimorphy which is associated with the heterostyly in some species of *Lithospermum* may be unique.

The two kinds of pollen produced by the various heterostylic species of *Lithospermum* are illustrated in Plates I and II. It is to be seen that size differences occur in all the species. Dimorphy is extreme in *L. tubuliflorum* (fig. 10) and *L. caroliniense* (fig. 12), moderate in *L. Hookeri* and *L. euchromon* (fig. 3), *L. fimbriatum* (fig. 4), *L. guttatum* (fig. 5) and *L. hispidissimum* (fig. 7), and only weak or variable in *L. californicum* (fig. 9), *L. cobrense* (fig. 15), and *L. canescens* (fig. 11).

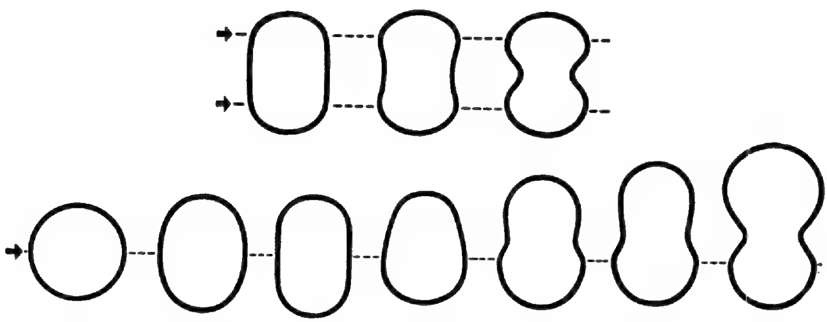
The pollen of five species (*L. incisum*, *L. Parksii*, *L. confine*, *L. mirabile*, and *L. Tournefortii*) is almost perfectly spherical. In a few others it is subglobose with the sides slightly angulate when viewed in lateral profile (*L. viride*, *L. Macbridei*, *L. strictum*, *L. Muelleri*). In most species, however, it is distinctly elongate with the length twenty-five to two hundred per cent greater than the maximum thickness. In polar view and in transverse sections perpendicular to the axis, the grains have a circular outline or sometimes a slightly polygonal one if prominent pores are included. In lateral view the profile varies greatly. The sides may be convex or outwardly angled, concave or inwardly angled, or straight and parallel or somewhat convergent. What is most unusual, the outline of the upper half of the grain may differ greatly from that of the lower half. As a result, the grains have a wide variety of forms. They may be spherical, ellipsoidal, barrel-shaped (cylindric with rounded ends), ovoid in various modifications, or, as a result of a medial or submedial constriction, achieve a lateral outline suggestive of an hourglass or a shoe-print in the snow. In size they also vary widely, from 65–72 μ in *L. densiflorum* down to 13–16 μ in *L. officinale*. As observed by me under 450 magnification, the grains appear smooth; I have detected no furrows. The pores are small and usually inconspicuous or even invisible. Only in a few species are they noticeably protrudent in lactic acid (*L. Pringlei*, *L. indecorum*). Their position and number is usually most readily determined by a study of shrunken or collapsed grains.

Two fundamentally different types of pollen, best distinguished by the position of the pores, are recognizable in the genus. One is represented by fifteen of the species formerly referred to *Arnebia* and *Macrotomia;* the other by the remaining twenty-nine species here referred to *Lithospermum*. In the latter type the pores are in a single row, equally spaced around the grain. Their number may be six, seven, eight, or nine, the particular number being relatively constant in the pollen of a given plant, but usually varying over two or three numbers among individuals of the species. When the grain of this type is spheric, ellipsoidal, or barrel-shaped, the pores are on the equator or at least equidistant from the two poles. There is, however, in this type of pollen, a tendency for the upper and lower halves of the grain to differ in size and form. When such asymmetry is present the band of pores may occur at levels below the middle of the grain. In the subcylindric grains of *L. calcicola* the pores are only slightly below the middle. They are more so in the somewhat ovoid grains of *L. tuberosum* and very conspicuously so in grains having the hourglass or shoe-print profiles. In such medially constricted grains the pores are located where the lower half of the grain is broadest, or, in other words, at the point where the evenly rounded curve of the base of the grain terminates and constriction begins. When these grains are viewed in lateral profile, the constriction just above the pores is by sloping, straight (not curved) lines. The convergent straight lines of this constriction form the distinctive shoulders recognizable in many grains of this type. As landmarks, even in grains of the hourglass form, these sloping shoulders distinguish the lower from the upper half of the grain and are always an indicator as to the location of the single band of pores.

The other type of pollen in *Lithospermum*, that which is characteristic of most species formerly placed in *Arnebia* and *Macrotomia*, is always perfectly symmetric, with the bottom and top halves alike. It may be cylindric or nearly so, or weakly to strongly constricted medially and hence sometimes subcylindric with slightly concave sides or more or less clearly of the hourglass form. The pores are very indistinct. They appear to be arranged about the convex ends of the grain, five (or rarely four) in the row at each end. Possibly there may be additional pores, one at each pole. In this type of pollen there are no pores on or near the equator. In three species, *L. densiflorum*, *L. detonsum* (fig. 29) and *L. Aucherii*, the grains sometimes appear to be serrulate at the constricted equator. When empty, or dry and shriveled, they have an unusual form, being somewhat basket-like and consisting of superimposed rings joined by five (or four) equally spaced ribs. The ribs are usually verrucose at the middle and presumably form the serrulations previously mentioned. The empty or shrunken grains of the other species in this type are not ribbed nor basket-like. Commonly they appear subcyclindric or bag-like. If they burst open, it is usually at one or more places at the ends, never at or near the middle. The pollen-walls are evidently thicker and more rigid in these grains than in the other type of pollen.

The developmental history of the asymmetric pollen grains deserves study. Prepared sections of the anther at various stages of development should reveal exactly how the unusual grain-shapes arise and how, for example, grains with the hourglass form can be efficiently packed together in the theca. Until the matter is investigated we can only suspect that the peculiarities in the form of the grains must be a manifestation occurring late in their ontogeny.

Of the two types of pollen in the genus, the more common one, that with six to nine pores in a single row, shows the greatest diversity in outline. The many forms assumed by this pollen type can be homologized, however, as modifications of a spheric grain with equatorial pores. From a spheric grain, by equal enlargement of both hemispheres, ellipsoidal and barrel-shaped grains can be derived. The asymmetrical grains, those bearing the row of pores below the middle, are probably the result of hypertrophy of one hemisphere. In the very asymmetric pollen with the hourglass or foot-print profile, in which the row of pores is near one end, one half of the original basic spherical form is to be recognized in the rounded base of the grain. The major portion of the grain, that above the band of pores, is the other hemisphere excessively enlarged and greatly modified in outline (fig. 1).



TEXT-FIG. 1. Relation of the forms in the two types of pollen in *Lithospermum*. Levels at which rows of pores are borne indicated by arrows and broken lines. Type with two rows of pores (upper figures) always symmetrical, differing in the degree of medial constriction. Type with one row of pores (lower figures), probably all modifications of a sphere, becoming ellipsoidal or subcylindric by equal modifications of the two hemispheres or becoming ovoid or achieving more asymmetric form by excessive modification of only one hemisphere.

What relations this type of pollen may have with that which has the pores in two rows is obscure. The two different types remain distinct and their variants give no clues as to how one of the types might have given rise to the other or how they might both be derived from a common ancestral form.

THE RELATIONS OF LITHOSPERMUM AND ARNEBIA

In a subsequent paper I will discuss the nature and relations between *Lithospermum* and the numerous allied genera and give reasons why certain species previously classified under *Lithospermum* should be excluded. Some justification must be given at this time, however, for the inclusion within *Lithospermum* of species which other authors have believed generically separable. The species concerned are those which constituted the genus *Arnebia* or its segregate *Macrotomia*. For convenience in discussion I have listed below all the species that recent authors have classified under these two genera. Those genera other than *Arnebia* under which the species have been classified are named within brackets.

1. *Arnebia tinctoria*
2. *Arnebia decumbens*
3. *Arnebia Griffithii*
4. *Arnebia hispidissima*
5. *Arnebia Bungei*
6. *Arnebia fimbriopetala*
7. *Arnebia minima*
8. *Arnebia linearifolia*
9. *Arnebia [Macrotomia] euchroma*
10. *Arnebia [Macrotomia; Leptanthe] Benthami*
11. *Arnebia [Macrotomia] densiflora*
12. *Arnebia fimbriata*
13. *Arnebia obovata*
14. *Arnebia Szechenyi*
15. *Arnebia guttata*

16. *Arnebia [Macrotomia] echioides*
17. *Arnebia [Lithospermum] Hancockiana*

Among the seventeen species that botanists have assigned to *Arnebia,* the first fifteen in the above list share the greatest number of significant characters. The two at the end of the list, although giving evidence of relationship with the others, deviate from them in important details. Below I have given the characters of "*Arnebia,*" deriving them only from the first fifteen species in the list. The aberrant characters of the two species at the end of the list are not included. For comparison, a characterization of *Lithospermum* (exclusive of *Arnebia* and *Macrotomia*) is also provided.

ARNEBIA, p.p.

Annual or perennial; flowers frequently heterostyled; corolla yellow, orange, blue, pink, or brownish, sometimes with an evanescent spot between the bases of adjacent corolla-lobes; corolla-throat without appendages, usually also lacking stipitate glands or these sparse if present; corolla-tube glabrous or rarely hairy; corolla-nectary present or absent, weak or well developed; style simple, forked or twice forked, stigmas two or four; stamens whorled in corolla-tube (except in *A. decumbens*); pollen cylindric or constricted medially, symmetric, bearing a row of four or five pores at each end; nutlets roughened, more or less tuberculate, verrucose or rugose, gray, brown, olivaceous or rubiginous, never white. — Asia and north Africa.

LITHOSPERMUM, p.p.

Perennial or rarely annual; flowers sometimes heterostyled; corolla yellow, orange, or white, never spotted; corolla-throat with or without intruding appendages, more or less glanduliferous; corolla-tube glabrous or rarely hairy; nectary weak or well developed; style simple; stigmas two; stamens whorled in the corolla-tube; pollen globose, cylindric, ellipsoidal, more or less ovoid, or more or less constricted medially, bearing six to nine pores in one row at or below the middle of the grain or near one end; nutlets usually smooth, white and lustrous, but sometimes brownish or pitted, rough only in a few species. — America, Eurasia, and Africa.

Even with its two aberrant species eliminated, *Arnebia* differs sharply from *Lithospermum* only in one character, nature of pollen. The annual habit is well developed in *Arnebia*, but a few examples of it exist in *Lithospermum* (*L. matamorense*, *L. Pringlei*). The corolla of *Arnebia*, unlike that of *Lithospermum*, is sometimes spotted, and may be blue, pink, or brownish, but it may also be yellow or orange and unspotted as in *Lithospermum*. The corolla-throat has no appendages or at most very weak ones (*A. euchroma*), but many species of *Lithospermum* are similarly lacking in faucal appendages. Most species of *Arnebia* have no stipitate gland in the corolla-throat, but *A. obovata*, *A. guttata*, *A. Szechenyi*, and *A. densiflora* have them in limited numbers. The style can be forked in *Arnebia*, but it can also be simple and consequently similar to that of *Lithospermum*. None of the fifteen Arnebias have the smooth, polished, frequently white nutlets common in *Lithospermum*. They are brown, gray, greenish, or reddish, and roughened. Brown or gray roughened nutlets, however, do occur in some Lithospermums (*L. cinereum*, *L. mirabile*, *L. Parksii*).

The fifteen species of *Arnebia* cannot be distinguished from *Lithospermum* more readily if the practice of some authors be followed and the coarse perennials (*A. euchroma*, *A. Benthami*, and *A. densiflora*) be assigned to *Macrotomia* and the remaining twelve species be left in a restricted *Arnebia*. According to some authors *Macrotomia* is distinguishable from *Arnebia* by its simple style, lack of nectary in the corolla-tube, and its coarse habit. The authors who have used these characters had not dissected all the species of *Arnebia*. Simple styles also occur on *A. fimbriata*, *A. obovata*, and *A. Szechenyi*, and the nectary is also lacking in *A. tinctoria*, the type of the genus *Arnebia*. Furthermore, the coarseness of habit supposed to distinguish *Macrotomia* from *Arnebia* becomes only a vague matter of degree when forms of *Macrotomia euchroma* and *Arnebia guttata* are compared. *Macrotomia* is not a readily definable or useful concept, furthermore it is unnatural, for *Macrotomia euchroma* and *M. Benthami* are not immediately related to *M. densiflora*.

The two Arnebias recognized as aberrant, and as yet undiscussed, remain to be considered. The first of these, *A. Hancockiana*, combines characters of *Arnebia* and *Lithospermum*. Its blue or pink unappendaged corollas are more suggestive of *Arnebia*. In having ellipsoidal pollen with a row of pores at the equator, a glanduliferous corolla-throat, a simple style with subterminal stigmas, and smooth lustrous white nutlets, it has the characters of *Lithospermum*. The other aberrant species, *A. echioides*, has a yellow, spotted corolla devoid of appendages and glands in the throat, which is very characteristic of *Arnebia*. So also is the shape of its broadly affixed nutlets. Its globose pollen, with the pores on the equator, as well as the nearly smooth surface of its nutlets, are, however, characteristic of

Lithospermum. Its hairy corolla-tube is duplicated in both genera, as is also its simple style. In bearing stamens at unequal heights within the corolla-tube, it is dissimilar to *Lithospermum* but suggestive not only of *Arnebia decumbens* but also of species in other genera related to *Lithospermum*, such as *Stenosolenium*, *Lithodora*, and *Alkanna*. The suppressed nectary is to be compared only with that of *A. tinctoria*. In most of its characters the species is more closely allied to *Arnebia* than to *Lithospermum*.

Even when *A. echioides* and *A. Hancockiana* are not considered, the difference between *Lithospermum* and the fifteen species of *Arnebia* is weak and uncertain. When the aberrant species are taken into consideration, the differences between the supposedly different genera entirely disappear. If *A. echioides* be assigned to *Arnebia*, then there is no longer any difference in type of pollen. On the other hand, if the species be placed in *Lithospermum*, then the spotted corolla or the corolla devoid of glands in the throat is no longer found only in *Arnebia*. If *Arnebia Hancockiana* be treated as an *Arnebia*, then the two genera again lose their differences in type of pollen, and furthermore, the smooth, white, polished nutlets are no longer distinctive of *Lithospermum*. Should *A. Hancockiana* be treated as a *Lithospermum* that genus no longer has only orange, yellow, or white corollas, but also pink or blue.

The distinctive developments which occur singly or collectively in species of *Arnebia* and can give them an aspect so different from species of *Lithospermum* occur in only some, not all the species of that group. The spotted corolla-limb of *Arnebia* occurs in only five of the seventeen species assigned to that genus. Only six of the seventeen have colors other than yellow or orange, such as pink, blue, or brown. The forked style is found in only half the species. Pollen of the type with two rows of pores is found in only fifteen of the seventeen. Since these characters are not universal in the group and are frequently combined in species with traits characteristic of *Lithospermum*, it seems futile to make further attempts at distinguishing *Arnebia* from *Lithospermum*.

Happily, most of the species of *Arnebia* retain their familiar specific epithets when the group is submerged in *Lithospermum*. The five exceptions are as follows: *Lithospermum tetrastigma* (*Arnebia tinctoria*), *L. detonsum* (*A. minima*), *L. Aucherii* (*A. linearifolia*), *L. Sewerzowi* (*A. obovata*), and *L. Tournefortii* (*A. echioides*).

I have not recognized *Arnebia* because it cannot be sharply defined or decisively separated from *Lithospermum*. Another reason for not doing so involves nomenclature. As pointed out by Rothmaler, Fedde Repert. **49**: 56 (1940), the generic name, *Arnebia* Forsk. Fl. Aeg.-Arab. 62 (1775), typified by *Arnebia tinctoria*, is antedated by *Echioides* [Tourn.] Ortega, Tabulae Botanicae 7 (1773), typified by *Arnebia echioides*. If the group known as *Arnebia* is to be given generic recognition, *Echioides* must be substituted as the correct generic name.

I have seen only the second edition of Ortega's Tabulae Botanicae (1783), on page 16 of which the genus *Echioides* is keyed out in the synopsis under the following final item, "Flore infundibuliformi, sed isoperimetro. Seminibus capitis viberini aemulis." No species, no locality, no reference, nor other means of further identifying the plant are given. However, Ortega makes it very clear that he used the Institutiones of Tournefort as the model of his synopsis. The name "Echioides" appears in Tournefort's "Corollarium Institutionum," page 46 (1703), where it is associated with the following description: "Echioides est plantae genus, flore monopetalo, infundibuliformi, sed isoperimetro, qua notâ differt ab Echio. Pistillum enim abit in fructum ex quatuor seminibus compositum, caput viperinum aemulantibus. — Echioidis speciem unicam novi. — Echioides Orientale, Buglossi folio, flore luteo, maculis atropurpureis notato. — *Echioides quasi planta ad Echium accedens*." The similarity between Ortega's short diagnosis and the longer one of Tournefort leaves no doubt that the same plant is intended. The generic name *Echioides* Ortega (1773), applied to *Arnebia echioides,* fulfils all the requirements for legitimate publication. This is not the case with *Echioides* J. Agosti, De Re Bot. Tractatus 193 (1770), a name for *Nonnea,* recently put forward by Schwarz, Mitt. Thuring. Bot. Ges. 1^1: 113 (1949). Agosti's book, also an adaptation of Tournefort, has descriptions of the genera, but the numerous species mentioned bear only polynomials. Agosti, unlike Ortega, was not a follower of Linnaeus nor a user of binomial nomenclature. Because binomial nomenclature was not adopted, Agosti's "Echioides" may be ignored. The name *Echioides* Ortega remains the acceptable one for the genus formerly known as *Arnebia*. Confronted with the choice of transferring all the species of *Arnebia* either to *Echioides* or to *Lithospermum,* I much prefer the latter.

KEY TO THE SPECIES

Pollen encircled by 2 rows of pores, one at each end of the grain, the rows each with 4 or 5 pores, upper and lower half of pollen grain similar in size and outline; corolla orange, yellow, pink, blue or brownish, throat only very obscurely if ever appendaged, glandless or very sparingly glanduliferous; nutlets roughened, rugose or tuberculate or papillate, gray, brown, olivaceous or rubiginous, never white and porcelain-like; plants mostly Asiatic, with outliers in Greece and North Africa.

Plants annual.

Stigmas 4, style frequently twice forked.

Mature calyx not developing an enlarged, indurate, pentangular tube; corolla blue or bluish, lacking a nectary in the tube; stigmas elongate; nutlets with cordate base, flat dorsum, and convex venter .... 1. *L. tetrastigma.*

Mature calyx with tube enlarged, indurate and prominently veined and angulate; corolla orange or yellow, with a membranous collar-like nectary in tube; stigmas subcapitate; nutlets with a broad nearly flat base, rounded back and angulate venter .... 2. *L. decumbens.*

Stigmas 2, style simply forked.

Corolla-tube villulose inside near middle; filaments in short-styled flowers more than half as long as the anthers; flowers strongly heterostylic; pollen strongly dimorphic .... 3. *L. hispidissimum.*

Corolla-tube glabrous inside; filaments always less than half as long as the anthers; pollen monomorphic.

Calyx not strongly accrescent, mature lobes slender, 10–15 mm. long and 0.5–1 mm. broad; corolla-limb with 5 evanescent black spots; flowers always heterostylic . . . . 4. *L. Griffithii.*

Calyx strongly accrescent, mature lobes lanceolate or lance-ligulate, 10–28 mm. long and 2–5 mm. broad; corolla-limb not spotted; flowers weakly heterostylic or monomorphic.

Corolla-lobes fimbriate, margins lobulate or lobulate-lacerate . . . . 5. *L. fimbriopetalum.*

. . . . 6. *L. Bungei.*

Corolla-lobes with margins entire or practically so.

Mature calyx 20–28 mm. long; leaves with lower surface glabrous or nearly so; nutlets nearly as broad as long, dorsum with medio-longitudinal depression below the middle and more or less definitely carinate above the middle . . . . 7. *L. detonsum.*

Mature calyx 12–17 mm. long; leaves strigose beneath; nutlets evidently longer than broad, back rounded and neither depressed nor carinate along the medial line . . . . 8. *L. Aucherii.*

Plants distinctly perennial.

Corolla-lobes with conspicuously fimbriate margins, pink changing to blue; nectary in corolla-tube a villose lineate ring . . . . . 9. *L. fimbriatum.*

Corolla-lobes entire or practically so.

Nectary in corolla-tube a well-developed villose collar.

Corolla blue . . . . 10. *L. Sewerzowi.*

Corolla yellow or orange, limb usually bearing 5 black evanescent spots.

Bracts of cymes broad, more or less elliptic, foliaceous, not simulating the narrow calyx-lobes; style not forked . . . . . . 11. *L. Szechenyi.*

Bracts narrow, simulating the calyx-lobes in size and form; style usually forked at apex . . . . 12. *L. guttatum.*

Nectary in corolla-tube obscure or absent.

Corolla yellow or orange, very large, limb 20–25 mm. broad, tube 20–37 mm. long; stamens borne at or near the mouth of the corolla-tube; corolla-tube sparsely villulose just above the base inside; pollen homomorphic, very large; Greece and Turkey . . 13. *L. densiflorum.*

Corolla pink, purple or brownish, limb less than 15 mm. broad, tube less than 15 mm. long; stamens in long-styled flowers borne near the middle of the corolla-tube; corolla-tube glabrous inside; pollen dimorphic; n.w. Himalayas to eastern Iran and north into Central Asia.

Inflorescence cylindric, much longer than broad; calyx-lobes slender, very elongate and flexuous, usually much longer than the corolla-tube; leaves usually evidently 3–5-ribbed from the base . . . . 14. *L. Benthami.*

Inflorescence subglobular, tending to become broader than long; calyx-lobes lanceolate, coarse and rigid, usually equalling the corolla-tube or surpassed by it; leaves usually with only a strong midrib . . . . 15. *L. euchromon.*

Pollen encircled at the middle, below the middle, or near one end with a single row of 6–9 pores, upper and lower halves of the grain similar or differing in outline and size; corolla orange, yellow or white (or exceptionally bluish, in *L. Hancockianum*), with or without evident faucal appendages, usually bearing abundant minute stipitate glands in and below the throat; nutlets prevailingly polished and porcelain-like, completely smooth or with scattered punctate pits, white or more or less stained with brownish (or minutely mottled in *L. Tournefortii*; rough and dull only in *L. mirabile*, *L. Parksii*, *L. matamorense*, *L. papillosum*, and *L. cinereum*); plants of America, Eurasia and Africa.

Corolla orange, yellow, yellowish or greenish, not white.
  Flowers heterostylic or dimorphic, the two types of flowers differing in the height at which the stamens are affixed in the corolla-tube.
    Pollen broadest at the equator, pores medial.
      Flowers not truly heterostylic, pollen (ellipsoidal) of one size, length of style not correlated with the position of the stamens; Central Asia .... 16. *L. tschimganicum.*
      Flowers strongly heterostylic, the two types of flowers differing not only in position of stamens but also in the length of the style and in the size of pollen.
        Stamens affixed at three different levels on the corolla-tube; corolla-limb bearing 5 evanescent black spots; corolla-tube minutely hairy inside; pollen globose; basal leaves well developed; Caucasus .... 17. *L. Tournefortii.*
        Stamens all affixed at the same level on the corolla-tube; corolla-limb without spots; pollen longer than broad; America.
          Stems not arising from a leaf rosette, lower cauline leaves small and poorly developed, very much smaller than the middle and upper ones; corolla-tube always glabrous within .... 18. *L. multiflorum.*
          Stems arising from the center of a well-developed leaf-rosette; basal leaves much larger than the middle and upper cauline leaves; corolla-tube hairy inside or at least so in long-styled flowers.
            Basal leaves large, obovate to elliptic, 15–25 mm. broad, upper surface with coarse appressed hairs only; corolla-tube not hairy within in short-styled flowers ...... 19. *L. obovatum.*
            Basal leaves narrow, elongate, oblanceolate, 5–15 mm. broad, upper surface bearing long and short hairs; corolla-tube always hairy inside.
              Corolla funnelform, usually almost as broad as long; plant cinereous, evidently hairy .... 20. *L. cobrense.*
              Corolla tubular funnelform, usually about twice as long as broad; plant green, inconspicuously hairy .... 21. *L. tubuliflorum.*
    Pollen constricted at the middle or evidently broader at one end, bearing the pores below the middle.
      Basal leaves larger than the middle cauline ones; stems arising from center of leaf-rosette; pollen of long-styled flowers ovoid, of short-styled flowers ellipsoid; Mexico .... 21. *L. tubuliflorum.*
      Basal cauline leaves small and imperfectly developed, much smaller than the middle cauline ones; stems arising directly from a bud on the caudex; pollen never ellipsoidal.

Nutlets strongly constricted just above base, 5 mm. long; nectary in corolla-tube a glabrous tumid ring; herbage glaucescent; fruiting calyx usually recurved; California .... 22. *L. californicum.*

Nutlets not constricted just above base; nectary in corolla-tube 10-lobed, villulose; herbage not glaucescent; fruiting calyx remaining erect; eastern United States.

Corolla orange-yellow, 13–25 mm. long, faucal appendages glanduliferous ridges not invaginate; mature calyx-lobes 6–13 mm. long; nutlets 3.5–4.5 mm. long .... 23. *L. caroliniense.*

Corolla yellow, 10–18 mm. long, faucal appendages invaginate, gibbose; mature calyx-lobes 5–6 mm. long; nutlets 2–3 mm. long .... 24. *L. canescens.*

Flowers not heterostyled, monomorphic.

Stamens borne at middle of corolla-tube; pollen neither ellipsoidal nor globose.

Stems arising from a cluster of thickened fusiform roots, developing a basal rosette of leaves which persists at least until anthesis; pollen distinctly ovoid; southeastern United States ... 25. *L. tuberosum.*

Stems arising directly from a strong sparingly branched, dye-stained tap-root; basal leaves small and imperfectly developed, not forming a rosette; pollen constricted at middle or rarely subcylindric.

Stems with slender, loosely appressed or spreading hairs .... 26. *L. erythrorhizon.*

Stems short-strigose, the hairs closely appressed.

Mature leaves 5–15 (–20) mm. broad, firm, acute, veins 1 or 2 on either side of midrib, not obviously anastomosing nor branched; calyx at most only shortly surpassing the corolla-tube, commonly shorter, in fruit 3–5 (–8) mm. long; nutlets commonly 3 mm. long; Eurasia .... 27. *L. officinale.*

Mature leaves 15–45 mm. broad, thin, frequently somewhat acuminate, veins 2–4 on either side of midrib, obviously anastomosing and usually branched; calyx distinctly longer than the corolla-tube, in fruit 9–13 mm. long; nutlets 4.5–5 mm. long; America .... 28. *L. latifolium.*

Stamens borne near summit of corolla-tube; pollen ellipsoid to globose or practically so.

Pollen perfectly globose, 33–42 μ; plant always developing some cleistogamic flowers; chasmogamic flowers with an elongate corolla-tube and well-developed invaginate faucal appendages.

Nutlets angulate, much punctate and roughened, narrowed to the base; attachment-scar flat, without a subulate projection; tap-root short-lived, fusiform .... 29. *L. mirabile.*

Nutlets rounded, ellipsoidal-ovoid, usually somewhat constricted just above base to delimit a basal collar that surrounds the markedly concave attachment-scar, scar bearing a prominent subulate projection; taproot not fusiform, usually strong and perennial.

Corolla-lobes erose or fimbriate; fruiting calyx usually nutant or cernuous; nutlets smooth or somewhat pitted; cleistogamous flowers very abundant .... 30. *L. incisum*

Corolla-lobes with entire margins; fruiting calyx erect.
Nutlets roughened, strongly verrucose or rugose; chasmogamic flowers abundant, large . . . . 31. *L. Parksii.*
Nutlets smooth and shiny; chasmogamic flowers few or none, plant commonly almost completely cleistogamic . . . . 32. *L. confine.*
Pollen ellipsoidal, if subglobose usually with angulate sides when viewed in lateral profile; cleistogamic flowers produced in only one species (*L. calycosum*).
Corolla small, less than 10 mm. long.
Pollen cylindric, sides straight and parallel in lateral profile; stems very elongate, 5–10 dm. long; Central Africa . . . . 33. *L. afromontanum.*
Pollen ellipsoidal, sides rounded or angulate in lateral profile; stems 1–5 dm. long; America.
Stems bearing numerous floriferous branchlets from the uppermost leaf-axils, the inflorescence, hence, an elongate cylindrical thyrse, individual cymes even in advanced maturity usually less than 5 cm. long, obscurely racemose; nutlets 4–6 mm. long, strongly constricted just above base; western United States and adjacent Canada . . . . . . 34. *L. ruderale.*
Stems loosely branched, the cymes not aggregated into a cylindrical thyrse, scattered, usually becoming very elongate and racemose at maturity; nutlets not strongly constricted just above base; Mexico.
Margin of corolla-lobes erose-dentate or -lobulate or crisped; fruiting calyx 8–19 mm. long; corolla-throat with scattered glands but no invaginate intrusions; corolla very variable in size, the later ones small and sometimes cleistogamic . . . . 35. *L. calycosum.*
Margin of corolla-lobes entire or practically so; fruiting calyx 4–9 mm. long; corolla-throat with gibbous invaginations or definite congregations of glands.
Leaves evidently veined; corolla-tube 5–9 mm. long, surpassing the calyx 1–3 mm., corolla-throat with well-defined gibbous invaginations; pollen 33–37 × 25–27 μ, pores prominent . . . . 36. *L. Pringlei.*
Leaves obscurely veined or veinless; corolla-tube 3–5.5 mm. long not surpassing the calyx; corolla-throat with obscure convex areas bearing congregations of glands.
Plant green, hispidulous, hairs spreading or loosely appressed; larger leaves 6–12 mm. broad; pollen with prominent pores, 30–33 × 26–28 μ . . . . 37. *L. indecorum.*
Plant with a dense soft gray indument, abundantly appressed villulose-hispidulous; largest leaves 2–3 mm. broad; pollen 20 × 16 μ, pores obscure . . . . 38. *L. jimulcense.*
Corolla large, 10–40 mm. long.
Throat of corolla bearing 5 sharply defined invaginate appendages, tube usually constricted at the summit.

Cauline leaves large, 10–30 mm. broad, evidently veined; corolla 20–40 mm. long; pollen evidently longer than broad .... 39. *L. oblongifolium.*

Cauline leaves 1–8 mm. broad, veinless; corolla 10–20 mm. long; pollen subglobose, about as long as broad.

Taproot abruptly swollen, fusiform; lower leaf-face more or less strigose; corolla-lobes evidently longer than broad, narrowly obovate or oblong; style not exserted .... 40. *L. strictum.*

Taproot not abruptly thickened, lower surface of leaves glabrous except on midrib; corolla-lobes as broad or broader than long, broadly attached, not narrowed at the base; style becoming evidently exserted ...... 41. *L. Muelleri.*

Throat of corolla without well-defined invaginate appendages, glanduliferous with the glands scattered or congregated.

Corolla bluish; leaves silky white-strigose beneath; plant with a sprawling very loosely branched woody caudex; southwestern China .... 42. *L. Hancockianum.*

Corolla yellow or yellowish; lower surface of leaves not white nor silky strigose; caudex small and compact; America.

Margin of corolla-lobes erose, denticulate or crisped; corolla varying widely in size, becoming reduced in size as the season advances, late one small and frequently cleistogamic; Mexico .... 35. *L. calycosum.*

Margin of corolla-lobes entire; flower never cleistogamic; style becoming tardily exserted.

Corolla-tube gradually expanding, evidently broader above the middle than at the base, lobes ascending; pollen ellipsoid .... 43. *L. guatemalense.*

Corolla-tube subcylindric, lobes divaricate or recurved; pollen subglobose, about as long as broad.

Cauline leaves 10–35 mm. broad, evidently veined; nutlets constricted just above the base; northern Mexico and adjacent United States .... 44. *L. viride.*

Cauline leaves 3–7 mm. broad, veinless; nutlets gradually narrowed at base; Peru .... 45. *L. Macbridei.*

Corolla white or with only the faucal appendages yellow.

Pollen constricted at the middle.

Flowers heterostylic; corolla-tube villose inside ...... 46. *L. discolor.*

Flowers monomorphic; corolla-tube glabrous inside.

Nutlets with a constriction just above the base; America.

Plant annual; nutlets usually conspicuously pitted and more or less brownish .... 47. *L. matamorense.*

Plant perennial; nutlets smooth and white.

Corolla-tube 10–15 mm. long, 2–3 times as long as calyx, limb 10–14 mm. in diameter .... 48. *L. Nelsonii.*

Corolla-tube 2.5–3.5 mm. long, equalling or barely surpassing the calyx, limb 4–6 mm. broad .... 49. *L. Berlandieri.*

Nutlets narrowed to a rounded base; Eurasia.

Stem strigose, the hairs closely appressed; fruiting calyx 3–5 (–8) mm. long; corolla longer than broad, lobes elongate, ascending .... 27. *L. officinale.*

Stems with spreading or loosely appressed hairs, fruiting calyx 5–10 mm. long; corolla about as broad as long, lobes broad and spreading . . . . 26. *L. erythrorhizon.*

Pollen not constricted at the middle.

Plants of South Africa.

Leaves broadest just above the base, sparsely appressed hispid, "nutlets rugose." . . . . 50. *L. papillosum.*

Leaves broadest at or above the middle.

Stems 4–8 dm. tall, lower leaves 6–12 cm. long and 15–20 mm. broad; nutlets with smooth rounded back . . . . 51. *L. diversifolium.*

Stems 1–3 dm. tall, largest leaves less than 7 cm. long and 10 mm. broad.

Herbage with a smooth grayish indument of very abundant short closely appressed hairs; nutlets tumulose on back; corolla-tube not surpassing calyx . . . . 52. *L. cinereum.*

Herbage villose-hispid, hairs mostly spreading; nutlets with smooth rounded back; corolla-tube elongate becoming about twice as long as calyx . . . . 53. *L. scabrum.*

Plants of tropical America.

Stems very slender, elongate and prostrate; pollen ellipsoid . . . . 54. *L. peruvianum.*

Stems erect or ascending, not prostrate.

Corolla-throat bearing 5 congregations of glands but lacking definite invaginations; pollen ellipsoid or more commonly somewhat ovoid . . . . 55. *L. calcicola.*

Corolla-throat with well-developed glanduliferous and velvety more or less invaginate gibbose appendages.

Stems erect, 3–8 dm. tall; pollen ellipsoid . . . . . 56. *L. mediale.*

Stems erect to loosely decumbent, less than 3 dm. tall; pollen cylindric.

Plant with loosely appressed or spreading hairs; stems erect, arising from a short-lived thickened fusiform taproot; basal leaves broad . . . . 57. *L. sordidum.*

Plant closely strigose; stems spreading, numerous, arising from a small more or less well-developed caudex crowning a strong perennial taproot . . . . 58. *L. distichum.*

. . . . 59. *L. Gayanum.*

1. **Lithospermum tetrastigma** (Forsk.) Lam. Encyc. 3: 30 (1789), Tab. Encyc. 1: 398 (1791).

Arnebia tetrastigma Forsk. Fl. Aeg.-Arab. 63 (1775); C. Christ. Dan. Bot. Arkiv 4³: 17 (1922); Steud. Nom. ed. 2, 1: 56 (1840).

Arnebia tinctoria Forsk. Fl. Aeg.-Arab. 63 (1775); Coss. & Kral. Bull. Soc. Bot. Fr. 4: 404 (1857); Boiss. Fl. Orient. 4: 214 (1879).

Lithospermum tinctorium (Forsk.) Vahl, Symb. 2: 33, t. 28 (1791), not L. (1753).

Echioides tinctorium (Forsk.) Rothm. Fedde Repert. 49: 56 (1940).

Lithospermum Arnebia Delile, Fl. Aegypt. Ill. 7 (1813); Lehm. Asperif. 2: 316 (1818); R. & S. Syst. 4: 45 (1819).

A small, compactly branched cinereous herb, 3–9 cm. tall, of Egypt and northern Arabia. Root annual, slender and dye-stained. Cymes dense, becoming 2–5 cm. long at maturity, bracts longer and broader than the calyx-lobes. Corolla small, 5–8 mm. long, blue or bluish, scarcely longer than the calyx; limb small, formed of small ascending ovate or cuneate lobes; tube 4–7 mm. long; throat glabrous, without glands or appendages; base of tube glabrous inside, nectary completely absent. Stamens borne at or just below summit of corolla-tube. Pollen (fig. 28) cylindric, in lateral profile with rounded ends and straight parallel sides, 41–46 $\times$ 33 μ. Style reaching to the height of the stamens, bis-bifid at the apex and bearing 4 minute cylindric stigmas. Nutlets strongly compressed dorsi-ventrally, rubiginous or brownish, obscurely tuberculate or nearly smooth, somewhat lustrous, ca. 2 mm. long and nearly 2 mm. broad above the distinctly emarginate base, cordate in outline, plano-convex in cross-section, with a decidedly flat or slightly concave dorsum angled at the margin and a low-convex ventrum with a low broad medial keel. Attachment surface on the narrow retuse base of the nutlet, depressed and bearing a pit at the middle, 3-lobed, the lobes quadrate, the middle one extending upward on the ventral face of the nutlet. Seeds cordate. Gynobase with 4 distinct attachment faces, elevated and truncate at the center.

This very distinct species is the type of the genus *Arnebia*. It has general relationships with the other annuals of the Near and Middle East and perhaps its closest affinities with *L. Aucheri*. It presents several especially noteworthy developments. The dorsi-ventrally compressed, plano-convex nutlets, with a 3-lobed attachment on the cordate base, are unique. They are aberrant in this genus and deserve recognition as one of the very extreme types of nutlets in all the Boraginaceae. In having four stigmas *L. tetrastigma* resembles *L. decumbens*, but from that and all other congeners it differs in having elongate stigmas and not capitate, flabellate, or reniform ones. Another unusual feature of the plant is the complete suppression of the nectary in the corolla-tube.

2. **Lithospermum decumbens** Vent. Descr. Pl. Nov. Jard. Cels, t. 37 (1801).

Arnebia decumbens (Vent.) Coss. & Kralik, Bull. Soc. Bot. Fr. **4**: 402 (1857).
Echioides decumbens (Vent.) Rothm. Fedde Repert. **49**: 56 (1940).
Lithospermum cornutum Ledeb. Fl. Altai. **1**: 175 (1829), Icon. Fl. Ross. **1**: t. 25 (1829) and Fl. Ross. **3**: 139 (1847).
Arnebia cornuta (Ledeb.) F. & M. Ind. Sem. Hort. Petrop. **1**: 22 (1835) and Ann. Sci. Nat. ser. 2, **5**: 126 (1836); DC. Prodr. **10**: 95 (1846); Boiss. Fl. Orient. **4**: 213 (1879).
Arnebia orientalis [Pallas] Lipsky, Acta Hort. Petrop. **26**: 513 (1910). — Based on a misidentified drawing without analyses; "Onosma orientale" sensu Pallas, not Linnaeus; cf. Bornm. Beih. Bot. Centralbl. **33**^{2}: 174 (1915).

The name *L. decumbens* is here applied to a bewildering assemblage of very diverse plants occurring from Algeria, across north Africa, and in Asia from Palestine and the Caspian area eastward to Songoria and Afghanistan. Only a few of its many synonyms are given above. The group is one that must be studied in the field before its many forms can be interpreted properly. In the present paper I can only circumscribe it, establish its general relations with other congeners, and indicate some of its more striking features. The plants with which we are concerned are all annuals, characterized by a combination of unusual features relating to the stigmas, the attachment of the stamens, and the form and behavior of the fruiting calyx.

The stigmas, four in number, are borne paired terminally on the two branches of the simply forked style or solitary and terminal on the four branches of the twice-forked style. They are globose in form. The stamens are not borne in perfect whorls, or in other words not all at the same level in the corolla-tube. In some plants, particularly the western ones and especially those from North Africa, the deviation from a whorled arrangement may be slight, only one anther being slightly though distinctly lower than the other four. In plants from the region east of Mesopotamia and the Caspian, however, the anthers are attached at very different heights on the corolla-tube. Commonly they are borne in three well-spaced superimposed groups, with a pair in the throat, another pair below, and the fifth anther lowest down in the tube, 2–4 mm. below the pair in the throat. This arrangement of the anthers at differing heights can be ascertained without dissection by simply viewing the corolla with transmitted light.

The calyx is strongly accrescent. At maturity it becomes a tough rigid bur-like structure which eventually detaches from the rhachis of the inflorescence with the nutlets still enclosed. As in species of *Cryptantha* and *Myosotis*, the bur-like calyx appears to have some role in dissemination. At maturity it has thick prominent indurate veins and an enlarged very prominently pentangular tube. The slender lobes are rigid and appressed. Between the ten indurate ribs the tube becomes membranous or opaquely vitreous. The five more prominent ribs, at times narrowly cristate, bear coarse warts or slender papillae, each terminated by a pungent hair.

In the forms of the species growing in Mesopotamia and westward, the corollas are usually subtubular and 10–15 mm. long and have a limb 2.5–4 mm. broad and a tube 8–12 mm. long. The stamens, as already mentioned, are crowded towards the summit of the corolla-tube and frequently deviate from a perfectly whorled arrangement only by having the base of one anther projecting below the bases of the other four. In some plants the stamens are borne in three groups differing in the level at which they are attached, but unlike the anthers in the plants of Central Asia, the tip of the lowest anther in the western forms is never below the level of the base of the anther attached directly above. In other words, the distance between the attachment-levels of superimposed stamens is always less than the length of the anther, and frequently only half as long. The stigmas are always carried distinctly below the level of the lower stamens.

The western plants of *L. decumbens* occur in two well-marked forms. One is found in the whole of the region from Transcaucasia and Mesopotamia to Algeria. It is a small low plant, frequently branching at the base and decumbent, having corollas ca. 10 mm. long, and mature calyces 7–10 mm. long. It is the form represented by the type of *L. decumbens*. The other form of the western plant is restricted to Algeria and Tunis. It is conspicuously more robust, having corollas 12–15 mm. long and mature calyces 15–20 mm. long, and has been distinguished as *Arnebia decumbens* var. *macrocalyx* Coss. & Kral. Before giving it a close study I had suspected that it might prove to be specifically separable. It has been a surprise to discover that it lacks distinctive structures and that it differs from true *L. decumbens* only in the matter of degree.

The forms of the species occurring east of Mesopotamia and the Caspian Sea differ from the western ones in being commonly much taller (1–6 dm.), more erect plants with very much larger corollas and very unequal stamen-attachment. In size the corolla varies widely. At times it is no larger than in western forms (10–15 mm.), but commonly it approaches 20 mm. in length and develops a limb 6–8 mm. in diameter. In extreme forms, however, it can attain as much as 25 mm. in length and may develop a limb 15–20 mm. broad. The corolla-limb seems to be always slightly oblique. It is yellow or orange (or exceptionally blue or bluish?) and frequently bears five black evanescent spots. Selected forms of this plant can differ greatly in size, shape, and coloration of the corolla. In any large representative series of specimens, however, the corolla-variations are found in all combinations and degrees of development. Lipsky, Acta Hort. Petrop. 26: 513–26 (1910), did select out and give varietal names to some of the extreme forms but stated definitely that transition between them was complete and that many specimens were intermediate in character and difficult to place.

As mentioned previously, the stamens in the large-flowered eastern forms are usually attached at unequal heights in the corolla-tube. Commonly the attachments of the superimposed anthers are separated by a distance equivalent to 1½–2 anther-lengths. This departure from radial symmetry in the androecium associated with the slightly oblique corolla-limb allows the corolla to be described as somewhat zygomorphic. The style in such forms commonly reaches up to slightly below the lowest stamen or, at times, to about the same height. Occasionally (e.g. *Spiridonow 167* from Golodnaja Steppe) the flowers seem to be heterostylic, the uppermost anthers on some plants being 3–4 mm. below the summit of the corolla-tube and surpassed by the style, while in other plants, as is common in the species, the upper stamens are just below the summit of the tube and the style is short. There is, however, no associated difference in size or shape of pollen.

Some of the structures relatively constant and shared by all forms of *L. decumbens* remain to be mentioned. The nectary in the corolla-tube is a membranous collar about 0.5 mm. high. The pollen (fig. 27), despite the inordinate diversity in size and form of corolla, is relatively constant in form. It is elongate, in lateral profile has concave sides, and measures 43–61 × 30–41 μ. Within the limits given there is a rough correlation between pollen-size and size of corolla, particularly as to the smaller sizes. The nutlets are 2.5–3 mm. long, brownish, and scantily to abundantly tuberculate. They are roughly ovoid in form and have a rounded back and angulate venter. The attachment surface is rounded and basal.

3. **Lithospermum hispidissimum** [Sieber] Lehm. Icones 1: 23, t. 39 (1821).

Arnebia hispidissima (Lehm.) DC. Prodr. **10**: 94 (1846); Wight, Icones **4**: t. 1393 (1848); Jaubert & Spach, Ill. Pl. Orient. **4**: 100, t. 363 (1852); Boiss., Fl. Orient. **4**: 213 (1879).
Anchusa hispidissima Sieber ex Lehm. Icones **1**: 23 (1821), in synonymy.
Dioclea hispidissima [Sieber] Spreng. Syst. **1**: 556 (1825).
Echiochilon hispidissima Tausch, Flora **12²**: 643 (1829).
Strobila hispidissima G. Don, Gen. Syst. **4**: 327 (1837).
Anchusa asperrima Delile, Fl. Aegypt. Ill. 7 (1813), nomen.
Arnebia asperrima (Del.) Hutch. & Dalz. Fl. W. Afr. **2**: 201 and 608, f. 246 (1931).
Echioides asperrimum (Del.) Rothm. Fedde Repert. **49**: 56 (1940).
Lithospermum vestitum Wall. Numerical List. no. 941 (1829), nomen; Benth. in Royle, Ill. 305 (1836); Don, Gen. Syst. **4**: 325 (1837).
Toxostigma luteum A. Rich., Tent. Fl. Abyss. **2**: 86 (1850).
Arnebia lutea (Rich.) Armari in Pirotta Ann. Ist. Bot. Roma **8**: 161 (1904).
Toxostigma purpurascens A. Rich., Tent. Fl. Abyss. **2**: 87, t. 77 (1850).
Arnebia purpurascens (Rich.) Baker, Fl. Trop. Africa **4²**: 56 (1906).
Anchusa polygama Hamilton ex Don, Gen. Syst. **4**: 325 (1837), in synonymy.
Arnebiola migiurtina Chiov. Fl. Somala. 227, t. 24, f. 1 (1929).

A hispid annual herb of the deserts of northern Africa and across southern Asia to Pakistan. It grows 5–50 cm. tall and has erect to decumbent stems and a slender dye-stained root. Cymes scorpioid, numerous, terminating the main stem and the numerous branches, simple, elongating, becoming 8–12 cm. long and racemose at maturity. Calyx with very unequal lobes, usually much shorter than the corolla-tube, 2.5–10.5 mm. long. Corolla 10–16 mm. long, retrorsely villulose outside; limb blue, funnelform, 4–7 (–8) mm. broad; tube 7–13 mm. long, inside villulose in a band ca. 1 mm. broad near the middle; throat glabrous, without glands or appendages, tube-nectary a very narrow lobulate sparingly villulose ring. Flowers heterostylic. Stamens borne in the upper middle quarter of the tube on filaments less than half as long as the anthers, or borne at the summit of the tube on filaments as long or nearly as long as the anthers. Style reaching the middle of the corolla-tube or reaching its summit or even somewhat exserted, evidently forked, more deeply so on long styles. Stigmas reniform or in long-styled flowers flabellate-reniform and somewhat lobed. Pollen (fig. 7) of long-styled flowers constricted at the middle, 25–33 $\times$ 16–25 μ. Pollen of short-styled flowers short cylindric, sides straight and parallel in lateral profile, 37–46 $\times$ 30–37 μ. Nutlets 1–2 mm. long, broadest at base, ovoid, brown or rubiginous, nearly smooth or more or less abundantly tuberculate.

A bristly desert herb varying greatly in habit, apparently in response to the varying rigors of its habitat. It may be an erect, loosely and ascendingly branched herb nearly 5 dm. tall, but is usually lower and more compactly branched. The type of *Arnebiola* is the plant in its most depressed and compact form.

The species has several unusual features. The corolla is villulose inside the tube and perhaps has a slightly zygomorphic limb. The filaments of the short-styled flowers are at least twice as long as those of the long-styled flowers. In the long-styled flowers, as characteristic in most species of this genus, the filament is distinctly less than half as long as its anther. In the short-styled flowers of *L. hispidissima*, however, the filaments are usually 0.9–1.2 mm. long and the anthers 1.2–1.8 mm. long. The species is well marked but is not as distinct as the repeated attempts to give it generic recognition might suggest. Surprisingly, four different generic names have been proposed for it: *Dioclea* Spreng., *Strobila* G. Don, *Meneghinia* Endl., and *Arnebiola* Chiov.

4. **Lithospermum Griffithii** (Boiss.), comb. nov.

Arnebia Griffithii Boiss. Diag. ser. 2, **3**: 135 (1856) and Fl. Orient. **4**: 213 (1875); Hook. Bot. Mag. **87**: t. 5266 (1861); Clarke, Fl. Brit. Ind. **4**: 176 (1883).
Echioides Griffithii (Boiss.) Rothm. Fedde Repert. **49**: 56 (1940).

A slender annual of Pakistan and Afghanistan, having erect hispidulous simple or ascendingly branched stems 1–3 dm. tall. The very slender root is only slightly stained with dye. Calyx-lobes slender, linear, hispid-villose, weakly accrescent, 1 mm. wide or less. Corolla yellow or orange, 20–23 (–30) mm. long; limb spreading, 10–15 (–20) mm. broad, with 5 black evanescent spots; tube slender, much surpassing the calyx, 15–18 mm. long; throat glabrous or scantily glanduliferous, without appendages; tube-nectary a narrow villulose collar. Flowers heterostyled. Stamens borne either just above middle of corolla-tube or at the summit and almost exserted. Style reaching to above the middle of the tube or reaching the summit or even shortly exserted, forked at the apex; stigma compressed reniform or somewhat flabellate, entire or obscurely lobed. Pollen (fig. 6) somewhat constricted at middle, in lateral profile with concave sides, in long-styled flowers 33–41 $\times$ 20–26 μ and in short-styled flowers 43–49 $\times$ 23–28 μ. Nutlets 2 mm. long and nearly as broad at the base, brown or rubiginous, somewhat lustrous, sparsely and coarsely tuberculate, back somewhat cordate at base.

5. **Lithospermum fimbriopetalum** (Stocks), comb. nov.

Arnebia fimbriopetala Stocks in Hook. Jour. Bot. & Kew Misc. **3**: 180, t. 6 (1851); Boiss. Fl. Orient. **4**: 205 (1879).
Echioides fimbriopetalum (Stocks) Rothm. Fedde Repert. **49**: 56 (1940).

A species of eastern Persia and Baluchistan known to me only from the references cited above. It is most closely related to *L. Bungei* and perhaps has a synonym in that species. According to Bornmüller, Beih. Bot. Centralbl. 33: 176 (1915), *Arnebia leptosiphonoides* Vatke (1875) is a synonym of the present species.

6. **Lithospermum Bungei** (Boiss.), comb. nov.

Arnebia Bungei Boiss. Fl. Orient. **4**: 215 (1879).
Echioides Bungei (Boiss.) Rothm. Fedde Repert. **49**: 56 (1940).

Only duplicates of the original collection, from middle eastern Persia, have been seen. These plants are in full flower but lack fruit. They represent the long-styled form of the species. The calyx at anthesis is 10–15 mm. long and has very slender linear lobes 0.5–1 mm. broad. The yellow or orange corolla becomes 25–28 mm. long and has a spreading limb 10–14 mm. in diameter. The corolla-lobes have distinctly lobulate and hence more or less fringed margins. The tube is 20–23 mm. long and is glabrous and devoid of appendages in the throat. Its nectary is a papery collar ca. 0.5 mm. high. The anthers are borne 15–17 mm. above the base of the tube. The style reaches the summit of the tube, is shortly forked at the very summit, and bears 2 simple or bilobed reniform stigmas. The pollen grains have slightly constricted sides and measure 45–49 × 28–30 μ.

The species is closely related to *L. fimbriopetalum* of Baluchistan and eastern Persia and perhaps is not distinct. Boissier stated that his species differed in its short pubescence, slender less elongated fruiting calyx, and its crenate rather than fimbriate corolla-lobes. The isotype of *L. Bungei* dissected by me, however, has the margin of the corolla-lobes not merely crenate, but distinctly and narrowly lobulate.

7. Lithospermum detonsum, nom. nov.

Arnebia minima Wettstein in Stapf, Denkscr. Acad. Wiss. Wien **50:** 30 (1885); Bornm. Bull. Herb. Boiss. **7:** 783 (1907). Not *Lithospermum minimum* Moris. (1827).

A sparingly and loosely branched herb of Transcaucasia and northern Iran. Its thickish leaves are glabrous or subglabrous on the lower surface. The slender root is dye-stained. The scorpioid cymes become very elongate (to 10 cm. long) and very conspicuous at maturity. Calyx conspicuously accrescent at maturity, 20–28 mm. long, tuberculate and hispid at the base; lobes ligulate or lanceolate. Corolla yellow or orange, subtubular, 19–25 mm. long; lobes ascending; limb only 4–6 mm. in diameter; tube 17–20 mm. long, usually about 3 mm. longer than the calyx; throat glabrous, without glands or appendages; nectary a lobed papery collar 0.3–0.8 mm. high, glabrous. Anthers borne at or just beneath the summit of the tube, not exserted. Style reaching up to 1–3 mm. below the anthers, short, forked at apex; stigmas 2, compressed, globular or reniform. Pollen (fig. 29) with concave sides, usually somewhat dentate at the middle, 49–59 × 30–40 μ. Nutlets brownish, 3–3.5 mm. long, ca. 3 mm. broad near the base, coarsely tuberculate, constricted above the middle, lower half of dorsum swollen on either side of a medio-longitudinal depression, upper half usually with a rounded medial keel.

The description given above is based on three collections: Ulja Norashen, Nakhichevan ASSR, May 9, 1947, *Grossheim, Iljinskaja & Kirpitschnikas* (G); Transcaucasia, *Heideman* (Stockholm); and Patschinar, Iran, *Bornmüller 7711* (G). They appear to represent the short-styled form of the species. Another collection from Patschinar, *Bornmüller 7708* (G, Stock.) appears to be the long-styled form. Its coarser corolla is 25 mm. long and has a limb up to 12 mm. in diameter. Its tube (20 mm. long) does not surpass the calyx. The anthers are borne 5–6 mm. below the summit of the corolla-tube and the style (surpassing the anthers 2–3 mm.) reaches up to 3–4 mm. below the summit of the tube. In other respects, however, and this includes pollen, as well as nectary and nutlets, the plant is similar to the short-styled form described. If the plant is heterostylic such dimorphy is unaccompanied by differences in size of pollen.

This plant of Transcaucasia and northern Iran has been confused with *L. Aucherii* (*Arnebia linearifolia* DC.), a related but apparently distinct species of the deserts of Egypt, Sinai, and southern Palestine. It is a more northern plant with a more robust habit, scanty indument, larger cymes, larger calyx, and larger bigibbose nutlets.

8. **Lithospermum Aucherii**, nom. nov.

Arnebia linearifolia DC. Prodr. **10:** 95 (1846); Boiss. Fl. Orient. **4:** 214 (1875); Coss. & Kralik, Bull. Soc. Bot. Fr. **4:** 404 (1857). Not *Lithospermum linearifolium* Goldie (1822).

Echioides linearifolium (DC.) Rothm. Fedde Repert. **49:** 56 (1940).

Arnebia flavescens Boiss. Diagn. **11:** 117 (1849), a substitute for *A. linearifolia* DC. Not *Lithospermum flavescens* Mey. ex Steud. (1841).

A compactly branched herb 5–10 cm. tall, arising from a slender dye-stained annual taproot. The plant is known from Egypt and eastward into northern Arabia and southern Palestine. Its cymes, glomerate at anthesis, remain short (1–3 cm. long) and dense even in fruit. The calyx is strongly accrescent; mature lobes lanceolate, 10–17 mm. long, 2–3.5 mm. broad, and coarsely tuberculate and hispid at base. The yellow corolla is subtubular, 10.5–13.5 mm. long, and has a limb of small ascending lobes 2–3 mm. in diameter; tube slender, 9–12 mm. long, usually surpassing the calyx 2–3 mm.; throat glabrous, without gland or appendages; nectary a papery lobulate collar ca. 0.5 mm. high. Anthers borne at summit of corolla-tube, included. Style reaching up to 1–3 mm. below the anthers, short-forked at apex, bearing 2 compressed reniform stigmas. Pollen measuring 43–52 $\times$ 33–37 μ, with sides slightly concave, frequently seeming to be dentate near the middle. Nutlets 2.5–3 mm. long, about 2 mm. broad near the base, rubiginous, sparingly punctate and tuberculate and sometimes rugose, back rounded.

If this be a heterostylic species, the five collections dissected and described all represent the short-styled form of the species. This plant has its closest relative in *L. detonsum* of northern Iran and Transcaucasia.

9. **Lithospermum fimbriatum** (Maxim.), comb. nov.

Arnebia fimbriata Maximovicz, Bull. Acad. St. Petersb. ser. 3, **27:** 507 (1881); Diels in Futterer, Durch Asien **3**^{1}: 19 and 28, t. 3 (1911).

A low perennial with a purple-stained woody root and a pallid indument of stiff straight loosely appressed hairs. The plant is known only from western Outer Mongolia and adjacent Kansu. Leaves all cauline, numerous, acute, mostly oblanceolate and 2–5 mm. broad; those at the base of the stem imperfectly developed. Inflorescence coarsely and loosely glomerate, terminal, bracts narrow and commonly not surpassing the subtended calyx. Corolla pink changing to dark blue when dry, 16–24 mm. long; limb 10–17 mm. broad; lobes ovate, spreading, with conspicuously erose or shallowly lacerate margins; tube 13–17 mm. long, surpassing the calyx 2–8 mm.; throat without appendages or glands; tube-nectary a villulose linear ring (not a collar!). Flowers heterostylic. Stamens borne low in the upper third of the corolla-tube (10–12 mm. above the base) or borne at the summit of the tube and partially exserted. Style reaching to beyond the middle of the corolla-tube or shortly exserted from it; stigmas 2, sessile, obovate, strict, compressed, usually somewhat united dorsally. Pollen in long-styled flowers (fig. 4) measuring 26–31 $\times$ 20–23 μ, evidently constricted at middle. Pollen of short-styled flowers (fig. 4) 35–38 $\times$ 33 μ, short-cylindric with the sides in lateral profile parallel or nearly so. Nutlets dorsi-ventrally compressed, 2.5–3 mm. long and below the middle nearly as broad, 1.5 mm. thick, broadest at base, dull, gray or olivaceous, with scattered coarse tuberculations, attachment large, nearly flat.

10. **Lithospermum Sewerzowi** (Regel), comb. nov.

Arnebia ["Amebia"] *Sewerzowi* Regel, Descr. Pl. Nov. a cl. O. Fedtsch. 57 (1882).

Arnebia obovata Bunge, [Lehmann rel. bot.] Mem. savants étrang. St. Petersb. 7: 407 (1851); Lipsky, Acta Hort. Petrop. 26: 526 (1910). Not *Lithospermum obovatum* Macbr. (1916).

Echioides obovatum (Bunge) Rothm. Fedde Repert. 49: 56 (1940).

Arnebia Olgae Regel, Descr. Pl. Nov. a cl. O. Fedtsch. 57 (1882).

I have seen only two collections possibly referable to this blue-flowered species of southeastern Turkestan. The two differ to a surprising degree in shape of leaves, indument, tip of style, and relative length of calyx-lobes and corolla-tube. One, *von Knorring 128* from Namangan dist., Uzbek S.S.R., has obovate or obovate-oblanceolate obtuse leaves, a hispid-villose indument with the slender hairs arising from thickened bases, long-styled flowers with the corolla-tube twice as long as the calyx, and the style with a forked apex. The other collection, *G. Balabajew s.n.* (July 12, 1915) from Iskanderaul, Serawschen dist, Tadzhik S.S.R., has narrow very elongate acute oblanceolate leaves, an indument of minute retrorse hairs, short-styled flowers with the elongate calyx-lobes as long or even longer than the corolla-tube, and a style not forked at the apex. The collection from Namangan, except as to indument, agrees most closely with the emended description of *Arnebia obovata* given by Lipsky, l.c. The elongate calyx-lobes of Balabajew's collection appear to be aberrant.

The salient features of the species appear to be as follows: — A perennial with a woody root and loosely branched stems 1–3 dm. tall. Cymes terminal and very elongate in age; bracts simulating the calyx-lobes in size and form. Corolla blue, 20–23 mm. long, with a spreading limb 8–10 mm. broad; tube 14–20 mm. long and usually much surpassing the calyx; throat not appendaged, glanduliferous in a narrow band at the summit; tube-nectary well developed, a densely villous collar 0.8–1 mm. high. Stamens affixed either at the middle of the corolla-tube or at its summit. Style extending up to the middle of the tube or shortly exserted, sometimes forked at the summit. The two reniform stigmas are either sessile or terminate the short branches of the style. Pollen of long-styled flowers measures 28–33 × 16–20 μ, and is evidently constricted at the middle. The pollen of short-styled flowers measures 35–41 × 26–30 μ, is subcylindric, in lateral profile with sides straight and parallel or nearly so. Nutlets longer than broad, 2.5–3 mm. long, dull, gray, or olivaceous, tuberculate, and broadest at the base.

11. **Lithospermum Szechenyi** (Kanitz), comb. nov.

Arnebia Szechenyii A. Kanitz, Pl. Exped. Szecheny 42, t. 5 (1891) and Wiss. Ergebn. Reise Szechenyi Ostasien **2:** 719, t. 5 (1895).

Plant suffrutescent, perennial, 15–35 dm. tall, known only from western Kansu. Stems erect or loosely spreading, simple or ascendingly branched, 1.5–2.5 mm. thick. Root woody, not stained with dye. Leaves firm, veinless, oblanceolate to elliptic, mostly 7–15 mm. broad, slightly cinereous, bearing hairs of two distinct types, scattered stout bristles (1–1.5 mm. long) arising from a discoid or bulbous base, and rather abundant minute slender pallid hairs (0.2–0.5 mm. long) which tend to be antrorse on the upper leaf-face and more or less retrorse on the lower face. Lower cauline leaves smaller than the middle and upper cauline ones. Inflorescence terminal, scorpioid with coarse leafy bracts, in age racemose and 3–7 cm. long. Corolla yellow, 15–20 mm. long; limb 7–10 mm. broad, with 5 evanescent black spots; lobes minutely puberulent on upper face; tube 11–15 mm. long, shortly but distinctly surpassing the calyx; throat puberulent and also bearing scattered glands, unappendaged; tube-nectary a well-developed villose collar ca. 0.6 mm. high. Flowers heterostylic. Stamens borne either at the middle of the corolla-tube or at its summit. Style simple, reaching the middle of the corolla-tube or to its summit; stigmas 2, cordate-reniform, sessile, distinct nearly to the base or more or less united along their medio-dorsal line. Pollen of long-styled flower not seen. Pollen of short-styled flowers measuring 39–44 × 23–30 μ, moderately constricted at the middle. Nutlets broadly attached basally, tuberculate, only immature ones seen.

The original description and plate of this species is based on the long-styled plant from "Tschung-pe-shien in valle Si-ning-fu," Kansu. I have had for study a short-styled plant collected near Hsuin Hwa Hsien, Kansu, *Ching 731*. The species is very distinct. Notable among its distinctive features are the large foliaceous bracts in its inflorescence.

12. **Lithospermum guttatum** (Bunge), comb. nov.

Arnebia guttata Bunge, Ind. Sem. Hort. Dorpat. p. vii (1840) and Linnaea **15:** Litteratur Bericht 85 (1841); Ledeb. Fl. Ross. **3:** 139 (1847); Lipsky, Acta Hort. Petrop. **26:** 530 (1910); Krylov, Fl. Siberiae Occ. **8:** 2282 (1937).
Macromeria guttata Farrer, English Rock Garden **1:** 469 (1919).

Arnebia tibetana Kurz, Jour. Asia. Soc. 43[2]: 189 (1874); Clarke, Fl. Brit. Ind. 4: 176 (1883).
Arnebia Thomsoni Clarke, Fl. Brit. Ind. 4: 176 (1883).

Ranging from Kashmir north and northeastward in the mountains of Central Asia to the Mongolian Altai and westernmost Kansu. Plant 1–2.5 dm. tall, flowering the first year but becoming perennial; stems one to several, simple or bearing short ascending floriferous branches, arising from a dye-stained taproot. Leaves thickish, oblanceolate, 3–8 mm. broad, with obtuse or rounded apex; basal leaves well developed but usually disappearing before time of anthesis. Cymes terminal, at first glomerate and 1–2 cm. in diameter, in age elongating and 5–10 cm. long; middle and upper bracts simulating the calyx-lobes in size and form. Corolla orange or yellow, 14–19 mm. long, commonly with 5 black evanescent spots on the limb and occasionally with a purpurescent tube; limb spreading, 8–12 mm. broad; tube 10–15 mm. long, evidently surpassing the calyx; throat without appendages or glands, or at times (especially in short-styled flowers) with a narrow transverse band of glands below each corolla-lobe; tube-nectary a well-developed villose collar. Flowers heterostylic. Stamens borne just above middle of tube or near its summit and partially exserted. Style reaching up to middle of tube or short-exserted, usually distinctly forked with the branches once to several times as long as the stigmas; stigmas 2, reniform, entire or more or less bilobed. Pollen of long-styled flowers (fig. 5) measuring 25–32 $\times$ 13–20 μ, narrowed at the middle. Pollen of long-styled flowers (fig. 5) measuring 33–37 $\times$ 23–26 μ, subcylindric, in lateral profile with sides straight and parallel or slightly concave. Nutlets 2–3 mm. long, dull, gray or olivaceous, more or less tuberculate, broadest at the base; attachment surface large, rough, usually with a quadrate prolongation upward and outward in the recessive angle beneath the base of the ventral keel of the nutlet.

The species is very distinct. Although to be classed as a perennial, its root is not as strong nor apparently as long-lived as the other perennials of this affinity. Among the many collections examined there are frequent individuals which appear to have flowered when less than a year old. Another character suggestive of some relationship with the annual species is the forked style. That type of style prevails among the related annual species, but among the perennial species is consistently developed only in *L. guttatum*. A tendency for the nutlets to be slightly excised ventrally at the base and for the attachment-surface to be upwardly prolonged there, is observable in related perennials, but never to the degree characteristic of *L. guttatum*. Indeed, a well-developed ventral upward extension of the basal attachment is known in only one other species, the annual *L. tetrastigma*.

13. **Lithospermum densiflorum** Ledeb. ex Nordmann, Bull. Acad. St. Petersb. 2: 312 (1837).

Arnebia densiflora Ledeb. Fl. Ross. 3: 140 (1847).
Munbya densiflora (Ledeb.) Boiss. Diag. 11: 116 (1849).

Macrotomia densiflora (Ledeb.) Macbride, Contr. Gray Herb. **48:** 56 (1916); Farrer, English Rock Garden **1:** 469 (1919).
Arnebia cephalotes DC. Prodr. **10:** 96 (1846).
Munbya cephalotes (DC.) Boiss. Diag. **11:** 116 (1849).
Macrotomia cephalotes (DC.) Boiss. Fl. Orient. **4:** 612 (1879); Köhler, Medizinal Pfl. **3:** t. 25 (1898); Ball, Gard. Chron. ser. 3, **98:** 319, f. 126 (1935).
Munbya conglobata Boiss. Diag. **11:** 116 (1849).
? *Arnebia macrothyrsa* Stapf, Wiener Ill. Gart. Zeitung **16:** 128 (1891); Gard. Chron. ser. 3, **9:** 148 and 180 (1891).

A montane plant of Turkey and Greece. The coarse caudex and the strong perennial root are rich in purple dye. Stems 1–3 dm. tall, 3–6 mm. thick at the base, simple below the inflorescence. Basal leaves oblanceolate, 10–15 cm. long. Cauline leaves lanceolate, 4–8 cm. long, lower and middle one about equal in size. Inflorescence globular or corymbose, 6–10 cm. broad, a dense aggregation of coarse, very short-pedunculate cymes arising terminal on the stem and from its uppermost leaf-axils; bracts simulating the calyx-lobes in size and form. Corolla yellow or orange, very large and attractive; limb spreading 20–25 mm. broad; tube 20–37 mm. long, commonly ca. 10 mm. longer than the large calyx, without a nectary but scantily villulose inside just above the base; throat scantily glanduliferous, without appendages. Style forked at apex, with branches 0.5–1 mm. long; stigmas 2, rounded, compressed. Flowers heterostylic. Corolla of long-styled flowers slightly smaller than those with short style; tube 20–27 mm. long and limb ca. 20 mm. broad; anthers borne slightly below mouth of tube with their apices 1–2 and their bases 3.5–4.5 mm. below the mouth; style 22–32 mm. long, exserted 2–5 mm. from the tube; pollen (fig. 2) constricted at middle, 46–50 $\times$ 26–31 μ. Corolla of short-styled flowers with tube 32–37 mm. long and limb 20–25 mm. broad; anthers borne partially exserted in the mouth of the tube with their bases 1–2 mm. below the top of the tube; pollen (fig. 2) constricted at the middle, similar in form to that of the long-styled flower but much larger, measuring 65–75 $\times$ 38–43 μ, in lateral profile frequently appearing serrate at the middle; style 20–23 mm. long, reaching up to beyond the middle of the tube. Nutlets 5–6 mm. long, broadest at base, gray, dull, abundantly and very minutely papillate, coarsely rugose.

This very well marked species is notable for having the largest flowers and the largest pollen-grains in the genus. Its nutlets, floral organization, and pollen type are obviously those of the Arnebia group. Although heterostyly is well developed in the species, being expressed in differences of corolla-size and -form, length of style and pollen size, the anthers differ very little as to the level at which they are borne in the very elongate corolla-tube. In both types of flowers the anthers are high in the tube, in the short-styled only 2–3 mm. higher than in the long-styled flowers. In the former they are partially exserted and in the latter they have their tip only 1–2 mm. below the mouth of the tube.

14. Lithospermum Benthami (Wall.), comb. nov.

Echium Benthami Wall. Numerical List. no. 931 (1829), nomen; G. Don, Gen. Syst. **4**: 333 (1838).

Macrotomia Benthami (Wall.) A. DC. Prodr. **10**: 27 (1846); Clarke, Fl. Brit. India **4**: 177 (1883); Hooker, Bot. Mag. **114**: t. 7003 (1888); Coventry, Wild Flowers Kashmir **1**: t. 37 (1923); Blatter, Beautiful Flowers of Kashmir **2**: t. 45 (1929).

Leptanthe macrostachya Klotzsch, Bot. Reise Prinz. Waldemar. 95, t. 62 (1862).

A coarse perennial of northwestern Himalaya. Its underground parts contain much purple dye. The flowering stems are 1–8 dm. tall and 5–10 mm. thick, and arise from the center of a leaf-cluster. The lower cauline leaves are accordingly larger than the middle and upper ones. Leaves usually 3–5-ribbed from the base. A very distinctive feature of the plant is its elongate slender long-attenuate bracts and calyx-lobes and its elongate cylindrical flower cluster. The inflorescence is a dense cylindrical thyrse 4–7 cm. thick and 5–30 cm. long. The calyx, 13–25 mm. long at anthesis, becomes 25–35 mm. long in fruit. Its very slender flexuous lobes are 0.5–1 mm. broad at the base and very gradually attenuate. Corolla elongate, pink to purple or maroon, 20–25 mm. long, usually shorter than the calyx; throat without glands or appendages; tube-nectary not developed. Flowers heterostyled. Stamens borne either at the middle of the corolla-tube or partially exserted at its summit. The style reaching up to the middle of the tube or nearly to its summit; stigmas 2, rounded, broader than long. Pollen of long-styled flowers strongly constricted at middle, 30–37 $\times$ 16–20 μ. Pollen of short-styled flowers subcylindric, 39 $\times$ 25–26 μ, in lateral profile with sides nearly parallel or somewhat concave. Nutlets 3–4 mm. long, dull, abundantly and very minutely papillate, and also coarsely and irregularly rugose and more or less tuberculate, broadest near middle, the ventral keel continuous over the beaked apex, the attachment scar frequently with 2 distinct dorsal traces.

Previously, Contr. Gray Herb. **73**: 48 (1924), I stated that the corollas of this species were slightly zygomorphic and possessed a ventral longitudinal plication. These observations are entirely false and the result of misinterpretation of the poor and inadequate material then available for study.

No material of *Arnebia speciosa* Aitchison & Hemsl. (1880) from Afghanistan, or *Arnebia inconspicua* Hemsl. & Lace (1891) from Baluchistan, has been available for analysis. These two species are close relatives of *L. Benthami*, but are probably sufficiently distinct to be worthy of recognition.

15. Lithospermum euchromon Royle ex Benth. in Royle, Ill. Bot. Himal. 305 (1836).

Macrotomia euchroma (Royle) Paulsen, Bot. Tidsschr. **27**: 216 (1906) and Studies Veg. Pamir 58, f. 20 (1920); Lipsky, Acta Hort. Petrop. **26**: 505 (1910).

Arnebia euchroma (Royle) Johnston, Contr. Gray Herb. **73**: 49 (1924).
Stenosolenium perenne Schrenk ex Fischer & Meyer, Enum. Pl. Schrenk **1**: 34 (1841).
Arnebia perennis (Schrenk) DC. Prodr. **10**: 95 (1846).
Munbya perennis (Schrenk) Boiss. Diag. **11**: 115 (1849).
Macrotomia perennis (Schrenk) Boiss. Fl. Orient. **4**: 212 (1879).
Macrotomia endochroma Hook. & Thom. ex Henders. & Hume, Lahore to Yarkand 328 (1873); Aitchison, Jour. Linn. Soc. **18**: 81 (1880), nomen; cf. Clarke, Fl. Brit. India **4**: 177 (1883).
Macrotomia onosmoides Regel & Smirn. Acta Hort. Petrop. **2**: 624 (1878).
Macrotomia euchroma var. *subacaulis* Lipsky, Acta Hort. Petrop. **26**: 510 (1910).
Macrotomia ugamensis Popov in Baranov, Jour. Turkest. Branch, Russian Geogr. Soc. **17**: 26, t. 3 (1925).
Arnebia tingens A. DC. Prodr. **10**: 96 (April, 1846).
Lithospermum cyanochroum Boiss. Diag. **7**: 33 (1846).
Munbya cyanochroa Boiss. Diag. **11**: 115 (1849).
Macrotomia cyanochroa Boiss. Fl. Orient. **4**: 212 (1879).
Macrotomia grandis Bornm. Oesterr. Bot. Zeit. **47**: 289 (1897).

A coarse, hirsute, frequently glanduliferous perennial. In typical form it ranges from the northwestern Himalaya northward in the mountains of Central Asia to the Dzungarian Ala-tau. A pungently hirsute form also occurs in the mountains of eastern Iran. This latter may deserve at least varietal recognition. The last five names listed above apply to it. The underground parts of all forms of the species contain an abundance of purple dye. The flowering stems are 1–5 dm. tall and arise from the axils of leaves that formed a sterile basal cluster the previous season. The basal cauline leaves are small and imperfectly developed and much smaller than the middle cauline ones. The terminal inflorescence is congested and tends to be broader than long. The corolla is purplish white to purple or brownish, 16–22 mm. long; limb 8–16 mm. broad, with ascending lobes; throat usually unappendaged and glandless, but, particularly in long-styled flowers, occasionally developing 5 small weakly invaginate swellings; nectary not developed. Flowers heterostyled. Anthers borne either at middle of tube or at its summit. The style reaches up to the middle of the tube or is short-exserted, and is usually forked at the very summit; stigmas 2, compressed, rounded, broader than long. Pollen in long-styled flowers (fig. 3) strongly constricted at middle, 26–30 $\times$ 16–20 μ. In short-styled flowers (fig. 3) pollen somewhat cylindric, in lateral profile the sides nearly parallel or only slightly concave, 33–43 $\times$ 25–28 μ. The gray or dusky nutlets are 3–4 mm. long, irregularly and coarsely tuberculate and more or less rugose, the surface dull, covered with crowded microscopic papillae. The nutlet is broadest near the middle and has a well-developed keel on the venter which extends up and over the beaked apex and continues down the back of the nutlet. The attachment scar is flat and frequently bears 2 ventral traces.

The species has its closest relative in *L. Benthami* and agrees with that species in pollen, fruit, coloration, and general organization of the corolla.

16. **Lithospermum tschimganicum** B. Fedtsch. Bull. Jard. Bot. St. Petersb. **5**: 42 (1905); Lipsky, Acta Hort. Petrop. **26**: 510 (1910).

A very distinct and unusually interesting species of Central Asia, endemic in the mountains east and southeast of Tashkent. It is a perennial with stems 15–60 dm. tall. The numerous evidently veined leaves, 1–5 cm. broad, increase in size upward along the stems, the lowest one being small and imperfectly developed. The cymes, terminal on the main stem and on a few upper branches, are conspicuously bracted, and are small in size, even in fruit being less than 7 cm. long. The nutlets are lance-ovoid, 4–5 mm. long, and white. They are completely smooth or only sparingly punctate. In general appearance and nutlets, and also in pollen, the plant is more suggestive of the large-flowered American species than of any of the other species of the Old World. The corollas, however, particularly in having an unappendaged very sparingly glanduliferous throat, are perhaps more suggestive of the Asiatic "Arnebias" than of American species.

Of the five collections available for study, three have provided corollas for dissection, viz., *von Knorring 180* from Osch dist., Kirghiz S.S.R., *von Minkwitz 752* from Kokand dist., Uzbek S.S.R., and *von Knorring 359* from Namangan dist., Uzbek S.S.R. Though apparently all representing one species and though indistinguishable in all other structures, these three collections show surprising differences inside their corollas. The corollas from Kokand and Namangan districts are 17 mm. long and have a gradually ampliate tube ca. 9 mm. long. The anthers (ca. 1.5 mm. long) are borne on slender filaments 0.2–0.3 mm. long attached 5 mm. above the base of the corolla. The unappendaged throat is sparingly and inconspicuously glanduliferous. The glands occur very sparingly from the throat down to the middle of the corolla-tube, with most of them confined to the principal veins. More occur, locally abundant, just below the attachment of each filament. The collections from Kokand and Namangan agree very closely in all details save only the length of the style. In the former the style is 15–17 mm. long and is shortly exserted from the corolla-tube. In the collection from Namangan, however, it is only 5.5 mm. long and reaches upward in the corolla-tube only to the tip of the anthers.

The dissection of the corolla on the plant from Osch, on the other hand, reveals a very different condition. The corolla is 20 mm. long and is tubular below the middle and gradually ampliate above. The anthers (2 mm. long) are borne on uncinate-cuneate filaments 1.7–1.9 mm. long affixed in the corolla-throat 13.5–14 mm. above the base of the corolla and only 3 mm. below the base of the corolla-lobes. The filaments are most unusual, not only in size but also in form. They are 0.5–0.6 mm. broad at the base, gradually narrowed, curved, very strongly compressed laterally, and provided with an evident excentric vein. There are no glands clustered at their base. Glands, however, do occur scattered in the corolla-throat. The style is 5–6 mm. long. As in the collections from Kokand and Namangan, the 2 stigmas are obcordate in form and divergent from the tip of the style. In all three collections the nectary in the corolla-tube is glabrous and obscurely developed, at most only a vaguely defined tumid annular area just above the corolla-base.

Since the collections from Kokand and Namangan have anthers borne low in the corolla-tube and that from Osch has slightly larger anthers borne high in the tube, heterostyly can be suspected. The flowers in the collections from Kokand and Namangan, however, have low-placed stamens associated with a short, as well as a very long style. Furthermore, the pollen in all the three collections mentioned is similar in size and form and shows no correlation with the differences in style-length or stamen-attachment. In all collections mentioned the grains are ellipsoidal, 20–25 × 16–18 μ, and in lateral profile have rounded or slightly angled sides (fig. 30). They bear their very obscure pores at the middle and are broadest there. Heterostyly, certainly of the strongly developed type characteristic of other congeners, is not present in *L. tschimganicum.* If heterostyly is not present, then the collections must represent another type of floral dimorphism or two distinct species must be represented. I find it impossible to believe that two species with such floral differences could be so all-prevailingly similar in all other structures. I am also aware of the fact that in this genus, among species with elongate corollas, the stamens are always borne above the middle of the corolla-tube when only monomorphic flowers are produced. Stamens borne low in the corolla-tube are found only in long-styled flowers of heterostylic species. It is not unreasonable to believe, therefore, that, though *L. tschimganicum* may not now be heterostylic, it may have been derived from such an ancestor. Though now without correlated differences of pollen and style, it may have retained only the corolla-dimorphism of its heterostylic ancestry. If so, the condition is very unusual, and certainly unique in this genus. The matter should be investigated by someone who can observe the plants in the field, or at least by one who has access to many more specimens than have been available to me.

17. **Lithospermum Tournefortii,** nom. nov.

Lycopsis Echioides L. Sp. Pl. ed. 2, 199 (1762). — Based on *Echioides,* Tourn. Coroll. Inst. 46 (1703) and Buxbaum, Cent. **1:** 1, t. 1 (1728). Not *Lithospermum echioides* Benth. in Royle (1836).

Arnebia echioides (L.) DC. Prodr. **10:** 96 (1846); Bot. Mag. **74:** t. 4409 (1848); Gartenfl. **25:** 259, t. 877 (1876).

Anchusa echioides (L.) M. v. B. Fl. Taur.-Cauc. **1:** 123 (1808).

Macrotomia echioides (L.) Boiss. Fl. Orient. **4:** 211 (1879); Farrer, English Rock Garden **1:** 469 (1930).

Aipyanthus echioides (L.) Stevens, Bull. Soc. Nat. Moscou **26:** 600 (1851).

Arnebia longiflora C. Koch, Linnaea **22:** 640 (1849). Not *Lithospermum longiflorum* Salisb. (1796), nor Spreng. (1825).

A handsome and very distinct species of Armenia and the Caucasus, frequently cultivated as a rock-garden plant. The large yellow corolla becomes 2–3 cm. long and has a tube usually twice as long as the calyx.

The tube is villose inside and the broad limb has an evanescent black spot at the base of each sinus. The throat has neither appendages nor glands and the tube neither nectary nor rudiments of it. The stamens are affixed on the corolla at several superimposed levels, in the long-styled flowers in a zone below the middle of the tube and in the short-styled flowers in a zone high in the throat. In these antheriferous zones there appear to be two stamens that are uppermost, an alternating pair that are lowermost, and a fifth stamen at an intermediate level. Furthermore, very close examination reveals that in both upper and lower pair one member has a slight but still perceptibly lower attachment than its companion. Accordingly, in various degrees, the stamens are all attached at differing levels. The androecium appears to have no plane of symmetry. The style reaches either to the middle of the corolla-tube or to its summit. The two stigmas are broad and terminal and tend to be somewhat united, sometimes to form a single obconic stigmatic mass. The pollen (fig. 8) is globose or very slightly longer than broad. There are 9 obscure pores spaced about its equator. In long-styled flowers the grains measure 30–35 μ in diameter and in the short-styled flowers 40–50 μ. The large nutlets are smooth or only inconspicuously and minutely tuberculate towards the apex. They are brownish, minutely mottled with purple, and not lustrous. The ventral side is sharply angled. The attachment surface is broad, rounded, and basal. The gynobase is very broadly pyramidal.

18. **Lithospermum multiflorum** Torr. in Gray, Proc. Am. Acad. **10**: 51 (1874).

Lithospermum cognatum Greene ex Spengler, Oesterr. Bot. Zeit. **68**: 118, f. 31 (1919).

A species of western United States (Colorado and Utah south to western Texas and Arizona) and adjoining Mexico. Flowers are clearly heterostylic. The corollas have 5 glanduliferous slightly swollen (but not invaginate) areas in the throat and a well-developed basal nectary composed of 10 quadrate villulose lobes. The corolla-tube is glabrous within. In short-styled flowers the stamens are borne in the throat of the corolla and the style reaches up to the middle of the tube. In long-styled flowers the style is nearly exserted and the stamens are borne at the middle of the corolla-tube and the tube above them is glanduliferous. In flowers of both types the filaments are usually somewhat glanduliferous at and just below their base. The pollen (fig. 14) is characteristically ellipsoid and broadest at the equator, but occasionally may become almost cylindric with the sides nearly parallel. The pores are in a single medial row. In long-styled flowers the grains measure 16–20 $\times$ 8–13 μ and in short-styled flowers 25–33 $\times$ 20–28 μ. The two terminal stigmas are somewhat semicircular or flabellate and frequently bilobulate. They tend to be spreading or even slightly reflexed. Commonly they are umbonate at the base just above their attachment to the end of the style. I have had a great number of specimens of this species for study, among them, surprisingly, are very few in the fruiting state.

19. **Lithospermum obovatum** Macbride, Contr. Gray Herb. **48**: 56 (1916).

Lithospermum gentianoides Brand, Fedde Repert. **28**: 15 (1930).

A well-marked species having obvious relations with *L. cobrense*. It is known only from the Sierra Madre Occidentale of northern Mexico (Chihuahua and Durango). The thickish basal leaves are very broad, obovate to elliptic, and form a conspicuous rosette. They are conspicuously veined, with the veins not merely prominent beneath but also strongly sulcate on the upper face. Their indument consists of slender elongate hairs only, not of a mixture of long and short hairs as in *L. cobrense*. The corolla resembles that of *L. cobrense* in form but differs in a number of other respects. The glands in the throat of the corolla tend to form small but evident aggregations below the base of each corolla-lobe. The corolla-tube inside is hairy only in long-styled flowers. In short-styled flowers the tube is glabrous. The stamens in the long-styled flowers are borne in the lower third of the corolla and hence lower proportionately than in *L. cobrense*. The pollen (fig. 16) is ellipsoid and broadest at the equator. It measures 14–18 $\times$ 10–13 μ in long-styled flowers and 25–28 $\times$ 18–23 μ in the short-styled flowers. The nutlets of this species are unknown.

20. **Lithospermum cobrense** Greene, Bot. Gaz. **6**: 157 (1881).

A species known only from Arizona, New Mexico, and western Texas, and in the mountains of northern Mexico, in Chihuahua and Durango. The flowers are strongly heterostylic. The funnelform orange or yellow corollas have the tube hairy inside and possess a well-developed basal nectary composed of 10 crowded quadrate lobes. The throat is unappendaged but evidently glanduliferous. The glands are numerous and generally distributed. They are not aggregated as in *L. obovatum*. In the short-styled flowers the stamens are borne in the throat and the style is very short, usually not half the length of the calyx. In the long-styled flowers the stamens are borne just below the middle of the corolla and the style reaches up into the glanduliferous throat. The two stigmas are terminal, spreading, and semicircular or obovate. The pollen (fig. 15) is ellipsoidal and usually broadest at the equator. In the two types of flowers it differs only in size and in the position of the 7–9 pores. In the long-styled flowers the pores tend to be slightly submedial rather than exactly medial in position. The grains of the long-styled flowers measure 21–25 $\times$ 12–20 μ, and those of the short-styled flowers 26–39 $\times$ 23–31 μ.

21. **Lithospermum tubuliflorum** Greene, Pittonia 1: 155 (1888).

Lithospermum lasiosiphon Johnston, Contr. Gray Herb. **70**: 22 (1924).

A species showing relationship with *L. cobrense* and *L. obovatum*. It is known only from the east base of the Sierra Madre Occidentale in Chihuahua and Durango in northern Mexico. The foliage is thin, light green, and inconspicuously hairy. The basal leaves form a rosette and, like those of *L. obovatum*, have the veins evident on both surfaces. The flowers are strongly heterostylic. The corolla is tubular-funnelform with ascending lobes and most resembles that of *L. multiflorum* in general form. The throat is very sparingly glanduliferous and completely lacking in appendages. The tube is always hairy inside. The nectary is similar to that of *L. cobrense* but is less prominent. The stamens of the long-styled flowers are borne extremely low, in the lower third of the tube. The pollen (fig. 10) in the two types of flower differs in shape as well as size. That of long-styled flowers is broadest and shouldered just below the middle. It measures 26–30 × 16–25 μ. The pollen of short-styled flowers measures 33–40 × 26–32 μ and is ellipsoidal and broadest at the equator. There are apparently 8 pores. The nutlets resemble those of *L. cobrense* but are slightly smaller and perhaps more sharply keeled.

22. **Lithospermum californicum** Gray, Proc. Am. Acad. **10**: 51 (1875).

A species known only from northern California and adjacent Oregon. Although in many ways very suggestive of *L. ruderale*, and especially so in form and organization of corolla and nutlets, *L. californicum* differs in type of inflorescence, pollen, and presence of heterostyly. Distinctive features of the species are its slightly glaucescent herbage and its recurved fruiting calyx. The elongate yellow corolla is gradually ampliate, 10–15 mm. long, and has a limb of loosely ascending lobes 5–10 mm. in diameter. The throat is glanduliferous and sometimes bears very obscure swellings below each of the corolla-lobes, but is otherwise unappendaged. The stamens are borne either slightly above the middle of the glabrous corolla-tube or near its summit. The style reaches up to near the middle of the tube or is nearly exserted from it. The two stigmas are terminal. The pollen on the long-styled flowers (fig. 9) measures 25–28 × 10–18 (–22) μ. It tends to be rather variable in form, sometimes resembling that of the short-styled flower and sometimes being distinctly constricted at the middle. The pollen of the short-styled flowers (fig. 9) measures 33 × 20–25 μ and is nearly ovoid or is ovoid with distinct shoulders. The nectary in the corolla-tube is an obscurely lobed glabrous tumid ring. The smooth white ovoid nutlets, ca. 5 mm. long, are rather pointed and have a strong constriction just above their base.

23. **Lithospermum caroliniense** (Walt.) MacMill. Metasp. Minn. Valley 438 (1892).

Anonymos caroliniense Walter, Fl. Carolina 91 (1788).
Batschia caroliniensis (Walt.) Gmel. Syst. **1**: 315 (1791).
Lithospermum carolinianum Lam. Tab. Encyc. **1**: 397 (1791).
Onosmodium carolinianum (Lam.) A.DC. Prodr. **10**: 70 (1846).
Batschia Gmelini Michx. Fl. Bor. Am. **1**: 130 (1803).
Lithospermum Gmelini (Michx.) Hitchc. Spring Fl. Manhattan 30 (1894).
Anchusa hirta Muhl. Cat. 19 (1813), nomen.
Lithospermum hirtum (Muhl.) Lehm. Asperif. **2**: 304 (1818).
Lithospermum strigosum Raf. New Fl. No. Amer. **4**: 18 (1836).
Lithospermum bejariense A. DC. Prodr. **10**: 79 (1846).
Lithospermum croceum Fernald, Rhodora **37**: 329, t. 376 (1935).

A well-known species, widely distributed in eastern United States. Plant 3–10 dm. tall, arising from a strong dye-stained root, and commonly becoming very dark in drying. Flowers heterostyled. Corolla orange-yellow, 13–25 mm. long, with a funnelform limb nearly as broad. Corolla-tube cylindric, in long-styled flowers 7–8 mm. long, about equalling the calyx; in short-styled flowers 10–12 mm. long, surpassing the calyx by as much as 3–4 mm. The corolla-throat is very obscurely if at all invaginate, its appendages are represented only by 5 arcuate clusters of glands at the summit of the 'ube. Inside the tube is sparingly glanduliferous above the middle but otherwise glabrous. The anthers are borne either above the middle of the tube or just below its summit. The style reaches almost to the middle of the tube or almost to the summit. The 2 stigmas are terminal. The corolla-nectary is 10-lobed and minutely villulose. The pollen (fig. 12) has 7–9 pores, and in the two types of flowers differs in size as well as shape. In long-styled flowers it is elongate, constricted at the middle, and measures 33 × 13–18 μ. In short-styled flowers the pollen is ovoid, with shoulders, and is broadest at one end. It measures 33–39 × 25–33 μ. It may be noted in passing that the floral differences used by Fernald to distinguish *L. croceum* from *L. caroliniense* are those which distinguish the short- and long-styled flowers of the species.

24. **Lithospermum canescens** (Michx.) Lehm. Asperif. 2: 305 (1818).

Batschia canescens Michx. Fl. Bor. Am. 1: 130, t. 14 (1803).
Anchusa canescens Muhl. Cat. 19 (1813).
Anchusa virginiana L. Sp. Pl. 133 (1753). Not *Lithospermum virginianum* L. (1753).
Lithospermum sericeum Lehm. Asperif. 2: 306 (1818).
Batschia sericea (Lehm.) R. & S. Syst. 4: 743 (1819).
Batschia conspicua R. Br. in Richardson, Bot. Append. to Frankl. Jour. 732 (1823).

A native of eastern United States. Stems 1–4 dm. tall, arising from a strong dye-stained root. When young the plant has a very distinctive vesture of slender, appressed, somewhat silky hairs. The flowers are heterostylic. The yellow corolla is 10–18 mm. long and has a funnelform limb 11–15 mm. in diameter. Its tube is cylindrical, 7–8 mm. long, and evidently longer than the small calyx. The throat bears weakly invaginate appendages which are usually gibbose and somewhat velvety as well as glanduliferous, especially on the sides. The tube is glanduliferous above the middle, and most abundantly so in long-styled flowers. Its nectary is 10-lobed and minutely villulose. The anthers are borne either just below the middle of the corolla-tube or near its summit. The style is either very short, 1–2 mm. long and less than a third of the tube-length, or surpasses the stamens and becomes 5–9 mm. long. It is terminated by 2 small stigmas. The pollen (fig. 11) of the long-styled flowers is constricted at the middle and measures 20–25 × 10–13 μ. That of the short-styled flowers (fig. 11) is shouldered-ovoid, broadest at one end, and measures 25–33 × 14–23 μ.

25. **Lithospermum tuberosum** Rugel ex DC. Prodr. 10: 76 (1946).

A species of southeastern United States readily recognized by its rosette of basal leaves and clustered fleshy fusiform roots. The flowers resemble those of *L. officinale* and allies. *Lithospermum tuberosum* probably has its closest relations with those species. The yellow or yellowish corolla is 4.5–6 mm. long and has a tube 3–4 mm. long. The corolla-lobes, 1.5–2 mm. long, are longer than broad and ascending. The throat bears 5 small intruding velvety trapeziform appendages formed by invagination. Below the appendages the throat is sparingly glanduliferous. The calyx is shorter than the corolla-tube or at most equals it in length. The filaments are attached at the middle of the corolla-tube and have no glands at their base. The nectary is a narrow glabrous flange. The style is 2–3 mm. long and bears 2 small terminal stigmas. The pollen (fig. 20) is somewhat ovoid, being broadest towards one end and commonly measuring 20 $\times$ 16 μ. The nutlets are small, 1.5–2.5 mm. long, and may be abundantly punctate.

26. **Lithospermum erythrorhizon** Sieb. & Zucc. Abh. Bayer, Akad. Wiss. 4^3: 149 (1846); Hara, Bot. Mag. Tokyo 51: 50 (1937) and Enum. Spermatoph. Japon. 1: 176 (1948).

Lithospermum officinale β erythrorhizon (Sieb. & Zucc.) Maxim. Bull. Acad. St. Petersb. **17**: 441 (1872).
Lithospermum officinale subsp. *erythrorrhizon* (Sieb. & Zucc.) Hand.-Mazz. Symb. Sin. 7^4: 817 (1936).
Lithospermum murasaki Siebold, Syn. Pl. Oecon. Jap. 32 (1830), nom. subnud.
Lithospermum officinale var. *japonica* Miquel, Ann. Mus. Lugd.-Bat. **2**: 94 (1865).
Lithospermum albiflorum Vaniot, Monde de Plantes ser. 2, **7**: 42 (1905).

This species is a very close relative of *L. officinale* and occurs beyond the eastern limit of the latter in China and northward in Korea and Japan. It differs in having spreading rather than closely appressed hairs on the herbage, a larger, somewhat differently shaped corolla, and a larger, more strongly accrescent calyx. Its root appears to contain larger quantities of purple dye than that of *L. officinale*. The corolla has been illustrated as pure white, and collectors have so reported it. Unlike that of *L. officinale*, the limb of the corolla is spreading and formed of rounded lobes about as broad as long. Its diameter is commonly about equal to the total length (5–9 mm.) of the corolla. The corolla-tube, 3–4 mm. long, is usually equalled or shortly surpassed by the calyx-lobes. The faucal appendages are trapeziform invaginations which are velvety on the summit and glanduliferous on the side. The filaments are affixed at the middle of the tube and are glanduliferous at the base. The nectary is a glabrous flange. The pollen, 13–16 $\times$ 8–10 μ, is constricted at the middle or rarely has near straight and parallel sides. The fruiting calyx is commonly 5–10 mm. long and usually several times longer than the nutlets.

Plants from Afghanistan, Pakistan, and Kashmir agree with those from eastern Asia in having spreading hairs on the stems. In characters of calyx and corolla, however, they agree with typical *L. officinale* and probably deserve to be classed as variants of that species.

27. **Lithospermum officinale** L. Sp. Pl. 132 (1753).

Native in Europe and east to central Asia. In Afghanistan, Kashmir and Pakistan it is replaced by a variety with spreading hairs, and in China, Korea, and Japan by the closely related *L. erythrorhizon.* Over its wide range *L. officinale* remains a reasonably constant species. Its stems are closely strigose and have no spreading hairs. The yellowish or greenish, or sometimes nearly white corollas are 4–6 mm. long. The corolla-limb is at most 4 mm. broad and consists of ascending usually oblong lobes 1–1.5 mm. long. The tube is 2.5–3.5 (or rarely 4) mm. long. The calyx may be shorter than the corolla-tube or slightly longer, but commonly it has about the same length. The corolla-throat bears 5 trapeziform, intruded, distinctly invaginate appendages which are densely velvety on top and glanduliferous, particularly on the sides. Below the level of the faucal appendages glands are scattered. The filaments, attached at the middle of the corolla-tube, are usually glanduliferous at the base. The style is 1–2 mm. long and bears 2 small terminal stigmas. The nectary on the corolla-tube is a glabrous, entire, or obscurely lobed flap. The pollen (fig. 32) is constricted at the middle and measures 13–16 $\times$ 8–10 μ. The nutlets (2.7–3.8 mm. long) are most commonly about 3 mm. in length and more than half as long as the fruiting calyx.

28. **Lithospermum latifolium** Michx. Fl. Bor. Am. 1: 131 (1803).

Lithospermum officinale β latifolium Lehm. Asperif. **2**: 311 (1818).
Cyphorima latifolia (Michx.) Raf. in DC. Prodr. **10**: 76 (1846).
Cyphorima lutea Raf. Cat. 13 (1824).
Lithospermum luteum (Raf.) House, Bull. N. Y. State Mus. **243–4**: 61 (1923).
Lithospermum lutescens Coleman, Cat. Pl. Grand Rapids 29 (1874).

A species of northeastern United States very closely related to the Eurasian *L. officinale.* The pale yellow corolla is 5–7 mm. long and has ascending lobes nearly as broad as long. Its tube is 2.5–3.5 mm. long and is evidently shorter than the slender calyx-lobes. The throat has 5 intruded velvety trapeziform appendages formed by invagination. The inner face of the appendages is glanduliferous and so also is the throat directly below them. The filaments arise at the middle of the corolla-tube and usually bear some glands at their base. The style is very short, usually only 1 mm. or less long, and bears two small terminal stigmas. The nectary is a glabrous flange. The pollen (fig. 25) resembles that of *L. officinale* but is slightly larger and less constricted. It measures 16–20 $\times$ 8–14 μ. The nutlets, 4.5–5 mm. long, are usually much surpassed by the calyx-lobes.

29. **Lithospermum mirabile** Small, Fl. Southeast. United States 999 and 1337 (1903).

Lithospermum longiflorum var. *mirabile* (Small) Brand, Fedde Repert. **28**: 14 (1930).

A very distinct species which is most closely related to *L. incisum* and *L. Parksii.* It is confined to the eastern half of Texas. The plant is a biennial or a short-lived perennial and has a thickened, dye-stained, fusiform taproot. The stems, usually few, bear elongating cymes that produce only conspicuous chasmogamic flowers or first chasmogamic flowers and then later cleistogamic ones. Both types of flowers are fertile. The conspicuous flowers have corollas similar in form, size, and organization to those of *L. incisum,* but differ in their darker coloration and in the entire margin of their lobes. The nutlets are very distinctive and are readily separable not only from those of related species but from those of all other members of the genus. They are brown, dull, abundantly punctate, rough, and distinctly angulate. They have only a weakly defined collar at the base and their attachment-scar is flat. The gynobase is depressed pyramidal or nearly horizontal. The pollen resembles that of *L. incisum* in form and size (33–44 μ), but unlike that species tends to have its pores slightly visible. These pores are 7 or more commonly 8 in number and are equally spaced about the equator.

Meriting publication are some interesting field observations concerning *L. mirabile* contained in a letter addressed to me on Aug. 5, 1937, by Dr. H. B. Parks, then Chief of the Apicultural Research Laboratory, San Antonio, Texas. "This is the plant that sent me on the quest to find out something about this genus. I noted that in travelling through the country in early spring there were two colors of flowers among the Lithospermums seen by the roadside. A casual investigation revealed the fact that the darker yellow one had smooth edges to the corolla, while the light yellow one was toothed or crisped. On investigation I became convinced that the yellow flowered one was *L. mirabile* and now after having raised the plant and produced the seeds I am sure of this determination. *Lithospermum mirabile* does produce a few small cleistogamous flowers which sometimes develop fruits, however the most of its fruits come from perfect flowers. This plant contrary to statements is not restricted to the vicinity of San Antonio. It seems to be restricted to the Eocene plains which stretch across Texas south of a line from Texarkana to Del Rio. The plants are generally found in poor, gravelly or clay soils. They commence to bloom by the latter part of March and will stay in bloom until the first of July. From a distance, with the exception of color in the flowers, there is little to distinguish this plant from *L. incisum*; however, the whole manner of growth, the shape of the leaves, and the shape of the seed show it is a good species. I have collected it from Bexar County on the north to Brooks County on the south and from Medina County west to Anderson County on the east. In many places it is more abundant than *L. incisum,* a thing which I think is due to the difference in soil requirement."

30. **Lithospermum incisum** Lehm. Asperif. **2**: 303 (1818).

Lithospermum angustifolium Michx. Fl. Bor. Am. **1**: 130 (1803), not Forsk (1775).

Lithospermum linearifolium Goldie, Edinb. Phil. Jour. **6**: 322 (1822).

Batschia longiflora Nutt. in Pursh, Fl. Sept. Am. **1**: 132 (1814).
Lithospermum longiflorum (Pursh) Spreng. Syst. **1**: 544 (1825), not Salisb. (1796).
Batschia decumbens Nutt. Gen. **1**: 114 (1818).
Lithospermum decumbens (Nutt.) Torr. Ann. Lyceum N. Y. **2**: 225 (1826), not Vent. (1800).
Lithospermum crypthantiflorum Brand, Fedde Repert. **28**: 13 (1930).
Lithospermum boreale Brand, Fedde Repert. **28**: 13 (1930).

A species widely distributed in the United States, chiefly on the Great Plains and along the Rocky Mountains, and extending into adjacent Canada and Mexico. The plant has been given many names. Only the older and the most recent ones are given above. For additional synonymy see Johnston, Contr. Gray Herb. **70**: 24 (1924).

In the spring the plant produces compact terminal clusters of very conspicuous yellow flowers. The tube of the corolla is 20–35 mm. long, 2–3 mm. thick, and two to three times as long as the calyx. The limb is 8–15 mm. in diameter, and its broad rounded lobes have erose-fimbriate margins. There are five evident faucal appendages. These are invaginate, trapeziform, and moderately glanduliferous. The stamens are always borne high in the corolla-tube, 1–2 mm. below the base of the appendages. The style varies considerably in length, from half as long as the corolla-tube to slightly longer. There is some evidence for believing that the style may change in length between anthesis and the time the corolla is shed. The two stigmas are semicircular or ovate and terminal. The nectary at the base of the corolla-tube is very weakly developed or absent and commonly consists only of five very minute tufts of hairs.

The nutlets are elongate, 2.5–3 mm. long, broadest near the middle and smooth or somewhat punctate. A lineate constriction just above the base gives the nutlet a more or less well defined basal collar. This collar, commonly slightly different from the rest of the nutlet in color and surface, surrounds the concave or excavated basal attachment-scar. The scar is notable not only for its concavity, but also for bearing a subulate appendage, ca. 1 mm. long, resulting from a projection of tissue surrounding the dorsal vascular bundles of the nutlet. The gynobase is distinctly pyramidal, about one and a half times as broad as high. After the fall of the nutlet each of its attachment-surfaces has a central pit, the socket into which the appendage on the nutlet-scar formerly fitted. As a result of a bend in the pedicels, the fruiting calyces are usually nutant or cernuous.

After the appearance of the bunched large conspicuous vernal flowers, the plant becomes much branched and then produces cleistogamic flowers exclusively, and these in very great abundance. The early flowers with conspicuous corollas mature few fruits, but the later flowers with minute (1–3 mm. long) closed corollas are extremely fertile. This fact is readily established by observing the length of the persistent style. Few fruits are to be found associated with the long (10–30 mm.) style of the conspicuous vernal flowers. The pollen (fig. 17) of this species is spherical and bears 7 or 8 obscure pores equally spaced about the equator. In chasmogamic flowers it measures 33–42 μ in diameter. In cleistogamic flowers it is slightly smaller, 27–35 μ, but otherwise indistinguishable.

31. **Lithospermum Parksii**, sp. nov.

Herba perennis 2–3 (–5) dm. alta erecta; caulibus pluribus praesertim supra medium adscendenti-ramosis; foliis costatis sed saepissime enervatis griseis adpresse villoso-hispidulis, maturitate margine saepe evidenter revolutis; foliis inferioribus majoribus oblanceolatis 5–10 cm. longis 5–10 mm. latis obtusis; foliis caulinis mediis linearibus obtusis saepe 2–4 cm. longis 2–4 mm. latis; cymis conspicue bracteatis caules ramulosque terminantibus simplicibus, juventate circinatis, maturitate elongatis racemosis ad 10 cm. longis, saepe floribus chasmogamicis abundantibus gestis et solum senescentibus apicem versus flores cleistogamicos paucos gerentibus vel rare a basi usque ad apicem floribus cleistogamicis donatis; floribus chasmogamicis fertilibus, corolla more *L. incisi* sed margine loborum integerrimo, tubo saepe 15 mm. longo 2–3 mm. crasso, limbo 10–12 mm. diametro, lobis rotundis integerrimis, fauce appendiculis trapaeziformibus glanduliferis instructo, calyce supra medium tubi corollae attingenti, in statu fructifero erecto, lobis calycis linearibus margine revolutis quam nuculis saepe subtriplo longioribus; floribus cleistogamicis fertilibus, corolla 1–3 mm. longa perinconspicua, calyce ei florum chasmogamicorum simili; nuculis elongatis opacis densissime verrucosis et punctatis supra basim aliquantum constrictis, basi tumidis, cicatrice concava.

TEXAS: Edwards County: 25 mi. n.w. of Rocksprings, *Cory 24195* (G); 7.25 mi. n.w. of Rocksprings, *Cory 38768* (G); Little Hackberry Creek, 14.5 mi. s.e. of Rocksprings, *Cory 42962* (G); Pulliam Creek below Blue Hole, *Cory 43779* (G). Kinney County: 23.7 miles north of Brackettville, *Cory 645* (G). Sutton County: Substation no. 14, Pasture E, *Corey 24189* (G). Val Verde County: 6.33 miles south of Loma Alta, *Cory 41685* (G); Devils Lake, ca. 20 miles n.-n.w. of Del Rio, *McVaugh 7725* (TYPE, Gray Herb.). Jeff Davis County: Piedra Pinta, 1851, *Wright*, field no. 110 (G); Brewster Glass Mountains, 1936, *Cory* (G); Gage Ranch, Glass Mts., *Warnock 553* (G); Hess Canyon, Glass Mts., *Warnock 294* (G); Jim Nichol's Ranch, Old Blue Mt., *Warnock 567* (G); Sierra del Norte, ca. 10 mi. s.e. of Alpine, *McVaugh 7856* (G).

Lithospermum Parksii var. **rugulosum**, var. nov.

A varietate genuina differt pilis sparsioribus vestita, radice minus persistente; nuculis subnitidis dense rugosis haud verrucosis.

MEXICO: COAHUILA: near Rancho Encampanada, Sierra Hechiceros, *Stewart 206* (G); Muzquiz, *Marsh 2108* (G); Caracol Mts., southeast of Monclova, *Palmer 897* (G); Soledad, west of Monclova, *Palmer* (G). NUEVO LEON: descent into Alamar, ca. 15 mi. s.w. of Galeana, *Mueller 598* (TYPE, Gray Herb.). TAMAULIPAS: cliffs s.w. of Victoria, *Runyon 726* (US).

A species known only from areas of limestone in southwestern Texas and northeastern Mexico. Obviously a close relative of *L. incisum* and native to an area in which that species occurs also. It is, however, certainly distinct! Among the characters distinguishing it from its relative are the olivaceous rather than gray-green herbage, the loosely appressed hairs of stem and leaves, the entire margins of the corolla-lobes, and the verrucose or rugose nutlets. Unlike *L. incisum* the plant does not become diffusely branched. Its cymes are all elongate and racemose at maturity.

The chasmogamic flowers are usually fertile. They are the flowers first developed in the spring and frequently make up the majority of those developed on the elongating cymes. The last flowers on the cyme, however, are usually cleistogamic. Cymes developed late in the season may bear only cleistogamic flowers. Mature, fully elongate cymes, whether producing open or closed flowers, are similar in size and form. This is very different from the condition in *L. incisum*. The chasmogamic corolla of *L. Parksii* differs from that of *L. incisum* only in its paler yellow color and entire lobes. The appendages, stamens, pollen, and style in the two species are indistinguishable. The nutlets of the two species, though very different in surface features, are rather similar in size, form, and attachment. In *L. incisum* the nutlets are smooth or merely pitted. In *L. Parksii* they are covered with crowded warts or are distinctly rugose. The fruiting calyx is erect and never nutant or cernuous as prevalent in *L. incisum*.

As here defined *L. Parksii* included two recognizable forms, the var. *typicum* of Texas and the var. *rugulosum* of near-by Mexico. Possibly these should be treated as two closely related species. However, until a larger suite of specimens of the Mexican plant becomes available for comparison, and especially until collections showing the fully mature nutlets can be studied, the present disposition of the two plants seems desirable. The Texan plant is much more vigorous and obviously has more numerous, stiffer stems and a stronger and much more persistent root than does the Mexican. All the plants of Texas give the appearance of having grown in sunny exposed places, while those from Mexico seem to have come from partial shade, perhaps from open woodland. The most important difference between the varieties, however, is in the nutlets. The nutlets of the Texan plants are coarsely and densely verrucose. The surface is opaque and covered with very crowded warts which are separated here and there by pits and deep narrow irregular fissures. On the other hand, the nutlets of the Mexican plants are slightly lustrous and are roughened only moderately by crowded irregular ridges.

The species is named for Dr. H. B. Parks, former chief of the Texas Apicultural Research Laboratory, to whom I am indebted for many valuable notes concerning the Texan species of *Lithospermum*, the results of his cultivation and observation of the species over many years. The present plant, which he first called to my attention fifteen years ago, is very fittingly associated with his name.

32. **Lithospermum confine**, sp. nov.

Planta erecta strigosa perennis e radice palari valida erumpens, 2–4 dm. alta; caulibus pluribus erectis praesertim supra medium ramosis foliosis; foliis costatis sed enervatis viridibus utrinque strigosis numerosis obtusis

2–6 cm. longis 1–10 mm. latis, inferioribus oblanceolatis, superioribus lanceolatis vel linearibus, margine anguste revolutis; cymis caules et ramos terminantibus, juventate glomeratis maturitate ad 10 cm. longis racemosis foliosis distantifloris; inflorescentiis a basi fere ad apicem flores chasmogamicos gerentibus solum apice floribus cleistogamicis donatis vel cymis omnino flores cleistogamicos proferentibus; floribus chasmogamicis flavis, tubo 7–10 mm. longo 1–2 mm. crasso calyce subduplo longiori, limbo 5–6 mm. diametro, lobis rotundis margine integris, fauce appendiculis trapeziformibus invaginatis glanduliferis donato, stylo 5–10 mm. longo; floribus cleistogamicis inconspicuis 1–3 mm. longis, stylo 1.5–3 mm. longo; calyce subanthesi 4–5 mm. longo, lobis linearibus statu fructifero saepe ad 10 mm. longis nuculis duplo longioribus; pedicello fructifero 2–10 mm. longo erecto; nuculis laevibus nitidis albis supra basim plus minusve constrictis 3–3.5 mm. longis 2–2.5 mm. crassis.

ARIZONA: Chiricahua Mine, 6500 ft. alt., Oct. 17, 1907, *Blumer 1796* (G); 8 m. north of Metcalf, Greenlee Co., June 5, 1935, *Maguire et al. 11805* (G). TEXAS: Smith Canyon, Guadalupe Mts., Culberson Co., 5500 ft., Sept. 15, 1948, *Warnock 113* (G); (?) Little Hackberry Creek, 14.5 mi. southeast of Rocksprings, Edwards Co., Aug. 9, 1943, *Cory 42961* (G).

MEXICO: Coahuila: Sierra del Pino, mouth of southern canyon, Aug. 26, 1940, *Johnston & Muller 746A* (G). Nuevo Leon: Canyon de los Capulines, above San Enrique, Hacienda San Jose de Raices, Aug. 6, 1935, *Mueller 2378* (type, Gray Herb.) and *2379* (G).

The plants above described agree in gross habit and vegetative characters, in calyx, nutlets and pollen, and in their predominantly cleistogamic flowering. Annotation on the specimens cited gives evidence of my uncertainty and changing opinions concerning their identity. At one time or another they have been questionably identified as *L. obtusifolium*, *L. calycosum*, *L. multiflorum*, *L. cobrense*, and *L. incisum*, and even their possible hybrids, as well. In grouping them in a proposed species I am aware that they are relatively few in number and that they represent a wide and erratic geographic distribution on either side of the United States–Mexican boundary. The specimens come from scattered localities in southeastern Arizona, in western Texas and northeastern Mexico, all areas much visited by botanists. I can only suggest that because the species is prevailingly cleistogamic and accordingly deficient in colorful flowers, it has not attracted the attention of collectors and so is poorly represented in herbaria.

In general appearance *L. confine* closely simulates *L. calycosum*, a Mexican species also developing cleistogamic flowers. It is, however, readily separable from that species by its large spherical pollen, basally constricted nutlets, and chasmogamic corollas with faucal appendages. The same characters also eliminate *L. cobrense* and *L. multiflorum*, as does also the presence of cleistogamy. Cleistogamy is known in *Lithospermum* only in *L. calycosum* and in the group of species containing *L. incisum*, *L. Parksii*, and *L. mirabile*. Our present plant obviously belongs in this latter group.

It has the distinctive pollen of that group, and also similar chasmogamic corollas. Its nutlets, furthermore, are very similar in appearance, size, form, and structure to those of *L. incisum* and, in all except surface markings, to those of *L. Parksii* also. I believe it to be most closely related to *L. incisum*. From that species it differs in its infrequent, much smaller chasmogamic flowers, entire-margined corolla-lobes, erect fruiting pedicels, elongate cymes, and erect, never diffusely branched stems.

33. **Lithospermum afromontanum** H. Weim. Bot. Notiser **1940**: 65, f. 7 (1940).

A very distinct plant of central Africa formerly confused with the very different *L. officinale*. From the latter it is easily distinguished by having very different pollen, a more accrescent calyx, and stamens borne high in the more elongate corolla-tube. The stems are very elongate, 5–10 dm. long, and bear numerous sharply acute lanceolate leaves 4–8 cm. long and 7–30 mm. broad. The yellow corolla has a subcylindric tube 5–7 mm. long, which usually surpasses the calyx by 1–2 mm. The spreading limb is about 8 mm. in diameter. The faucal appendages are well developed gibbose invaginations which are minutely hairy and glanduliferous. The nectary is a thickish collar. The style is 1.5–4 mm. long and terminated by two small stigmas. The pollen is cylindric with rounded ends and straight paralleling sides. It measures 20 by 13 μ.

34. **Lithospermum ruderale** Dougl. ex Lehm. Pug. **2**: 28 (1830).

Lithospermum pilosum Nutt. Jour. Acad. Philad. **7**: 43 (1834).
Batschia pilosa (Nutt.) G. Don, Gen. Syst. **4**: 372 (1838).
Lithospermum Torreyi Nutt. Jour. Acad. Philad. **7**: 44 (1834).
Batschia Torreyi (Nutt.) G. Don, Gen. Syst. **4**: 372 (1838).
Lithospermum ruderale var. *Torreyi* (Nutt.) Macbride, Contr. Gray Herb. **48**: 55 (1916).
Lithospermum laxum Greene, Pittonia **3**: 263 (1898)
Lithospermum lanceolatum Rydb. Mem. N. Y. Bot. Gard. **1**: 333 (1900).
Lithospermum ruderale var. *lanceolatum* (Rydb.) Nelson, Bot. Gaz. **52**: 272 (1911).
Lithospermum ruderale var. *macrospermum* Macbride, Contr. Gray Herb. **48**: 55 (1916).

Widely distributed in northern portions of western United States and adjacent Canada. A distinctive feature of the species is its cylindric thyrsoid inflorescence. Unlike most species of the genus, there is no large dominant cyme terminating the main stems. Indeed, in *L. ruderale* the terminal cyme is usually less developed than the numerous small lateral cymes that arise from the upper leaf-axils. The aggregation of these numerous small cymes is elongate, very leafy and cylindric. The pale yellow corollas have a cylindric tube not much longer than the calyx. The limb has ascending lobes. The throat bears more or less well defined congregations of glands below each corolla-lobe, but has no intruding appendages. Scattered glands are numerous in the tube above the level of the filament-attachments and further down, scanty along the principal veins to near the middle of the tube. The nectary is a somewhat tumid obscurely lobed glabrous ring. The style reaches up to the level of the stamens and is usually shorter than the calyx-lobes. The two stigmas are terminal and juxtaposed. The pollen (fig. 23) is ellipsoidal 25 × 18–20 μ, and in lateral profile has rounded or weakly angulate sides. It is clearly broadest at the equator. The pores are weak or obscure. The nutlets, 4–7 mm. long, are ovoid or globose-ovoid, pointed at the apex, and strongly constricted just above the broad base.

35. **Lithospermum calycosum** (Macbride) Johnston, Contr. Gray Herb. 70: 30 (1924).

Lithospermum strictum var. *calycosum* Macbride, Contr. Gray Herb. **48:** 56 (1916).
Lithospermum obtusifolium Johnston, Contr. Gray Herb. **70:** 27 (1924).
Lithospermum Galeottii Brand, Fedde Repert. **28:** 17 (1930).

A variable species ranging from northeastern Mexico south into the mountains of Guatemala. One of its features is its capacity for developing cleistogamic flowers. Cleistogamy is known in the genus otherwise only in *L. incisum* and its close relatives. The chasmogamic corollas of *L. calycosum* vary widely in size, being largest on vigorous plants and especially in the spring of the year. Late flowers or those on plants in unfavorable habitats tend to be small and frequently cleistogamic. The yellow corollas have a subcylindric tube 5–16 mm. long and 1.5–2.5 mm. thick. When large the tube may be twice the length of the calyx but when small it may scarcely surpass the calyx. The corolla-limb varies from 2 to 7 mm. in diameter. Its lobes are spreading and 1–2 mm. long and are erose or strongly crisped at the margin. The throat lacks invaginate intrusions. It is distinctly glanduliferous with the glands tending to congregate below each of the corolla-lobes. Scattered glands occur down in the tube to about the level of the stamen-attachment. The nectary in the corolla consists of 10 minutely hairy swellings. The style reaches up to the stamens or just beyond them and at times can be almost exserted from the tube. The two stigmas are terminal. The pollen is ellipsoidal and measures 35–41 × 24–33 μ, and commonly much resembles that of *L. Pringlei* and *L. indecorum*. In lateral profile it is evidently broadest at the equator and the sides are rounded or somewhat angulate. The pores may be either prominent or obscure.

The corollas of the cleistogamic flowers are 1–3 mm. long. Such flowers may be produced only at the ends of the cymes late in the growing season, or occasionally may be the only flowers produced by the plant. The type of *L. obtusifolium* appears to represent the latter condition. Since nutlets produced by cleistogamic flowers are associated with styles only 1–3 mm. long and those from chasmogamic flowers with styles up to 16 mm. long, the relative fertility of the two types of flowers is readily ascertainable. The two appear to be equally fertile, but the chasmogamic ones are much more numerous.

Plants from southern Mexico and Guatemala tend to be more robust than the more northern plants and have coarser, more spreading hairs. The name *L. Galeottii* is available for them if they prove worthy of recognition.

36. **Lithospermum Pringlei** Johnston, Contr. Gray Herb. **70**: 22 (1924).

Lithospermum Seleri Johnston, Contr. Gray Herb. **70**: 28 (1924).

A species of central Mexico, probably most closely related to *L. calycosum* and *L. indecorum*. Most of the specimens seen have a weak root which, if not annual, is probably no more than biennial in duration. The yellow corollas have a cylindric tube 5–9 mm. long and 1.5–2 mm. thick, which surpasses the calyx by 1–3 mm. The limb is 3–7 mm. broad. The rounded lobes frequently have a somewhat erose or crispulate margin and hence are suggestive of those of *L. calycosum*. The throat bears 5 definite gibbose invaginations which are densely glanduliferous on the inner side and at times are minutely velvety on the summit. Stiped glands occur only on the faucal appendages and just below them. The nectary in the tube is 5–10-lobed and usually minutely villulose. The style reaches up into the corolla-throat and bears two nearly terminal stigmas, left and right on its truncate or convex sterile tip. The pollen (fig. 21) is ellipsoid, 33–37 $\times$ 25–27 μ, and has prominent pores. The pores seem to be seven in number.

37. **Lithospermum indecorum,** sp. nov.

Herba perennis 1–4 dm. alta; caulibus simplicibus vel laxe ramosis basim versus 1–2.5 mm. crassis hispidulis vel villoso-hispidulis (pilis 0.5–2.5 mm. longis saepe adpressis) et pilulis inconspicuis 0.1–0.3 mm. longis saepe incurvatis obsitis, internodiis saepe 1–3 cm. longis; foliis basalibus tempore florendi delapsis; foliis costatis sed saepissime enervatis, eis infra medium caulis gestis oblanceolatis 1.5–4 cm. longis 4–10 mm. latis, eis supra medium caulis gestis plus minusve oblongis vel lanceolatis 3 cm. longis et 4 mm. latis vel minoribus, supra viridibus vix abundante adpresseque hispidulis (pilis gracilibus 1–4 mm. longis et pilulis 1–2 mm. longis praeditis), subtus pallidioribus sparse adpresse hispidulis vel secus costam et marginem adscendenter hispidulis; floribus inter folia apicem versus caulis et ramulorum dispositis in inflorescentiam distinctam haud collectis; calyce adpresse hispidulo, lobis lanceolatis tubo corollae aequilongis vel eum breviter superantibus maturitate 6–9 mm. longis; corolla flava extus sparse strigosa, limbo 2–3.5 mm. diametro, lobis rotundis 1–1.2 mm. latis, tubo subcylindraceo 4–5.5 mm. longo ad 2 mm. crasso, fauce appendiculis prominulis debiliter invaginatis sparse glanduliferis praedito; antheris 0.8 mm. longis, filamentis 3–3.5 mm. supra basim tubi corollae affixis; nectario tubi annulato tumido lobulato, lobulis villulosis; stylo 2.5–4 mm. longis; stigmatis 2 parvis terminalibus vel paulo subterminalibus saepe compressis et divaricatis; nuculis ovoideis ca. 3.5 mm. longis supra medium subconicis saepe brunnescentibus et sparse punctatis.

MEXICO: NUEVO LEON: Canyon Los Capulines above San Enrique, Hacienda San Jose de Raices, shaded situations on slopes, fl. cream-yellow, *Mueller 2380*

(TYPE, Gray Herb.; Mo, FM). TAMAULIPAS: between Marcella and Hermosa, burned-over area, fl. cream-yellow, *Stanford, Lauber & Taylor 2637* and *2649* (G).

Probably most closely related to *L. Pringlei,* from which it is distinguished by smaller veinless or nearly veinless leaves and smaller corollas that have weak faucal appendages and a tube not surpassing the calyx.

38. **Lithospermum jimulcense,** sp. nov.

Planta perennis indumento griseo vestita; caulibus erectis pluribus 10–15 cm. longis e rhizomate lignoso orientibus supra medium sparse breviter ramosis pilis rectis adpressis pallidis 1–2.5 mm. longis obtectis; foliis numerosissimis, infimis oblanceolatis 5–10 mm. longis 1–2.5 mm. latis tempore florendi delapsis, ceteris (eis parte medionali caulis majoribus) anguste oblongis vel lanceo-oblongis 2–4 mm. latis 1–5 mm. distantibus, apice obtusis, basi abrupte contractis sessilibus, margine anguste revolutis, in facie superiore pilis gracilibus hispidulo-villosis 1–2.5 mm. longis griseo-vestitis, in facie inferiore tomentulosis (pilulis contortis 0.1–0.3 mm. longis) et adpresse hispidulo-villosis; floribus parvis inter foliis minoribus supremis dispositis; calyce 3–4 mm. longo 0.3–1 mm. longe pedicellato, lobis 0.6–1 mm. latis tubo corollae brevissime longioribus; corolla lutea, extus supra medium dense adpresseque villulosa, tubo 3.5–4 mm. longo a basi ca. 1 mm. crasso sursum gradatim ampliato summum ad apicem aliquantum constricto, limbo 3–4 mm. diametro, lobis rotundis 1.5 mm. latis longisque, fauce glandulifero (glandulis dispersis) nullo modo invaginato-appendiculato; antheris 1.3 mm. longis in tertiam partem superiorem tubi positis apice mucronulatis; pollina late ellipsoidea $20 \times 16\ \mu$ a latere viso rotunda poris uniseriatis obscuris donata; filamentis 2.5 mm. supra basim tubi affixis; nectario tubi annulato lobulato, lobis inconspicue minuteque villulosis; stylo 2–4 mm. longo stigmatibus 2 minutis terminalibus donato; nuculis ignotis.

MEXICO: COAHUILA: summit of Mt. Jimulco, 3100 m., thick underbrush with oak, pine and juniper, fl. yellow, June 29, 1941, *Stanford, Retherford & Northcraft 100* (TYPE, Gray Herb.; Mo).

A very distinct species which has a gross habit more suggestive of *Heliotropium* than *Lithospermum.* The short subsimple stems are very numerous and crowded and arise from a very well developed loosely branched caudex growing in rock-crevices or among loose rocks. Among its notable features are its very abundant crowded small elongate leaves and its rather dense grayish indument of appressed slender hairs. The corolla is also noteworthy, being not only unusually small, but also very densely tomentulose-villulose outside. Until the fruit of the plant becomes available for study, the relations of *L. jimulcense* will remain questionable. However, its closest relationship is probably with *L. indecorum.*

39. **Lithospermum oblongifolium** Greenm. Proc. Am. Acad. 32: 300 (1897).

Lithospermum euryphyllum Brand, Fedde Repert. **28**: 16 (1930).

This well-marked species probably has its closest affinities among the large-flowered Mexican species with ellipsoid pollen, and particularly with *L. viride, L. guatemalense, L. strictum,* and *L. Muelleri.* Among its more distinctive features are its well-developed faucal appendages and its cylindric or somewhat ovoid pollen. The plant is confined to the central plateau of Mexico. It is a relatively coarse perennial with stems 3–10 dm. tall. The leaves are large and evidently veined. The greenish yellow corollas have a gradually expanded tube 15–30 mm. long and a small limb of broad rounded lobes 5–10 mm. in diameter. The throat has evident invaginate, emarginate, somewhat trapeziform appendages that are short-hairy and glanduliferous. Inconspicuous, very scattered glands are also present in the throat below the appendages and frequently also on the vein below the filament-attachment. The nectary is an ill-defined slightly swollen glabrous band. The style eventually becomes exserted 3–8 mm. from the throat and bears its two stigmas terminally or subterminally. In some plants the semicircular or transversely oblong stigmas arise from the tip of the style, but in others they are decidedly below and lateral to the obscurely lobed prolonged sterile tip of the style. The pollen, 25–27 $\times$ 16–20 μ, is cylindric with rounded ends or somewhat ovoid. In lateral outline the sides of the grains are usually straight and accordingly may be either slightly convergent or parallel. The pollen is not ellipsoidal or subglobose nor distinctly broadest at the middle, as is that of closely related species. Nevertheless, as in the latter, its pores are medial. They are apparently six in number and are evident only in collapsed grains.

40. **Lithospermum strictum** Lehm. Asperif. 2: 303 (Nov.–Dec. 1818).

Anchusa tuberosa HBK. Nov. Gen. et Sp. **3**: 92 (Sept. 1818). Not *Lithospermum tuberosum* Rugel (1846).

Heliotropium lithospermoides R. & S. Syst. **4**: 737 (1819).

Heliotropium mexicanum Sessé & Moc. Pl. N. Hisp. 20 (1888); Johnston, Jour. Arnold Arb. **30**: 109 (1949).

Lithospermum rosmarinifolium Sessé & Moc. Pl. N. Hisp. 20 (1888), not Boiss. (1879).

Lithospermum angustifolium Sessé & Moc. Fl. Mex. 32 (1893), not Forsk. (1775).

A readily recognizable species of central Mexico. From a slender taproot, which has a conspicuous fusiform swelling just below the surface of the soil, the plant produces one to many slender stems 2–4 dm. tall. The stems bear numerous slender leaves and terminate in elongate scorpioid cymes bearing numerous flowers and many small bracts. The yellow-green corolla is firm in texture, has a slender tube 6–15 mm. long and a slightly zygomorphic limb 3–6 mm. in diameter. The upper surface of the obovate or elliptic ascending lobes is microscopically velvety-puberulent and frequently also coarsely strigose. The slender corolla-tube is very gradually ampliate for most of its length but at the very summit is perceptibly constricted. The throat bears five evident faucal appendages. These are weakly invaginate convexities bearing a prominent arcuate ridge of tissue across their upper end. Like the corolla-tube below them, they are glabrous and lustrous. A cluster of glands is usually present at the base of the corolla-lobes just above each arcuate ridge, but below the ridges glands are very few and inconspicuous. The nectary in the corolla-tube consists of a 10-lobed very narrow flap which is very minutely, scantily, and inconspicuously villulose. The style is variable in length, in some plants reaching only to the middle of the corolla-tube but in others as high as the top of the anthers. The two stigmas are terminal, strictly ascending, and at times appear to be joined at the base. The lustrous, very smooth nutlets are distinctive. They have a very sharp and prominent keel which extends up the venter over the apex and partially down the back of the nutlet-body. Below the middle of the nutlets the dorsum is noticeably flattened or very low-convex. The pollen is globose or globose-ellipsoidal, as long as broad or slightly longer than broad. It measures 33–37 $\times$ 33–35 μ. In lateral outline the sides are rounded or angulate. The grain is clearly broadest at the equator. The pores (apparently 8) are very obscure.

41. Lithospermum **Muelleri** Johnston, Jour. Arnold Arb. 16: 187 (1935).

A very distinct species known only from the mountains of northeastern Mexico. It seems to be most closely related to *L. strictum*. The lower surface of the leaves in *L. Muelleri* bears some appressed hairs along the midrib, but otherwise the surface is glabrous or practically so. This condition is very uncommon in the genus. The elongating scorpioid cymes, as in *L. strictum*, have relatively small bracts and are produced, singly or geminate, terminal on the simple very leafy stems. The greenish yellow corolla has an elongate subcylindric tube 15–20 mm. long which is abruptly constricted at the top and bottom. The small limb, 2–3 mm. broad, is composed of broad, short, rounded ascending lobes. The throat has five small but well-defined faucal appendages. Each consists of a small low-convex area delimited above by an arcuate or somewhat trapeziform intrusion formed partially by an invagination and partially by a thickened ridge of epidermal cells. They are glabrous and somewhat lustrous below the intrusion. On the upper side of the intrusion stipitate glands are numerous. Below the appendages glands are very scattered and tend to be most numerous along the vein just below the filament-attachment. The style eventually becomes exserted from the corolla-tube, commonly by 1–3 mm. The two stigmas are terminal, strict, closely juxtaposed, and frequently more or less confluent. The nectary in the corolla-tube consists of a thin ridge bearing minute tufts of hairs. The pollen (fig. 18), 25–30 μ broad, is globose or very slightly longer than broad. In lateral profile the sides are rounded or somewhat angled. The grain is broadest at the equator. The pores, apparently 8 in number, are very slightly evident or are obscure. The fruit has not been seen.

42. **Lithospermum Hancockianum** Oliver in Hooker Icones 25: t. 2457 (1895); Hand.-Mazz. Naturbilder aus S.W. China 116, t. 2 (1927).

Lithodora Hancockiana (Oliver) Hand.-Mazz. Sym. Sin. **7:** 818 (1936).
Arnebia Hancockiana (Oliver) Johnston, Jour. Arnold Arb. **18:** 21 (1937).
Lithospermum Mairei Lévl. Fedde Repert. **12:** 286 (1913).

A very distinct species of China, known only from limestone ledges in eastern Yunnan. The functional leaves are borne clustered at the ends of the trailing branches of a very loose shrubby caudex and directly above a skirt-like mass of dead reflexed leaves persistent from previous seasons. They are very elongate and are covered with lustrous white silky appressed hairs beneath. The inflorescence, at first glomerate, later becomes somewhat racemose but is always shorter than the leaves in the cluster from which it arises. The salverform corolla is pinkish or bluish to purplish-red, but usually becomes yellowish in drying. The tube, 2–3 mm. thick, is cylindric and 18–25 mm. long. The spreading limb is 14–20 (–"25") mm. broad. The throat bears numerous scattered glands above the level of the filament-attachment. There are no faucal appendages. The anthers are borne either 2–3 mm. below the summit of the tube or at the summit and partially exserted from it. The nectary in the tube is a glabrous flange. The style is exserted 2–5 mm. from the tube. The two stigmas are terminal or subterminal. The pollen (fig. 31) is subglobose (26–33 μ in diameter) to ellipsoidal (26–30 $\times$ 23–26 μ), as long as broad to evidently longer than broad. In lateral profile the sides are rounded or angled. The grains are clearly broadest at the equator. The pores (7, or less commonly 6) may be evident or obscure. The nutlets (only submature seen) are white, smooth, bony, and ovoid.

In its non-yellow corolla devoid of faucal appendages, and in its partially exserted stamens, the plant suggests the Asiatic members of the genus formerly referred to *Arnebia*. It differs, however, in its smooth white nutlets and ellipsoid or globose pollen. The plant is one in which heterostyly might be expected. Evidence of it, however, has not been found in the five collections dissected. All the plants studied have elongate, shortly exserted styles, and stamens borne high in the corolla-tube. To be sure there are slight differences in the level at which the anthers are carried. On some plants the anthers are borne just low enough to be included in the corolla-tube, while in others they are borne just enough higher so that they are half exserted from the tube. Such a small difference in level of stamen-attachment is associated with heterostyly in *L. densiflorum*, but in *L. Hancockianum* there appears to be no correlation between stamen-position and a particular length of style or size of pollen.

43. **Lithospermum guatemalense** Donn. Sm. Bot. Gaz. 27: 436 (1899).

A coarse perennial native in the mountains of northern Guatemala and adjacent Mexico. The yellow corollas have a gradually ampliate tube which is 18–25 mm. long and at least twice the length of the calyx. The rounded lobes are 2–3 mm. long and ascending. The throat bears slightly convex, densely glanduliferous areas below each corolla-lobe. There are no strong invaginations. Glands are scattered over the inner surface of the tube above the level of the filament-attachments. The style becomes eventually exserted, usually as much as 2–3 mm. The two stigmas are terminal. The nectary in the tube consists of 5–10 sparsely villulose very minute swellings. The pollen is ellipsoidal and measures 28 $\times$ 25 μ. In lateral profile it has slightly angled sides and is evidently broadest at the equator. The pores, 7–8 in number, may be either obscure or evident. The nutlets are ovoid, ca. 4 mm. long, and usually grayish or tawny rather than white. They are usually very conspicuously sulcate and punctate adjacent to the ventral keel and generally punctate on the back also.

44. **Lithospermum viride** Greene, Bot. Gaz. **6**: 158 (1881).

Lithospermum Palmeri Wats. Proc. Am. Acad. **18**: 122 (1883).

A species of northeastern Mexico and adjoining United States (Arizona to Texas). Its closest affinities appear to be with *L. Macbridei* of Peru. The tubular corollas are yellowish or greenish and have a relatively small limb of divergent or recurved elliptic to broadly ovate lobes. The tube, 15–35 mm. long, is cylindric with a constriction at the summit. Inside, the throat is devoid of swellings or invaginations, but is abundantly glanduliferous. The nectary is represented by 5–10 very minute, usually villulose swellings. The pollen is subglobose to ellipsoidal and as long or very slightly longer than broad. It measures 16–23 $\times$ 16–22 μ. In lateral outline it is evidently broadest at the equator and its sides are angulate. There are 7 or 8 very obscure pores about the equator. The style is tardily exserted 1–5 mm. from the tube. It bears 2 terminal stigmas. The mature fruiting calyx becomes 10–20 mm. long. Its very narrow and elongate lobes greatly surpass the nutlets.

45. **Lithospermum Macbridei** Johnston, Contr. Gray Herb. **78**: 8 (1927).

This Peruvian plant seems to be most closely related to *L. viride* of Mexico, but is readily distinguished by having crowded, very numerous, much smaller, narrow veinless leaves as well as a neat pallid strigose indument. The greenish yellow corolla has a conspicuous subcylindric tube 10–14 mm. long and a small limb of diverging or recurving lobes. The throat has no intrusions. It is, however, densely glanduliferous with the glands in greatest concentration below each of the corolla-lobes. The nectary is represented by 5–10 minute villulose swellings. The style is eventually exserted 2–5 mm. from the throat and is terminated by 2 stigmas. The pollen is subglobose or nearly spherical, 16–20 μ in diameter. In lateral profile it is as broad as long, broadest at the equator, and with rounded or slightly angulate sides. There are 8 obscure pores on the equator. The mature fruiting calyx is 5–8 mm. long, and at most only twice as long as the nutlets.

46. **Lithospermum discolor** Mart. & Gal. Bull. Acad. Brux. **11**: 337 (1844).

Lithospermum discolor α *candicans* Kuntze Rev. Gen. **2**: 439 (1891).
Lithospermum obtusiflorum Sessé & Moc. Fl. Mex. 32 (1893); Johnston, Jour. Arnold Arb. **30**: 109 (1949).
Lithospermum chersinum Macbride, Contr. Gray Herb. **49**: 22 (1917).
Lithospermum hypoleucum Johnston, Contr. Gray Herb. **70**: 23 (1924).

A plant with erect, subsimple to loosely branched, usually hispid stems 5–15 dm. tall, frequently becoming suffrutescent. It is native to central and western Mexico. The evidently veined, usually lanceolate leaves are pale green above and white from a dense appressed indument beneath. The flowers are strongly heterostylic. The white corolla is 1–2 cm. long and has a limb 8–15 mm broad. The tube, slightly to conspicuously longer than the calyx, has the middle three-fifths of its length appressed villose inside. The throat bears abundant scattered glands but is devoid of appendages. The nectary is a tumid obscurely lobed glabrous ring. The stamens are borne below the middle of the corolla-tube or just below its summit. The style is either a quarter to a third the length of the tube or nearly as long as the tube. The two stigmas are terminal. The elongate pollen (fig. 13) is much constricted at the middle, most strongly so in the long-styled flowers. In the latter it measures 22–28 $\times$ 10–15 μ. In the short-styled flowers it is larger, 33–39 $\times$ 18–20 μ. There are 7–9 pores. The smooth white nutlets are elliptic-ovoid and are rounded and unkeeled ventrally.

47. **Lithospermum matamorense** A. DC. Prodr. **10**: 76 (1846).

Lithospermum prostratum Buckley, Proc. Acad. Philad. **1861**: 462 (1861).

A species known only from northeastern Mexico and adjacent Texas, which is probably most closely related to *L. Berlandieri*. It is an annual, with a juicy taproot and several ascending loosely branched hispidulous stems. The basal leaves are largest. The corolla has a spreading limb 4–6.5 mm. broad. Outside it is very minutely and sparingly strigulose. The tube, 1–1.5 mm. long, is about half the length of the calyx. The throat is provided with trapeziform invaginate appendages which are velvety on top and glanduliferous on the sides. Some glands occur also on the throat below the appendages. The minute anthers are borne on filaments attached at the middle of the corolla-tube. The nectary is a tumid ring, entire or 5–10-lobulate, which is glabrous or very inconspicuously puberulent. The pollen is constricted at the middle and measures 16–20 $\times$ 10–13 μ. The nutlets of the species are distinctive. They are 2.5–3 mm. long, usually brownish and conspicuously punctate. The ventral keel is broad and rounded and continues up over the apex and down onto the dorsum. The back of the nutlet is not only pitted but frequently also somewhat tuberculate or tumulose. As the result of a lineate constriction above its base the nutlet has a more or less well defined basal collar. The attachment-scar is concave. The funicular canal is evident, but the dorsal traces usually evident on the attachment-scar of the nutlets in other species are very vague or absent in *L. matamorense*. The gynobase is obscurely pyramidal, in fact almost plane.

48. **Lithospermum Nelsonii** Greenm. Proc. Am. Acad. **40**: 31 (1904).

A species local to northeastern Mexico. The corolla is large, white, and salverform. The limb is 10–14 mm. broad. The tube is 12–15 mm. long, commonly 2–3 times as long as the calyx, and though abruptly expanding at the very base it is cylindric for most of its length. The throat bears small but evident faucal appendages which are invaginate, trapeziform, and glanduliferous. Glands occur also in the throat below the appendages, and others are present at the base of the filaments. The nectary is a glabrous, obscurely lobed flange. The pollen (fig. 26) is medially constricted and measures 15–23 × 10–13 μ. It is similar in size and appearance to that of *L. matamorense* but larger than that of *L. Berlandieri*. The white smooth nutlets are 2.5–3 m. long, and as in *L. Berlandieri*, are constricted just above the base. The attachment-scar is concave.

49. **Lithospermum Berlandieri**, sp. nov.

Herba perennis 2–5 dm. alta; caulibus pluribus erectis hispidulis (pilulis minutis 0.2–0.3 mm. longis saepe incurvatis et pilis majoribus 0.7--1.2 mm. longis saepe divaricatis praeditis) supra medium sparse adscendenterque ramosis, basim versus 2–3 mm. crassis; foliis basalibus et caulinis inferioribus tempore florendi emarcidis; foliis caulinis numerosis saepissime patentibus oblanceolatis (majoribus 5–7 cm. longis et 10–15 mm. latis) supra medium latioribus deinde deorsum gradatim attenuatis, pilulis 0.2–0.3 mm. longis saepe adpressis et pilis majoribus 0.7–1.2 mm. longis adscendentibus vel adpressis vestitis, apice acutis vel saepissime obtusis, subtus pallidioribus saepe venis lateralibus pauce donatis, supra basibus pallidis discoideis pilorum non rariter ornatis; cymis caules et ramulos terminantibus, maturitate laxe racemosis 5–10 cm. longis bracteis divaricatis oblongis vel lanceolatis ad 3 cm. longis ornatis; corolla alba extus parce strigosa, tubo subcylindraceo 2.5–3.5 mm. longo ca. 2 mm. crasso, limbo ad 6 mm. diametro rotato, lobis rotundatis 2 mm. longis et latis, fauce appendiculis intrusis gibbosis ornato, appendiculis invaginatis apice sparse velutinis latere abundanter glanduliferis; antheris 0.7–0.8 mm. longis in tertiam partem superiorem tubi corollae gestis; filamentis ca. 2 mm. supra basim tubi affixis basi imo sparse glanduliferis; pollina elongata medie constricta 13 × 7–10 μ; nectario tubi corollae glabro 10-lobulato; stylo altitudinem antherarum attingenti 2–2.5 mm. longo e tubo corollae nullo modo exserto; stigmatibus 2 minutis apice emarginato styli positis; nuculis albis laevibus non rariter sparse punctatis ovoideis 3–3.5 mm. longis supra basim laeviter constrictis, cicatrice basali concava; gynobasi latissime pyramidali.

MEXICO: TAMAULIPAS: oak forests on Jaumave road about 13 mi. southwest of Ciudad Victoria, 1000 m. alt., abundant, fl. white, May 13, 1949, *R. McVaugh 10517* (TYPE, Gray Herb.); pié la cuesta de Victoria a Tula, Nov. 1830, *Berlandier s.n.* (G); Jaumave, 1932, *Rozynski 567* (Chicago); mountains south of Victoria, 1000 m., scattered, March 1925, *Runyon 747* (US); foot of mountains near Victoria, 400 m., April 1926, *Runyon 921* (US).

Closely related to *L. Nelsonii*, from which it differs in its very much smaller corollas with proportionately shorter tube and narrower limb. The present species is known only from the mountains southwest of Victoria, Tamaulipas, whereas *L. Nelsonii* is known only from the mountains west and south of Monterrey, Nuevo Leon.

50. **Lithospermum papillosum** Thunberg, Prodr. Pl. Cap. 34 (1794); Thunberg in Schrad. Neues Jour. Bot. 1^3: 44 (1806); Lehm. Asperif. 2: 329 (1818); Wright, Fl. Cap. 4^2: 21 (1904).

? *Lithospermum papillosum β ambiguum* DC. Prodr. **10**: 74 (1846).

A well-marked species endemic to South Africa. It has numerous ascending lanceolate or lance-oblong leaves crowded along erect stems 2–4 dm. tall. In general appearance it much resembles the American *Heliotropium ternatum* Vahl and its close allies. Especially distinctive of *L. papillosum* is the generous development of minute obese hairs on the upper face of the corolla-lobes, giving the latter a granular or somewhat velutinous appearance. The corolla-tube, 2–3 mm. long, may be as long as the calyx or be surpassed by it. The faucal appendages are densely glanduliferous, broad, low-convex invaginations. The throat is usually abundantly glanduliferous below the appendages and sparsely so at the base of the filaments. The nectary is a well-developed thickish collar. The style, 1–2.5 mm. long, bears 2 sessile terminal stigmas, and in some specimens appears to be sparingly and very minutely hairy and glanduliferous below the middle. The pollen is short-cylindric with rounded ends and measures 20–25 × 13–16 μ. No fruit has been seen. The nutlets, however, have been repeatedly described as rugose.

51. **Lithospermum diversifolium** DC. Prodr. **10**: 77 (1846); Wright, Fl. Cap. 4^2: 24 (1904).

A plant of South Africa that somewhat resembles *L. officinale* and was formerly confused with it. From *L. officinale* our plant is readily distinguished by the elevated position of the anthers in the corolla-tube, the broader and petiolate lower cauline leaves, and the very different pollen. The tube of the small white corolla is subcylindric, ca. 2.5 mm. long, and about twice the length of the calyx. The faucal appendages are prominent invaginate gibbosities bearing glands and obese hairs. The throat below the appendages is densely glanduliferous. Other glands are found at the base of the filaments. The nectary is a 5–10-lobulate collar. The style is 1.5–2 mm. long and bears 2 sessile terminal stigmas. The pollen is short-cylindric with rounded ends and measures 20 × 13 μ. The pores distributed about the equator are very obscure.

52. **Lithospermum cinereum** DC. Prodr. **10**: 73 (1846); Wright, Fl. Cap. 4^2: 23 (1904).

Lithospermum inornatum DC. Prodr. **10**: 73 (1846).

A well-marked species from South Africa. Among its notable features are its smooth closely appressed grayish strigose indument, small thickish veinless leaves, very small flowers, and tumulose nutlets. The white corollas are 2.5–3 mm. long. The tube is slightly ampliate, 1.5–2 mm. long, which is shorter than the calyx. The corolla-lobes, 0.5–1 mm. long, are ascending, oblong, and evidently veined. The throat bears 5 slightly invaginate rounded convex areas which are velvety and densely glanduliferous. A few glands are present on the vein directly below the filament-attachment. The nectary is 5–10-lobulate. The style is 1–1.5 mm. long and bears 2 terminal stigmas. The pollen measures 16–18 × 11–14 μ and varies from distinctly ellipsoidal with rounded sides to cylindric-ellipsoidal with nearly straight sides. The pores are borne at the equator and are very obscure. The nutlets, 2.5–3 mm. long, are half or two thirds the length of the fruiting calyx. Dorsally they have a broad low rounded keel, and towards the sides below the middle are pitted and sparingly but distinctly tumulose.

53. **Lithospermum scabrum** Thunberg, Prodr. Pl. Cap. 34 (1794); Thunb. in Schrad. Neues Jour. Bot. 1^3: 44 (1806); Lehm. Asperif. 2: 309 (1818); Wright, Fl. Cap. 4^2: 22 (1904).

Lithospermum hirsutum E. Meyer ex DC. Prodr. **10**: 77 (1846).
Lithospermum affine DC Prodr. **10**: 78 (1846).

A species of South Africa usually readily recognized because of its spreading, short, villose-hispid indument. The white corolla is 8–9 mm. long. Its tube, 5–6 mm. long, is twice as long as the calyx. For most of its length, 4–5 mm., it is cylindric, but towards its summit it becomes ampliate. The corolla-limb becomes 5–6.5 mm. broad. Its ascending lobes are rounded and ca. 2 mm. broad. The throat bears 5 weak gibbosities which are somewhat velvety at the summit and are glanduliferous on the sides. A few glands may also be present at the base of the filaments. The nectary is 10-lobulate. The style reaches at least to the apex of the stamens and may become even slightly exserted from the tube. It has a sterile apex that may be obscurely and weakly prolonged beyond the attachment points of the two stigmas. The pollen, 16–18 × 14 μ, is ellipsoidal. It is broadest at the equator and in lateral profile has rounded sides. The pores are very obscure and borne about the equator or very slightly below it. The small nutlets are ovoid, white, and very smooth.

54. **Lithospermum peruvianum** A. DC. Prodr. 10: 77 (1846).

Lithospermum aequatoriale Brand, Fedde Repert. **28**: 14 (1930).

A plant of northern Peru and southern Ecuador which forms prostrate mats. Stems numerous, very slender, very elongate and hispidulous. The leaves are very numerous and small, 15–25 mm. long. The small flowers are borne along the terminal portion of the elongate leafy stems and not in a sharply defined inflorescence. The small white corolla has a stout tube 1.5–2 mm. long, which barely if at all surpasses the calyx. The limb is 3–4 mm. broad. Its broad rounded lobes nearly equal the length of the corolla-tube. There are 5 circular glanduliferous and minutely hairy areas in the throat. These are convex and only very weakly invaginate. The nectary is villulose. The style is 1–2 mm. long and bears 2 juxtaposed small terminal stigmas. The pollen varies in form from cylindric to ellipsoidal, in lateral profile having the sides more or less parallel or slightly angulate and the body broadest at the equator. It measures 13–20 × 10–14 μ. The pores are usually obscure. The nutlet tends to develop a slightly swollen rim at the base.

55. **Lithospermum calcicola** Robinson, Proc. Am. Acad. 27: 182 (1892).

Lithospermum Conzattii Greenm. Bull. Field Mus., Bot. **2**: 339 (1912).
Lithospermum calcicola var. *Conzattii* (Greenm.) Johnston, Contr. Gray Herb. **70**: 27 (1924).
Lithospermum madrense Brand, Fedde Repert. **28**: 14 (1930).
Lithospermum hoyasense Brand, Fedde Repert. **28**: 15 (1930).

A species of Mexico, ranging from Coahuila and Nuevo Leon south to Oaxaca. The plant has a distinctive indument that aids in its ready recognition. The leaves on both surfaces bear stiff straight appressed hairs 1-1.5 mm. long. These hairs are loosely spaced (commonly 0.5–1 mm. apart) and, especially on the upper surface, arise from well-developed, evident, usually discoid mineralized bases. The corolla and also the style-length are surprisingly variable as to size and proportions, even among plants from a single locality. This variation may be correlated with the season and general vigor of the plant. The tube of the white corollas is subcylindric, 3–7 mm. long, and may equal the calyx in length or surpass it. The limb is 4–7 mm. broad. The throat bears a congregation of glands below the base of each corolla-lobe and also in the tube above the anthers. There are no definite faucal invaginations. The style, 3–11 mm. long, commonly just surpasses the anthers but is not quite exserted from the throat. In some plants, however, it becomes tardily exserted and protrudes as much as 1–4 mm. In other plants it reaches only to the base of the anthers. Furthermore, some very mature plants have nutlets associated with a style only 1 mm. in length. This latter condition suggests that cleistogamy may be present. Though searched for, no cleistogamic flowers have been recognized in the species. The two stigmas are either juxtaposed and terminal or are slightly subterminal and separated by the sterile tissue of the rounded tip of the style. The latter condition seems to prevail in plants from Puebla and Oaxaca. The nectary in the corolla-tube is a glabrous flange. The pollen is ellipsoidal or, more commonly, slightly but perceptibly broader at one end (fig. 19) and hence somewhat ovoid. The pores are weak or obscure and usually borne at a slight distance below the middle of the grain. Between plants, the grains of *L. calcicola* show more variation in size than is usual in the genus. They measure 16–25 × 13–16 μ.

56. **Lithospermum mediale** Johnston, Contr. Gray Herb. 70: 28 (1924).

Lithospermum discolor γ *subviride* Kuntze, Rev. Gen. **2**: 439 (1891).
Lithospermum colombianum Brand, Fedde Repert. **28**: 16 (1930).

This species is known only from Guatemala, Colombia, and Venezuela. The white corolla has a subcylindric tube 5–8 mm. long and 2–2.5 mm. thick, which surpasses the calyx 1–3 mm. The spreading limb is 4–8 mm. broad. The throat has well-developed invaginate gibbose appendages which are somewhat velutinous at the summit and densely glanduliferous on the sides. Glands are also present, not only on and just beneath the faucal appendages, but also along the vein just beneath the attachment of the filaments. The style reaches to the throat of the corolla. The two stigmas are clearly subterminal, being borne below the prolonged bilobed sterile tip of the style. The nectary is more or less lobulate and villulose. The pollen (fig. 22) is ellipsoidal and measures 23–27 × 18–20 μ. The pores are very obscure. In lateral profile the sides are rounded or somewhat angulate. In the South American plants the pollen is clearly broadest at the equator, but not so in all the Guatemalan material. In the latter the grains sometimes become nearly straight-sided. The fruiting calyx in *L. mediale* is usually weakly accrescent. Its lobes are usually only about twice as long as the nutlets.

57. **Lithospermum sordidum** Brand, Fedde Repert. **28**: 15 (1930).

Closely related to *L. distichum*, but distinguishable by its short-lived stout fusiform root and the broad, usually clustered basal leaves, the more or less evidently spreading indument, and the subsimple erect stems. It is known only from eastern Mexico (Nuevo Leon, Hidalgo and Puebla), where it appears to frequent lower altitudes and drier situations than its relative. In technical characters it agrees with *L. distichum*.

58. **Lithospermum distichum** Ortega, Hort. Matr. Dec. **1**: 8 (1797).

Batschia disticha G. Don, Gen. Syst. **4**: 326 (1838).
Myosotis grandiflora HBK. Nov. Gen. et Sp. **3**: 90, t. 199 (1818).
Heliotropium scorpioides Willd. ex Lehm. Nov. Act. Acad. Caes. Leop. Nat. Cur. **9**: 140 (1818), nomen; R. & S. Syst. **4**: 737 (1819), not HBK. (1818).
Myosotis foliosa Lehm. Asperif. **1**: 99 (1818).
Lithospermum spathulatum Mart. & Gal. Bull. Acad. Brux. **11**: 337 (1844).
Lithospermum laevigatum Sessé & Moc. Fl. Mex. 32 (1893); Johnston, Jour. Arnold Arb. **30**: 109 (1949).
Anchusa mexicana Sessé & Moc. Pl. N. Hisp. 21 (1888); Johnston, Jour. Arnold Arb. **30**: 109 (1949).
Lithospermum approximatum Brand, Fedde Repert. **28**: 15 (1930).

A perennial with a strong woody taproot and, usually, a shallowly buried, loosely branched caudex. A plant of the mountains of Mexico and Guatemala. The stems are ascending, usually branched at the base, and commonly only 1–2 dm. long. The herbage bears minute appressed hairs and is smooth in appearance. The white corollas have well-developed gibbose invaginations in the throat. They are evidently puberulent and are glanduliferous on the inner side. Glands are most abundant on the faucal appendages. A few, however, are usually present at the base of the filaments. The nectary is a thickish lobed collar. The two stigmas are subterminal and borne laterally just below the sterile bilobulate tip of the style. The pollen (fig. 24) is cylindric with rounded ends. The pores are equatorial. The grains measure 16–22 × 10–14 μ. The plant is variable in corolla-size and in the relative length of the corolla-tube.

59. **Lithospermum Gayanum** (Wedd.) Johnston, Contr. Gray Herb. **78**: 10 (1927).

Eritrichium Gayanum Weddell, Chor. Andina **2**: 88 (1859).
Lithospermum andinum Krause, Engler's Jahrb. **37**: 636 (1906).
Lithospermum Shepardae Johnston, Contr. Gray Herb. **78**: 10 (1927).

An Andean species ranging at high altitudes from central Peru south into northern Bolivia. It is most closely related to the Mexican *L. distichum*, but differs in its smaller stature and in details of floral structure. The faucal appendages are merely puberulent swellings and are not invaginate. Glands are few in the throat and none is present at the base of the filaments. The pollen is short-cylindric with rounded ends and measures 16–20 × 10–14 μ. The style is terminated by the two stigmas. It does not have the bilobate sterile tip developed by the styles of *L. distichum* and *L. sordidum*.

EXPLANATION OF PLATES

PLATE I

Pollen of heterostylic species of *Lithospermum*. In each pair the larger grain (left) from short-styled flower, the smaller (right) from long-styled flower. The arrow indicates the position of a row of pores. Species all Asiatic.

FIG. 2. *L. densiflorum*. FIG. 3. *L. euchromon*. FIG. 4. *L. fimbriatum*. FIG. 5. *L. guttatum*. FIG. 6. *L Griffithii*. FIG. 7. *L. hispidissimum*.

PLATE II

Pollen of heterostylic species of *Lithospermum*. In each pair the larger grain (left) from short-styled flower, the smaller (right) from long-styled flower. The arrow indicates the position of a row of pores. First species Asiatic, the others American.

FIG. 8. *L. Tournefortii*. FIG. 9. *L. californicum*. FIG. 10. *L. tubuliflorum*. FIG. 11. *L. canescens*. FIG. 12. *L. caroliniense*. FIG. 13. *L. discolor*. FIG. 14. *L. multiflorum*. FIG. 15. *L. cobrense*. FIG. 16. *L. obovatum*.

PLATE III

Pollen of representative non-heterostylic species of *Lithospermum* (American species, figs. 17–26; Eurasian, figs. 27–32). The arrow indicates the position of the row of pores.

FIG. 17. *L. incisum*. FIG. 18. *L. Muelleri*. FIG. 19. *L. calcicola*. FIG. 20. *L. tuberosum*. FIG. 21. *L. Pringlei*. FIG. 22. *L. mediale*. FIG. 23. *L. ruderale*. FIG. 24. *L. distichum*. FIG. 25. *L. latifolium*. FIG. 26. *L. Nelsonii*. FIG. 27. *L. decumbens*. FIG. 28. *L. tetrastigma*. FIG. 29. *L. detonsum*. FIG. 30. *L. tschimganicum*. FIG. 31. *L. Hancockianum*. FIG. 32. *L. officinale*.

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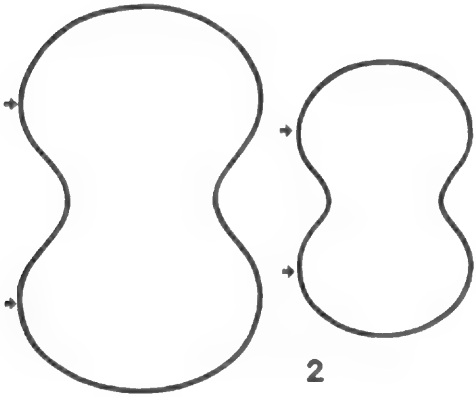

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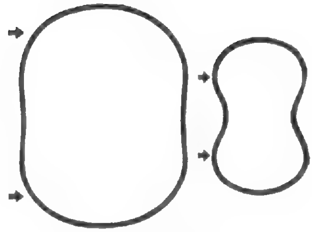

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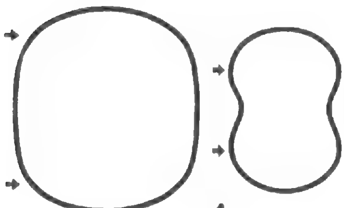

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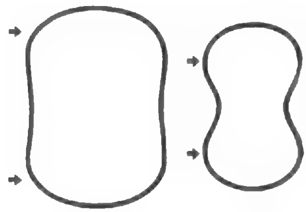

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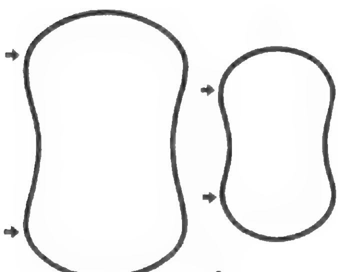

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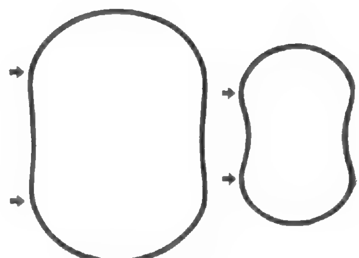

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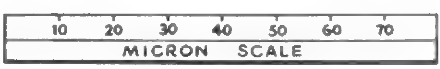
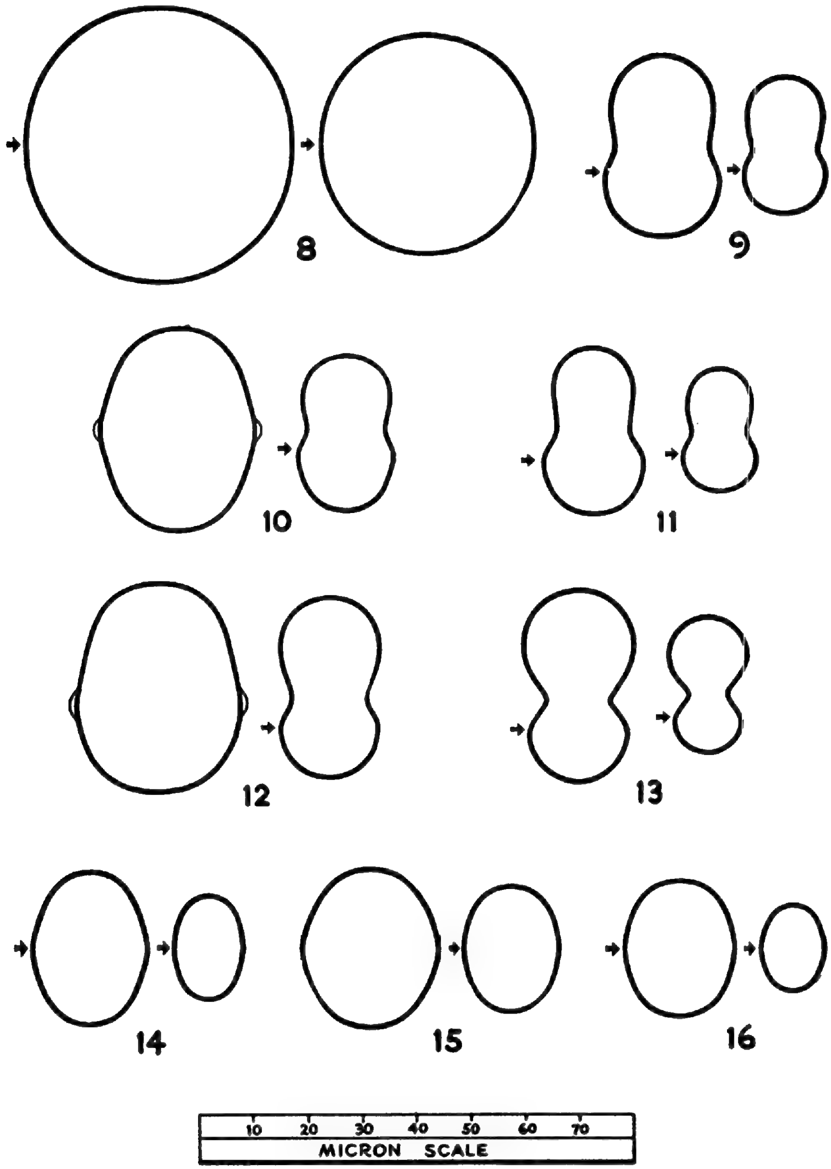
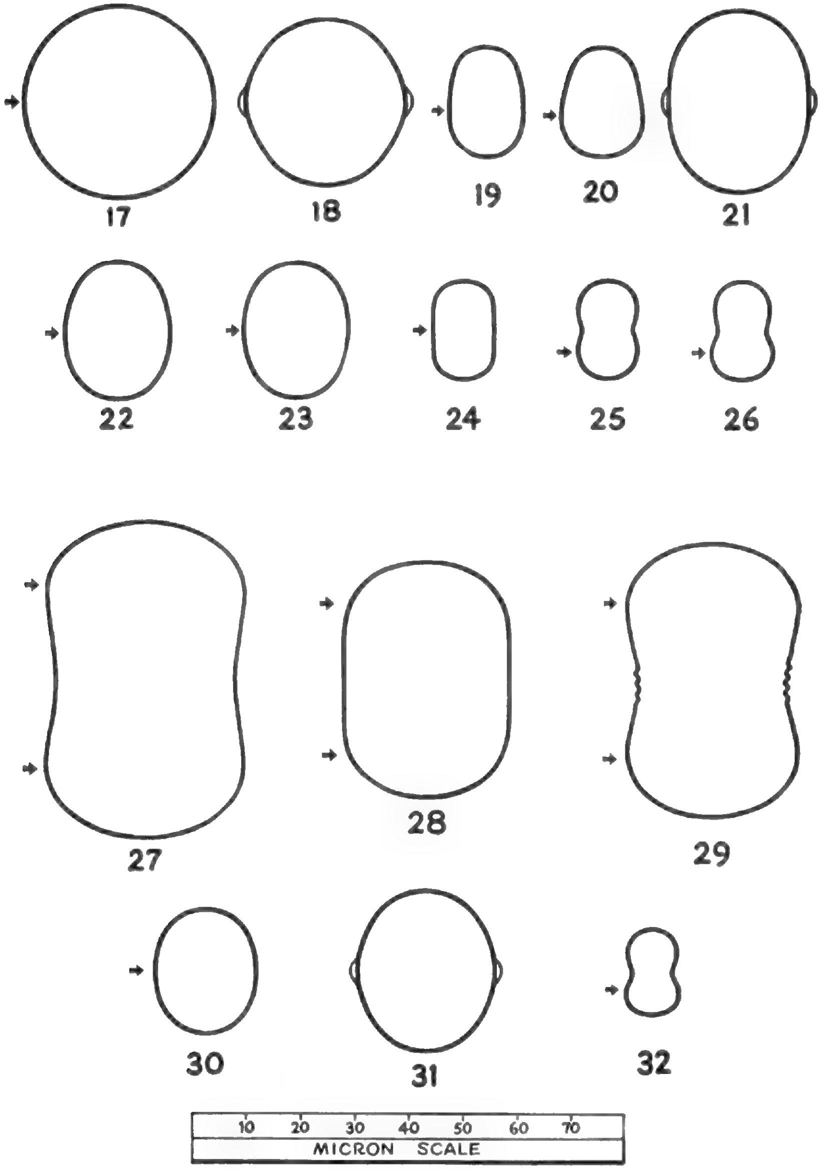


Johnston, Pollen of Lithospermum



JOHNSTON, POLLEN OF LITHOSPERMUM



JOHNSTON, POLLEN OF LITHOSPERMUM

STUDIES OF PACIFIC ISLAND PLANTS, XIII
NOTES ON FIJIAN EUPHORBIACEAE

A. C. SMITH

THE FAMILY EUPHORBIACEAE is taxonomically one of the most difficult groups of plants, and studies of it should preferably be undertaken only by a specialist with many years of experience in the group. However, the necessity of applying names to the material I collected in Fiji in 1947[1] has led me to study the Fijian Euphorbiaceae, the results of this study being incorporated in the present paper. Here are mentioned only the new or unusual species of my collection, except in the genera *Antidesma*, *Macaranga*, and *Acalypha*, which could be clarified only by examination of many Fijian specimens. For these genera keys are here provided and material is cited from the following herbaria: Arnold Arboretum (A); Bernice P. Bishop Museum (Bish); British Museum (BM); Gray Herbarium (GH); Royal Botanic Gardens, Kew (K); New York Botanical Garden (NY); and U. S. National Herbarium (US). The directors and curators of these institutions have kindly permitted the study of their material. Genera are discussed in the order of Pax & Hoffmann's treatment in Nat. Pflanzenfam. ed. 2. **19c** (1931).

ANTIDESMA L.

The interesting genus *Antidesma* was singularly overlooked by the earlier plant-collectors in Fiji; except for an Exploring Expedition specimen (the type of *A. pacificum*) and a single collection made by Horne, the genus was scarcely recorded from Fiji until Gillespie's trip in 1927. However, *Antidesma* is a not infrequent component of the Fijian hill-forest. Gillespie indicated his several collections as a new species, *A. insulare;* examination of these collections and those subsequently gathered demonstrates that this species has been too broadly interpreted in herbaria. In the present treatment I recognize five species, of which three are described as new.

KEY TO THE SPECIES

Calyx of ♀ flowers rotate, deeply 4- or 5-lobed, the lobes lanceolate-deltoid, puberulent on both sides; ovary and fruit asymmetrical, the stigmas lateral; inflorescence-branches and pedicels persistently puberulent; leaf-blades papyraceous, rounded or subcordate at base, faintly pilose on costa or in axils of nerves beneath. .... 1. *A. pacificum.*

Calyx cupuliform, truncate at apex or inconspicuously lobed, usually glabrous except on margin; ovary and fruit symmetrical, the stigmas terminal;

[1] Under the auspices of the Arnold Arboretum of Harvard University and the John Simon Guggenheim Memorial Foundation, with the aid of grants from the Penrose Fund of the American Philosophical Society and the Bache Fund of the National Academy of Sciences.

inflorescence-branches and pedicels usually glabrous at anthesis; leaf-blades chartaceous to subcoriaceous, attenuate to obtuse at base.

Leaf-blades glabrous; ♂ flowers with the rudimentary ovary copiously puberulent at least distally.

Petioles 4–15 mm. long; leaf-blades usually 14–21 × 5–11 cm., narrowly revolute at margin; ♀ calyx at anthesis 1–1.2 mm. long and about 1.7 mm. in diameter, the margin truncate or minutely denticulate, the limb equalled or exceeded by the disk; disk glabrous on both sides, ciliolate at apex; ovary narrowed into a short style 0.2–0.3 mm. long, the stigmas slender, acute, sharply recurved. . . . . 2. *A. insulare.*

Petioles 1–5 mm. long; leaf-blades usually 4–15 × 2–7 cm., plane or slightly recurved at margin; ♀ calyx at anthesis 1.5–1.7 mm. long and usually more than 2 mm. in diameter, the margin 4- or 5-lobed or dentate, the limb exceeding the disk; stigmas stout, obtuse, spreading but not recurved.

Leaf-blades usually 8–15 × 3.5–7 cm., the costa stout (0.7–1.5 mm. broad near base of blade); disk of ♀ flowers pilose on both sides at least distally as well as ciliolate; ovary narrowed into a short style about 0.2 mm. long; rudimentary ovary in ♂ flowers oblong-ovoid, about 0.8 mm. broad. . . . . 3. *A. gillespieanum.*

Leaf-blades 4–9 × 1.8–4 cm., the costa comparatively slender (0.5–0.8 mm. broad near base of blade); disk of ♀ flowers essentially glabrous except at the ciliolate margin; ovary narrowed into an obvious style about 1 mm. long; rudimentary ovary in ♂ flowers oblong-cylindric, 0.3–0.4 mm. broad. . . . . 4. *A. elassophyllum.*

Leaf-blades uniformly and persistently soft-pilose beneath, oblong- or ovate-elliptic, 8–13 cm. long, 4.5–7 cm. broad; young ♂ flowers with the disk very short, much exceeded by the calyx-limb, the rudimentary ovary essentially glabrous. . . . . 5. *A. trichophyllum.*

1. **Antidesma** (§ *Tetrandra*) **pacificum** Muell. Arg. in DC. Prodr. 15 (2): 254. 1866; Seem. Fl. Vit. 217. 1867; Pax & Hoffm. in Pflanzenr. 81 [IV. 147. XV]: 150. 1922.

DISTRIBUTION: Endemic to Fiji, known definitely only from Vanua Levu and Moala, at low elevations. On Moala I noted it as a tree 5 m. high with a deep purple fruit, growing in thickets.

VANUA LEVU: Mathuata or Thakaundrove: Undu Point, *Tothill 44* (K). MOALA: Near Maloku, *Smith 1332* (Bish, GH, K, NY, US). Fiji, without definite locality: *U. S. Expl. Exped.* (TYPE COLL., GH, US), *Horne 491* (GH, K).

This very distinct species is quite different from the remaining Fijian material of the genus; it is more closely related to the Samoan *A. sphaerocarpum* Muell. Arg., which also belongs to § *Tetrandra* but has much larger leaf-blades that are acute at base. *Antidesma sphaerocarpum* has been erroneously reported from Fiji by K. Schumann (in Notizbl. Bot. Gart. Berlin 2: 130. 1898); it appears to be limited to Samoa, where it is now represented by numerous collections.

2. **Antidesma** (§ *Montana*) **insulare** Gillespie in Bishop Mus. Bull. 91: 12. *fig. 13* (excl. *e–g*). 1932.

DISTRIBUTION: Endemic and apparently rare, as here circumscribed represented only by two collections from southeastern Viti Levu at elevations of 150–250 m.

VITI LEVU: Rewa: Southeastern slopes of Mt. Korombamba, *Gillespie 2292* (A, Bish TYPE, GH, K, NY); Naitasiri: Tamavua woods, *Gillespie 2030* (Bish, GH).

In describing this species, Gillespie cited six specimens in addition to the type; he noted that "The montane specimens tend to have smaller leaves, approaching lanceolate in shape, with shorter petioles, than those from lower altitudes, as represented by the type." A reconsideration of the Fijian specimens of *Antidesma,* with the benefit of many more recent collections in addition to those seen by Gillespie, convinces me that more than one species of this alliance must be recognized. As represented by the type and no. *2030, A. insulare* differs from the bulk of the Fijian material of § *Montana* not only in the larger leaves and longer petioles, but also in the narrowly revolute leaf-margin and in characters of the pistillate flower, as mentioned in my key. Although Gillespie referred his species to § *Venosa,* it clearly falls into § *Montana* as outlined by Pax & Hoffmann (in Pflanzenr. **81** [IV. 147. XV]: 112, 158–165. 1922), being of the general relationship of the widespread *A. bunius* (L.) Spreng. Gillespie's habit sketch and drawings of the pistillate flower were apparently made from his type, but the drawings of the staminate flower (*figs. e–g*) were from unspecified material and are probably referable to the species I describe below as *A. gillespianium.* Since in the present treatment *A. insulare* is used in a limited sense, a redescription based on the two cited collections follows:

Small trees, glabrous except for the strigose-puberulent young parts and some floral parts, the branchlets slender, verrucose-lenticellate; stipules oblong, 4–5 mm. long, about 1.5 mm. broad, obtuse at apex, caducous; petioles stout, rugose, shallowly canaliculate, 4–15 mm. long, the leaf-blades chartaceous, drying brownish, oblong-elliptic, (10–) 14–21 cm. long, (4–) 5–11 cm. broad, attenuate at base and decurrent on the petiole, short-acuminate at apex, narrowly revolute at margin, the costa stout, nearly plane above, prominent beneath, the secondary nerves 7–9 per side, erecto-patent, slightly curved, obviously anastomosing 7–15 mm. within the margin, slightly elevated above, sharply elevated beneath, the veinlet-reticulation coarse, immersed above, prominulous or subimmersed beneath; ♀ inflorescences racemose, axillary, 3–6 cm. long at anthesis, short-pedunculate, the rachis angled, the flower-subtending bracts deltoid, acute, 0.5–0.7 mm. long, caducous, the pedicels 1–2 mm. long at anthesis; calyx thin-carnose, cupuliform, 1–1.2 mm. long, about 1.7 mm. in diameter, truncate at apex or very minutely denticulate, the teeth (not more than 0.05 mm. long) obscurely tufted-pilose at apex, the limb exceeded by the projecting ciliae of the disk-margin; disk 0.4–0.5 mm. high, glabrous on both sides, copiously ciliolate at margin with hairs 0.1–0.15 mm. long; ovary ovoid, at anthesis 2.5–3 mm. long and about 2 mm. broad, narrowed into a short style 0.2–0.3 mm. long, the stigmas 4, slender, narrowed to an acute apex, 0.5–0.7 mm. long, sharply recurved; ♂ inflorescences (*Gillespie 2030*) immature; disk sparsely pilose without toward apex and copiously ciliolate, the stamens 4 or 5, the rudimentary ovary oblong-ovoid, copiously tomentellous-puberulent.

3. **Antidesma** (§ *Montana*) **gillespieanum** sp. nov.

Arbor dioica ad 12 m. alta partibus juvenilibus cinereo-strigosis et florum partibus exceptis ubique glabra, ramulis subteretibus cinereis verrucoso-lenticellatis apices versus 1.5–3 mm. diametro; stipulis chartaceis elliptico-lanceolatis, 4–10 mm. longis, 1.5–4 mm. latis, apice obtusis vel rotundatis, caducis; foliis alternatis, petiolis crassis rugosis leviter canaliculatis 1.5–5 mm. longis, laminis chartaceis vel subcoriaceis in sicco fusco-viridibus vel fuscis, elliptico- vel lanceolato-oblongis, (6–) 8–15 cm. longis, (2.5–) 3.5–7 cm. latis, basi obtusis vel acutis et in petiolum breviter decurrentibus, apice acutis vel breviter acuminatis, margine planis vel leviter recurvatis, costa valida supra elevata vel subplana subtus prominente, nervis secundariis utrinsecus 5–9 patentibus paullo curvatis infra marginem 3–10 mm. anastomosantibus supra leviter subtus valde elevatis, rete venularum crasso supra immerso vel paullo prominulo subtus manifeste prominulo; inflorescentiis axillaribus racemosis vel ♂ paniculatis (ramulis 2–5) 2–7 cm. longis multifloris, pedunculo subnullo, rhachi crassa angulata bracteis sub floribus ovato-deltoideis obtusis 0.5–1 mm. longis interdum dorso obscure strigosis caducis; floribus ♀ : pedicellis sub anthesi 1–2 mm. longis; calyce carnoso distaliter tenui cupuliformi, 1.5–1.7 mm. longo, 2.5–2.8 mm. diametro, interdum uno latere fisso, limbo quam disci margine longiore irregulariter 4- vel 5-lobato, lobis late deltoideis 0.3–0.5 mm. longis apice minute ciliolatis; disco carnoso cupuliformi 0.5–0.7 mm. alto utrinque saltem distaliter dense piloso et margine pilis 0.1–0.15 mm. longis copiose ciliolato; ovario ellipsoideo superne in stylum crassum circiter 0.2 mm. longum angustato, stigmatibus 3 vel 4 crassis obtusis 0.5–0.7 mm. longis patentibus; floribus ♂ : pedicellis sub anthesi 1.5–3.2 mm. longis; calycis limbo margine integro vel obscure denticulato quam disco saepe breviore; disco crasse carnoso 0.7–0.9 mm. alto ut ♀ copiose piloso; staminibus 4 vel 5 intra discum insertis, filamentis teretibus sub anthesi 1.5–2.5 mm. longis, antheris transverse ellipsoideis circiter 0.5 $\times$ 0.8–1 mm., connectivo carnoso, loculis discretis; ovarii rudimento oblongo-ovoideo apice truncato 1–1.2 mm. longo circiter 0.8 mm. lato ubique copiose tomentello-puberulo; pedicellis sub fructu 3–5 mm. longis, calyce demum subrotato; drupa rhomboideo-ellipsoidea, 15–20 mm. longa, 10–12 mm. lata, utroque angustata et obtusa, sarcocarpio carnosa in sicco valde contracto, putamine 13–17 mm. longo et 7–9 mm. lato utroque subacuto plerumque subcomplanato, angulis lateralibus acutis, faciebus obtuse vel acute unicostatis et medium versus saepe transverse angulatis.

DISTRIBUTION: Known from scattered localities on Viti Levu, Vanua Levu, and Kandavu, at elevations of 100–1100 m., but probably infrequently below about 400 m. It is a forest tree, often slender, with a height of 4–12 m.; the calyx is greenish or greenish yellow, the filaments are white or pale yellow, the anthers yellow, the stigmas greenish white, and the fruits deep red to purple. Recorded local names are *poroporo* (*Degener 15019*) and *saukalambuthi* (*Smith 1572*). As the diagnostic characters in this group are mostly in the pistillate flowers, I designate my no. *5990*, the only available ♀ specimen, as the type.

VITI LEVU: Mba: Vicinity of Nandarivatu, *Gillespie 4330* (Bish), *Smith 5050* (A, US); Mt. Nanggaranambuluta [Lomalangi], *Gillespie 4071* (Bish, GH); Nandala, near Nandarivatu, *Degener 15019* (A, Bish, K, NY, US); hills east of Nandala Creek, *Smith 6214* (A, US); hills between Nggaliwana and Tumbeindreketi Creeks, east of the sawmill at Navai, alt. 725–800 m., Sept. 12, 1947, *Smith 5990* (A TYPE, US), *5878* (A, US); Nandronga & Navosa: Southern slopes of Nausori Highlands, in drainage of Namosi Creek above Tumbenasolo, *Smith 4719* (A, US); Namosi: Mt. Naitarandamu, *Gillespie 3316* (Bish, GH, US); Mt. Vakarongasiu, *Gillespie 3255* (Bish, GH, K, NY). VANUA LEVU: Mbua: Southern portion of Seatovo Range, *Smith 1572* (Bish, GH, K, NY, US). KANDAVU: Mt. Mbuke Levu, *Smith 230* (Bish, GH, K, NY, US).

Antidesma gillespieanum appears to be the most abundant Fijian representative of the genus in middle-elevation forest, although it was not obtained by collectors earlier than Gillespie. It differs from the lowland *A. insulare* in its shorter-petiolate and smaller leaves with margins that are not revolute, in its larger and distinctly lobed ♀ calyx of which the limb exceeds the disk in length, in its pilose (rather than merely ciliolate) disk, and in its comparatively stout, obtuse and spreading (but not recurved) stigmas. The available ♂ flowers of *A. insulare* are too immature to permit comparison, but perhaps neither they nor the fruits would show diagnostic characters. It may be noted that the ♂ flowers of *A. gillespieanum* differ from the ♀ in having the calyx-limb essentially entire and the thicker disk projecting at anthesis.

4. **Antidesma** (§ *Montana*) **elassophyllum** sp. nov.

Arbor dioica ad 10 m. alta partibus juvenilibus strigoso-puberulis et inflorescentiae partibus exceptis glabra, ramulis subteretibus copiose verrucoso-lenticellatis apices versus 1–2 mm. diametro; stipulis papyraceis oblongo-lanceolatis vel ellipticis, 4–7 mm. longis, 2–3.5 mm. latis, apice rotundatis vel obtusis, utrinque parce strigosis vel glabris, caducis; foliis alternatis, petiolis crassis leviter canaliculatis 1–5 mm. longis mox glabratis, laminis chartaceis vel papyraceis in sicco fusco-viridibus, lanceolatis vel lanceolato-oblongis vel obovato-ellipticis, 4–9 cm. longis, 1.8–4 cm. latis, basi obtusis vel attenuatis et in petiolum decurrentibus, apice obtusis vel obtuse cuspidatis, margine planis, subtus juventute costa interdum inconspicue puberulis mox glabratis, costa gracili supra plana subtus prominente, nervis secundariis utrinsecus 4–7 patentibus vel suberectis leviter curvatis infra marginem 2–5 mm. inconspicue anastomosantibus supra planis vel immersis subtus prominulis, rete venularum crasso utrinque obscuro vel subtus prominulo; inflorescentiis ♂ et ♀ axillaribus racemosis sub anthesi et fructu 2–4.5 cm. longis, comparate paucifloris, pedunculo brevi, rhachi sub anthesi obscure puberula, bracteis sub floribus deltoideis subacutis 0.3–1 mm. longis dorso strigosis caducis; pedicellis sub anthesi

1.2–2 mm. sub fructu ad 3 mm. longis glabris; floribus ♀ : calyce carnoso distaliter submembranaceo cupuliformi, 1.5–1.7 mm. longo, 1.8–2.2 mm. diametro, limbo quam disci margine valde longiore 4- vel 5-dentato, dentibus latis acutis 0.2–0.3 mm. longis apice obscure ciliolatis; disco subcarnoso cupuliformi 0.4–0.5 mm. alto extus glabro intus parce piloso margine pilis 0.2–0.3 mm. longis copioso ciliolato; ovario ellipsoideo superne in stylum crassum manifestum circiter 1 mm. longum angustato, stigmatibus 3 vel 4 circiter 0.8 mm. longis crassis obtusis patentibus; floribus ♂ : calycis limbo margine truncato vel irregulariter et minute dentato quam disco interdum paullo breviore; disco crasse carnoso 0.5–0.8 mm. alto utrinque parce puberulo et margine incrassato puberulo-ciliolato; staminibus 4 vel 5 intra discum insertis, filamentis sub anthesi 1.2–1.5 mm. longis, antheris deltoideis 0.5–0.6 mm. latis, connectivo carnoso, loculis discretis; ovarii rudimento oblongo-cylindrico 0.8–1.2 mm. longo 0.3–0.4 mm. lato, apice truncato, superne copiose puberulo; drupa ei *A. gillespieani* simili saepe paullo minore, 14–16 mm. longa, 9–12 mm. lata, putamine 10–15 × 7–9 mm.

DISTRIBUTION: Known only from Viti Levu and Vanua Levu, where it occurs at elevations of 500–1120 m., characteristically in the mossy forest or dense crest thickets of high or exposed ridges. It is a shrub or small tree 3–10 m. high; the calyx and filaments are white and the fruits red to purplish. Recorded local names are *molau* (*Smith 557*) and *natha* (*Smith 656*). As the type I designate my no. *656*, from Vanua Levu, the only available specimen with pistillate flowers.

VITI LEVU: Mba: Mt. Evans Range, *Greenwood 951* (A, US), *1073* (A, US), *1263* (US); vicinity of Nandarivatu, *Tothill 376* (K), *Parks 20538* (Bish); near summit of Mt. Nanggaranambuluta [Lomalangi], *Gillespie 3784* (A, Bish); hills east of Nandala Creek, south of Nandarivatu, *Smith 5941* (A, US). VANUA LEVU: Mathuata: Summit ridge of Mt. Numbuiloa, east of Lambasa, *Smith 6465* (A, US); Thakaundrove-Mathuata boundary: Crest of Korotini Range, between Navitho Pass and Mt. Ndelaikoro, *Smith 557* (Bish, GH, K, NY, US); Thakaundrove: Mt. Mbatini, crest of range, alt. 700–1030 m., Nov. 28, 1933, *Smith 656* (Bish, GH, K, NY TYPE, US). Fiji, without definite locality: *Gillespie 4051* (A, Bish).

Antidesma elassophyllum differs from *A. insulare* in foliage to an even greater degree than does the above-described *A. gillespieanum*, to which it is evidently most closely related. From *A. gillespieanum* the new species differs in its smaller leaves; this character is not entirely dependable but is supplemented by the difference in the robustness of the costa as expressed in my key. *Antidesma elassophyllum* is further distinguished by having the disk of its ♀ flowers essentially glabrous except at the ciliolate margin and by its obvious style; in the ♂ flowers the rudimentary ovary is comparatively slender. The available specimens of this entire complex are not sufficiently adequate to indicate whether floral differences are entirely satisfactory, but those differences observed are correlated with the more obvious foliage characters, so that discontinuities in the Fijian population of § *Montana* are clearly indicated.

5. **Antidesma** (§ *Montana*) **trichophyllum** sp. nov.

Arbor dioica ad 8 m. alta, partibus juvenilibus pilis stramineis 0.2–0.3 mm. longis copiose hispidulo-puberulis mox glabratis, ramulis subteretibus cinereis apices versus 2–3 mm. diametro puberulis demum glabratis; stipulis papyraceis lineari-lanceolatis, 5–8 mm. longis, 1–2 mm. latis, apice acutis, utrinque parce puberulis mox glabratis; foliis alternatis, petiolis crassis rugosis semiteretibus 5–8 mm. longis ut ramulis puberulis glabratisque, laminis chartaceis vel subcoriaceis in sicco fusco-viridibus, oblongo- vel ovato-ellipticis, 8–13 cm. longis, 4.5–7 cm. latis, basi obtusis vel subacutis et in petiolum breviter decurrentibus, apice acutis vel breviter acuminatis, margine planis, supra costa saepe puberula excepta glabris, subtus pilis patentibus 0.3–0.5 mm. longis uniformiter et persistenter molli-pilosis, costa valida supra subplana subtus prominente, nervis secundariis utrinsecus 5–8 erecto-patentibus subcurvatis infra marginem 8–12 mm. anastomosantibus supra subplanis subtus valde elevatis, rete venularum crasso utrinque immerso vel prominulo; inflorescentiis ♂ immaturis solis visis axillaribus vel infra folia enatis, racemosis vel basim versus 2- vel 3-ramosis, 2–4 cm. longis multifloris, pedunculo brevi, rhachi striata glabra, bracteis sub floribus papyraceis deltoideis acutis 0.6–0.8 mm. longis dorso parce strigosis caducis; pedicellis glabris ante anthesin ad 1 mm. longis; floribus eis *A. gillespieani* subsimilibus; calycis limbo margine obscure dentato ciliolato, disco in alabastro circiter 0.3 mm. alto quam calycis limbo multo breviore, extus subglabro, intus parce piloso, margine ciliis, 0.2–0.3 mm. longis ornato; staminibus 5 intra discum insertis, filamentis glabris, antheris circiter 0.5 $\times$ 0.8 mm.; ovarii rudimento oblongo-ovoideo circiter 0.8 $\times$ 0.7 mm. apice truncato ubique glabro vel apice obscure puberulo.

VITI LEVU: Nandronga & Navosa: Northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, alt. 725–825 m., Aug. 7, 1947, *Smith 5573* (A TYPE, US) (*molatha*; slender tree 8 m. high, in dense forest; flower-buds yellowish).

Although the new species is described from a single collection bearing immature staminate inflorescences, it differs markedly from the other Fijian representatives of the genus in having its leaf-blades uniformly and persistently soft-pilose beneath. No intermediate states between this pubescent form and the usual glabrous-leaved type have been observed. Further collections are needed to indicate whether the ♀ flower will provide any dependable characters and whether the very short disk and the essentially glabrous rudimentary ovary of the ♂ flower are consequential.

GLOCHIDION J. R. & G. Forst.

Glochidion euryoides sp. nov.

Arbor monoica gracilis ad 4 m. alta multiramosa ubique glabra, ramulis cinereis teretibus apices versus subflexuosis, internodiis distalibus 3–7 mm. longis, foliis alternatis congestis, petiolis rugulosis 2–4 mm. longis fere ad basim anguste alatis, laminis chartaceis vel subcoriaceis in sicco fusco-viridibus oblongo-ellipticis, 2–3 cm. longis, 1–1.7 cm. latis, basi obtusis et in petiolum subito decurrentibus, apice rotundatis et inconspicue glanduloso-mucronulatis, margine integris incrassatis, costa supra subplana subtus valde elevata, nervis secundariis utrinsecus 6–9 patentibus inconspicue anastomosantibus supra planis subtus prominulis, rete venularum immerso vel subtus obscure prominulo; inflorescentiis axillaribus congestis glomeratis, bracteis basalibus 2 papyraceis deltoideis acutis 1–1.3 mm. longis, bracteolis sub floribus pluribus bracteis similibus sed 0.5–0.8 mm. longis; floribus ♂ in inflorescentia paucis, pedicellis gracilibus 1–3 mm. longis; perianthio carnoso, tubo breviter obconico, segmentis 6 late imbricatis oblongis apice obtusis margine scariosis, 3 exterioribus 1.3–1.6 mm. longis et 0.8–1.2 mm. latis, 3 interioribus paullo minoribus; columna staminali ellipsoidea circiter 1 mm. longa, antheris 3 loculis circiter 0.7 mm. longis connatis, connectivis in apices carnosos deltoideos 0.2–0.3 mm. longos liberos productis; floribus ♀ in inflorescentia (1–) 3–6 sessilibus vel pedicello haud ad 0.5 mm. longo; perianthio ♂ simili sed segmentis 6 subaequalibus 1.6–2 mm. longis et 1–1.3 mm. latis; ovario depresso-turbinato sub anthesi 0.8–1 mm. diametro, loculis 6, ovulis in quoque loculo 2 collateralibus, columna stylari carnosa 1.5–2 mm. longa (post anthesin elongata), stylis 6 apices versus liberis et ventro sulcatis apice emarginatis.

VITI LEVU: Mba: Upper slopes of Mt. Koromba [Pickering Peak], alt. 800–1075 m., June 3, 1947, *Smith 4659* (A TYPE, US) (slender tree 4 m. high, in forest on ridges and spurs; perianth white).

The very distinct new species here described is not closely related to any species of our region, being characterized by its strictly glabrous habit, its very small and congested leaves, its sessile pistillate flowers with 6 comparatively large and subequal perianth-segments, its 6-loculate ovary, and its thick stylar column with distally free styles. It is probably to be sought in § *Hemiglochidion* (cf. Pax & Hoffmann in Nat. Pflanzenfam. ed. 2. **19c**: 56–58. 1931), in some respects suggesting *G. vitiense* (Muell. Arg.) Gillespie. That species, however, has comparatively well spaced and large leaves and pedicellate ♀ flowers, of which the perianth-segments are much smaller.

BURAEAVIA Baill.

Buraeavia horneana sp. nov.

Arbor dioica ad 10 m. alta, partibus juvenilibus pilis aureis 0.2–0.3 mm. longis strigosis, alioqui inflorescentiis exceptis glabra, ramulis gracilibus subteretibus rugulosis cinereis; foliis oppositis, petiolis rugulosis leviter canaliculatis 5–10 mm. longis, laminis chartaceis vel subcoriaceis in sicco subviridibus vel fuscis, elliptico- vel obovato-rhomboideis, (3–) 5–8 cm. longis, (1.5–) 2.5–4.5 cm. latis, basi acutis vel attenuatis et in petiolum decurrentibus, apice obtusis vel rotundatis, margine integris et leviter incrassatis, costa supra leviter elevata vel plana subtus prominente, nervis lateralibus utrinsecus 4–6 adscendentibus anastomosantibus utrinque prominulis, rete venularum subimmerso; inflorescentiis ♂ axillaribus vel infra folia ortis plerumque 2 vel 3 superpositis compacte cymosis plurifloris ante anthesin ad 7 mm. longis, pedunculo brevi cupulam bracteis oppositis compositam apice gerente, bracteis subcoriaceis deltoideis subacutis 1–2 mm. longis ut pedunculo fulvo-strigosis, ramulis 3–5 parce strigosis radiatis, bracteolis oppositis 0.5–1 mm. longis, pedicellis teretibus 1–1.3 mm. longis subglabris; sepalis 4 membranaceis suborbicularibus, 2 exterioribus circiter 1.5 mm. diametro extus parce strigosis, 2 interioribus minoribus glabris; staminibus 7–9, filamentis haud 0.3 mm. longis, antheris subgloboso-oblongis circiter 0.5 mm. diametro, disco pulvinato minuto obscuro 4-gono; floribus ♀ in axillis foliorum vel e nodis defoliatis 2–4 aggregatis, pedunculo ruguloso 1–2 mm. longo apice inconspicue bibracteato, pedicellis paullo post anthesin circiter 3 mm. longis; sepalis papyraceis glabris, 2 exterioribus ovatis obtusis circiter 1 mm. longis latisque, 2 interioribus subreniformibus circiter 1 × 1.7 mm. margine irregulariter spinuloso-denticulatis; disco subcarnoso cupuliformi circiter 0.7 mm. alto inconspicue 4-lobato margine conspicue ciliolato ovarii basim cincto; ovario ellipsoideo glabro, stigmate sessili discoideo-pulvinato circiter 1.5 mm. diametro 3-lobato, lobis leviter sulcatis, loculis 3, ovulis 2 apice carunculae dependentis carnosae collateralibus; pedicellis sub fructu 4–7 mm. longis, calyce persistentibus; fructibus maturitate 7–8 mm. diametro, exocarpio in sicco tenui subcoriaceo ruguloso ab endocarpio in valvas 3 solubili, endocarpio circiter 0.5 mm. crasso in coccos 2-valves mox dissiliente, columella apice dilatata persistente; seminibus plerumque 2 in coccis descendentibus ellipsoideis circiter 5 mm. longis et 3 mm. latis, arillo aurantiaco irregulariter laciniato, testa in sicco rubro-castanea.

VANUA LEVU: Mathuata: Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, in patches of forest in open rolling country, alt. 100–200 m., *Smith 6669* (A, US) (tree 6 m. high; fruit dull red), *6872* (A TYPE, US) (Dec. 6, 1947; tree 10 m. high; young inflorescences yellowish green); Mathuata or Thakaundrove: Between Waiwai and Lomaloma, alt. about 600 m., *Horne 600* (GH, K).

The occurrence of a species of *Buraeavia* in Fiji is of particular interest, as otherwise the genus is known only from the two New Caledonian species originally assigned to it by Baillon (in Adansonia 11: 84. 1873). The existence of the Fijian species was intimated by Bentham & Hooker (Gen. Pl. 3: 280. 1880), who briefly discussed the Horne specimen cited above. Of the three known collections of the new species, the type bears staminate inflorescences, *Horne 600* has pistillate flowers past anthesis and a few fruits, and my no. *6669* bears mature fruits. In thus extending the range of another "New Caledonian" genus, one may note in passing that *Buraeavia*, like several other genera common to New Caledonia and Fiji, is known from Vanua Levu but not from Viti Levu (cf. my remarks in Sci. Monthly 73: 12. 1951).

The Fijian species is allied to *B. carunculata* Baill., from which it is readily distinguished by its rhomboid leaf-blades which are gradually narrowed at base and decurrent on the obvious petioles, by its shorter-pedicelled staminate flowers with fewer stamens, and by its smaller fruits.

There is disagreement among students of the family as to the separation of *Buraeavia* Baill. (1873) from *Longetia* Baill. (1866). Pax & Hoffmann (in Pflanzenr. **81** [IV. 147. XV]: 289. 1922, in Nat. Pflanzenfam. **19c**: 75. 1931) combine them under the earlier name, *Longetia*, but Guillaumin (Fl. Anal. et Synopt. Nouvelle-Caléd. 175, 181. 1948) retains both genera, indicating that *Longetia* lacks the disk that is characteristic of *Buraeavia*. The latter viewpoint is here adopted, but if future students consider the genera not separable our species will need a combination in *Longetia*.

MACARANGA Thou.

Pax & Hoffmann, in their revision of the vast and complex genus *Macaranga* (in Pflanzenr. **63** [IV. 147. VII]: 298–395. 1914), indicate three main trends of development within the genus, based on the surface of the developing fruit: (1) *Laeves*, with the capsule smooth; (2) *Tuberculatae*, having the capsule with short thick tubercles covering the surface to a greater or lesser degree; and (3) *Echinatae*, having the capsule ornamented with spines often of considerable length. In each of these major divisions, smaller categories are based upon combinations of such characters as the presence or absence of patelliform glands on the inflorescence-bracts, the number of ovary-locules, the number of anther-locules, and the basic venation pattern (whether palmate or pinnate). As a result of this selection of characters, Pax & Hoffmann propose 32 sections (36 sections in a later treatment, in Nat. Pflanzenfam. ed. 2. **19c**: 128–134. 1931). The phylogenetic validity and the usefulness of these sections cannot be assessed without a study of the entire genus, but if this system is carried to its logical conclusion certain additional sections will be needed. For instance, there is no proposed section for species with tuberculate fruits, patelliform-glandular bracts, and palmately nerved leaves, although two Fijian species proposed by Pax & Hoffmann (*M. vitiensis* and *M. graeffeana*, of which they did not know the fruits) have this combination of characters. In the present treatment I follow Pax & Hoffmann's grouping as to the Fijian species, but the major groups *Laeves* and *Tuberculatae* are not sharply distinct in our region.

Eight species, of which six are endemic, seem to occur in Fiji, on the basis of material now available; two of these are further subdivided and one of them is described as new. Since the original descriptions are usually inadequate I here include brief descriptions emphasizing the salient features. All of the Fijian species normally have peltate and palmately nerved leaves.

KEY TO THE SPECIES

Fruits smooth or tuberculate with oblong-conical processes not more than 1.5 mm. long; inflorescence-bracts (at least the larger ones) patelliform-glandular; styles 2, divaricate, not more than 3 mm. long.

Inflorescence-branches, bracts, pedicels, and at least the ♀ calyces persistently tomentellous or spreading-puberulent; fruits smooth.

Leaf-blades spreading-pilose on both surfaces with soft persistent hairs 0.5–1 mm. long, the hairs of the inflorescence-indument 0.5 mm. long or more, the ♂ calyx glabrous; stamens 12–15; stipules, branchlets, and petioles copiously pilose (hairs 0.4–1.3 mm. long). ....1. *M. membranacea.*

Leaf-blades glabrous or with the nerves beneath (rarely above) puberulent or tomentellous, the hairs of the inflorescence-indument minute, rarely more than 0.3 mm. long, the ♂ calyx with a similar but sparser indument, at length glabrate; stamens 6–11; stipules, branchlets, and petioles usually glabrous, sometimes short-pilose. ....2. *M. seemannii.*

Inflorescence-branches, bracts, pedicels, and calyces glabrous or soon glabrate (the few hairs, if present, scattered and not forming a uniform indument).

Leaf-blades broadly ovate to deltoid, less than twice as long as broad; fruits smooth or with processes rarely exceeding 0.5 mm. in length.

Leaves very large, the petioles 22–45 cm. long, the blades 34–60 cm. long, 23–50 cm. broad, broadly peltate (petiole attached 7–10 cm. from basal margin), the veinlets strongly elevated on lower surface; inflorescence often 15–30 cm. long, freely branching; stamens 12–14; developing ovary (mature fruits not seen) smooth ....3. *M. magna.*

Leaves smaller, the petioles 5–21 cm. long, the blades 8–30 cm. long, 5–23 cm. broad, less broadly peltate (petiole attached 1–6 cm. from basal margin), the veinlets on lower surface plane or merely prominulous; inflorescence not exceeding 12 cm. in length; stamens 5–10.

Stipules 1–5 cm. long; leaf-blades with 5–8 primary nerves; fruits comparatively small, 3.5–5 mm. long, 6–8 mm. broad, often tuberculate. ....4. *M. graeffeana.*

Stipules 5–7 cm. long, 12–18 mm. broad, glabrous; branchlets and petioles glabrous, the petioles 15–19 cm. long; leaf-blades broadly ovate, 13–17 × 12–16.5 cm., the petiole attached 3–4.5 cm. from basal margin, the primary nerves 8–10, the margin closely callose-crenulate; fruits comparatively large, the mature capsules 6–7 mm. long, 9–11 mm. broad, smooth or very rarely with a few scattered conical tubercles 0.1–0.4 mm. long. ....5. *M. marikoensis.*

Leaf-blades deltoid- or ovate-lanceolate, averaging 2.5–3 times as long as broad (13–55 × 4–20 mm.); fruits copiously tuberculate with oblong-conical processes 0.5–1.5 mm. long; stamens 3–6. ......6. *M. vitiensis.*

Fruits ornamented with somewhat flattened subulate processes 1.5–8 mm. long; inflorescence-bracts not patelliform-glandular; inflorescence-branches, bracts, pedicels, and calyces copiously puberulent.

Flower-subtending bracts of ♂ inflorescences 2–4 mm. long, entire; stamens (4–) 6–9; fruits with processes 3–8 mm. long and with 3 styles, these 4–10 mm. long, ascending to spreading, copiously papillose; branchlets and petioles glabrous (at least in Fijian specimens) ......7. *M. harveyana.*

Flower-subtending bracts of ♂ inflorescences 4–10 mm. long, at least the larger ones fimbriate-dentate; stamens 3–5; fruits with processes 1.5–3 mm. long and with 2 styles, these 1.5–2.5 mm. long, divaricate, not or inconspicuously papillose; branchlets and petioles copiously puberulent. ....8. *M. secunda.*

1. **Macaranga** (§ *Adenoceras*) **membranacea** Muell. Arg. in DC. Prodr. **15** (2): 996. 1866; Seem. Fl. Vit. 228. 1867; Pax & Hoffm. in Pflanzenr. **63** [IV. 147. VII]: 393. 1914.

Tanarius membranaceus Kuntze, Rev. Gen. Pl. **2**: 620. 1891.

Shrub or tree up to 8 m. high, the branchlets and petioles copiously spreading-pilose with pale hairs 0.5–1.3 mm. long; stipules lanceolate, 1.5–2.5 mm. long, densely pilose on both sides with hairs 0.4–0.8 mm. long; petioles 6–13 cm. long, the blades broadly ovate, 10–24 cm. long, 7–14 cm. broad, rounded at base and broadly (1.5–4 cm.) peltate, rarely deeply cordate and epeltate, long-acuminate at apex, the primary nerves 6 or 7, both surfaces copiously spreading-pilose with soft hairs 0.5–1 mm. long, scattered-glandular beneath; inflorescences 5–8 cm. long, the branches, bracts, and ♀ calyces densely pilose with spreading hairs 0.5–0.7 mm. long, the bracts lanceolate or obovate-lanceolate, up to 5 mm. long, at least the ♂ with often obscure patelliform glands; ♂ calyx glabrous, glandular distally, about 1.5 mm. in diameter, the lobes 3, oblong-ovate, rounded; stamens 12–15, the filaments 1–1.2 mm. long; fruits smooth, copiously glandular, the styles 2, divaricate, 1–2 mm. long.

DISTRIBUTION: Apparently endemic, and known with certainty only from Vanua Levu; the type, an Exploring Expedition specimen, is without data but may also be from Mathuata, where the species has been noted at elevations up to 200 m., on edge of forest or in patches of forest in open country. It is said to be a large shrub or a tree 5–8 m. high, with pale yellow latex that turns red on exposure, and with the calyx and filaments pale greenish yellow. The type is sterile, but an isotype precisely agrees with the cited specimens. I noted the local name as *mama*.

VANUA LEVU: *H. B. R. Parham 342* (BM); Mathuata: Mathuata coast, *Greenwood 654* (K); Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, *Smith 6641* (A, US), *6707* (A, US). Fiji, without definite locality: *U. S. Expl. Exped.* (TYPE COLL., GH).

As his material was sterile, Mueller was unable to suggest the alliance of this patently distinct species. The collection of staminate (Smith) and fruiting (Greenwood) inflorescences establishes the plant as belonging to § *Adenoceras* and as closely related only to *M. seemannii*, from which it differs in the longer and more abundant indument (except on the ♂ calyx, which is quite glabrous) and in the increased number of stamens.

2. **Macaranga** (§ *Adenoceras*) **seemannii** (Muell. Arg.) Muell. Arg. in DC. Prodr. **15** (2): 999, as *M. seemanni.* 1866.

Macaranga seemannii, a sharply marked species of § *Adenoceras*, differs from the species of our region (except the preceding, *M. membranacea*) in the dense indument of its inflorescences, the indument persisting even on pedicels and calyces of fully mature infructescences. Although most of the material here considered agrees well with the cotypes of the species, two variants seem worthy of note. As these have the basic characters of *M. seemannii*, I hardly consider them worthy of specific recognition, but they are perhaps worth recording as varieties.

KEY TO THE VARIETIES

Stipules oblong-lanceolate, 1.5–4 cm. long, 5–15 mm. broad; petioles 9–27 cm. long; leaf-blades broadly ovate, usually 13–31 × 8.5–22 cm., rounded at base, broadly peltate (petiole attached 2.5–8 cm. from basal margin); infructescence 3–12 cm. long.

Branchlets and petioles glabrous or with a few scattered hairs, not uniformly soft-pilose; stipules 5–10 mm. broad, glabrous or puberulent without when young; petioles 9–18 cm. long; primary nerves of leaf-blades 6–8; hairs of inflorescence-indument 0.1–0.2 mm. long . . . . 2a. var. *seemannii.*

Branchlets and petioles copiously soft-pilose; stipules 8–15 mm. broad, puberulent on both sides or glabrate distally; petioles 16–27 cm. long; primary nerves of leaf-blades 8 or 9; hairs of inflorescence-indument 0.2–0.4 mm. long. . . . . 2b. var. *capillata.*

Stipules narrowly oblong-lanceolate, 1–2 cm. long, 3–4 mm. broad, copiously spreading-pilose on both sides; branchlets and petioles densely tomentellous-puberulent, the petioles 8–12 cm. long; leaf-blades ovate-deltoid, 12–16 × 7–10 cm., rounded-truncate at base, less broadly peltate (petiole attached 1.5–2.5 cm. from basal margin); infructescence 2–3 cm. long. . . . . 2c. var. *deltoidea.*

2a. Macaranga seemannii var. seemannii

Mappa seemanni Muell. Arg. in Flora **47**: 468. 1864.

Macaranga seemanni Muell. Arg. in DC. Prodr. **15** (2) : 999. 1866; Seem. Fl. Vit. 228. 1867.

Tanarius seemannii Kuntze, Rev. Gen. Pl. **2**: 620. 1891.

Macaranga seemannii Muell. Arg. ex Hemsl. in Jour. Linn. Soc. Bot. **30**: 192. 1894; Pax & Hoffm. in Pflanzenr. **63** [IV. 147. VII] : 336. 1914.

Tree up to 18 m. high, the branchlets and petioles glabrous or with a few scattered spreading hairs up to 1 mm. long, not uniformly soft-pilose, glabrate; stipules oblong-lanceolate, 1.5–4 cm. long, 5–10 mm. broad, glabrous or sometimes puberulent without when young; petioles 9–18 cm. long, the blades broadly ovate, (12–) 13–30 cm. long, (7–) 8.5–22 cm. broad, rounded at base and broadly (2.5–7.5 cm.) peltate, long-acuminate at apex, with 6–8 primary nerves, glabrous above, spreading-puberulent on primary nerves beneath or with occasional longer hairs to 1.5 mm. long, copiously glandular beneath; inflorescences 3–12 cm. long, the branches, bracts, pedicels, and calyces tomentellous or spreading-puberulent with ferrugineous hairs 0.1–0.2 mm. long, the bracts lanceolate or obovate-lanceolate, up to 5 mm. long, the larger ones obviously patelliform-glandular; ♂ calyx about 1 mm. in diameter, at length subglabrate, the lobes 3, oblong-ovate; stamens 6–11, the filaments 0.5–1 mm. long; fruits smooth, copiously glandular, the styles 2, divaricate, 1–2 mm. long.

DISTRIBUTION: Fiji and Tonga; known from several islands in Fiji, at elevations from near sea-level up to 1100 m., occurring in different types of forest, in thin woods among reeds, along streams, etc. It is a tree 4–18 m. in height, with a thin, colorless or yellowish latex. The calyx, filaments, and styles are pale yellow and the fruit greenish yellow. Local names are *ndavo* (upland Viti Levu) and *mama* (Mathuata). In the original description Mueller cites three specimens, all deposited at Kew and cited below, which may be taken as cotypes; these are *Harvey s. n.* and *Seemann 397* and *419*. The occurrence of the species in Tonga is indicated by *U. S. Expl. Exped.* (US 66261).

VITI LEVU: "Nakaru," *Parks 20403* (Bish, GH); Mba: Mountains near Lautoka, *Greenwood 285* (K), *286* (K), *1197* (US); slopes of the escarpment north of Nandarivatu, *Smith 6028* (A, US); vicinity of Nandarivatu, *Parks 20655* (Bish); valley of Nggaliwana Creek, *Smith 5334* (A, US); slopes of Mt. Tomanivi, *Smith 5212* (A, US); Nandronga & Navosa: Northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, *Smith 5637* (A, US); Namosi: Vicinity of Namuamua, *Gillespie 3012* (Bish, GH), *3049* (Bish, GH, K, NY, US); vicinity of Namosi, *Gillespie 2499* (Bish); Naitasiri: Viria, *Meebold 16900* (Bish, K); vicinity of Nasinu, *Gillespie 3654* (Bish); Rewa: Lami, *Tothill 738* (K); near Suva, *Tothill 739* (K); Tailevu: Naivithula, *Valentine 18* (Bish). OVALAU: Vicinity of Levuka, *Gillespie 4458* (Bish). KORO: *Tothill 697* (K), *698* (K). VANUA LEVU: *H. B. R. Parham 39* (BM); Mathuata: Southern slopes of Mt. Numbuiloa, east of Lambasa, *Smith 6546* (A, US). TAVEUNI: Vicinity of Wairiki, *Gillespie 4716* (Bish, GH, K, NY). Fiji, without definite locality: *Harvey* (BM, GH, K COTYPE), *Seemann 397* (GH, K COTYPE), *419* (BM, GH, K COTYPE) [three cotypes indicated as from Viti Levu in Flora Vitiensis, but Kew sheet of no. *419* indicated as from Taveuni], *Horne 826* (GH, K).

2b. Macaranga seemannii var. capillata var. nov.

Arbor ad 15 m. alta, ramulis petiolisque copiose pilosis (pilis patentibus 0.2–0.3 mm. vel interdum ad 1 mm. longis); stipulis oblongo-lanceolatis 3–4 cm. longis 8–15 mm. latis utrinque puberulis vel superne glabratis; petiolis 16–27 cm. longis, laminis late ovatis, 20–31 cm. longis, 16–22 cm. latis, basi rotundatis et late (5.5–8 cm.) peltatis, apice acuminatis, supra glabris, subtus praeter nervos saltem basim versus pilosos glabris et copiose glandulosis, nervis primariis 8 vel 9; inflorescentiis ♀ et fructiferis solis visis 5–12 cm. longis ubique pilis 0.2–0.4 mm. longis copiose tomentellis, fructibus ut in var. *seemannii.*

KANDAVU: Hills above Namalata and Ngaloa Bays, alt. 200–400 m., *Smith 46* (Bish, GH, K, NY, US) (*venua*; tree 15 m. high, on edge of forest; fruits green to black). KAMBARA: Lowland forest of central basin, alt. 25–30 m., Aug. 24, 1924, *Bryan 500* (Bish TYPE) (*venua*; tree 10–12 m. high, the trunk 18–25 cm. diam., with red latex; flowers and fruits green).

The typical variety of *M. seemannii* is quite uniform, on the basis of the many collections referred to it above, and from it the new variety differs in its somewhat longer petioles, large leaf-blades and stipules, the soft indument of its branchlets and petioles, and the slightly longer hairs of its inflorescence-indument.

2c. Macaranga seemannii var. deltoidea var. nov.

Arbor ad 5 m. alta, ramulis petiolisque copiose tomentello-puberulis (pilis 0.2–0.3 mm. longis vel interdum longioribus); stipulis anguste oblongo-lanceolatis 1–2 cm. longis 3–4 mm. latis utrinque copiose pilosis; petiolis 8–12 cm. longis, laminis ovato-deltoideis, 12–16 cm. longis, 7–10 cm. latis, basi rotundato-truncatis et 1.5–2.5 cm. peltatis, apice graciliter acuminatis, supra glabris vel primo nervis tomentello-puberulis, subtus nervis et interdum venulis ut petiolis tomentellis et copiose glandulosis, nervis primariis 7 vel 8; infructescentiis 2–3 cm. longis pilis ferrugineis 0.1–0.3 mm. longis ubique copiose tomentello-puberulis, bracteis caducis, calyce sub fructu extus puberulo intus glabrato, fructibus ut in var. *seemannii.*

VITI LEVU: Mba: Upper slopes of Mt. Koromba [Pickering Peak], alt. 800–1075 m., June 3, 1947, *Smith 4669* (A TYPE, US) (tree 5 m. high, in dense forest on ridges and spurs).

From the typical variety of *M. seemannii,* the new variety differs primarily in its very narrow and copiously pilose stipules and the tomentellous-puberulent character of its branchlets and petioles. The leaf-blades are somewhat narrower than typical and the infructescence is comparatively short, but these characters may not be very significant.

3. **Macaranga** (§*Adenoceras*) **magna** Turrill in Kew Bull. **1924**: 393. 1924.

Macaranga grandifolia Turrill in Jour. Linn. Soc. Bot. **43**: 38. 1915, non Merr. (1913).

Tree up to 10 m. high, the branchlets glabrous or very soon glabrate; stipules oblong-lanceolate, 3–5 cm. long, 1.5–2.5 cm. broad, at first with spreading hairs 0.3–0.5 mm. long, at length glabrate, sometimes copiously sessile-glandular without; petioles 22–45 cm. long, copiously spreading-puberulent with pale hairs 0.2–0.5 mm. long, glabrate (indument often remaining in irregular patches); leaf-blades ample, ovate, 34–60 cm. long, 23–50 cm. broad, rounded or coarsely undulate-truncate at base and broadly (7–10 cm.) peltate, acuminate or cuspidate at apex, glabrous above or sparsely setulose on nerves with hairs 0.3–0.6 mm. long, similar beneath or soft-spreading-pilose on nerves and copiously glandular, the primary nerves 6–9, the veinlets strongly elevated beneath; inflorescences glabrous, the ♂ freely branching, 15–30 cm. long, the ♀ similar but 6–20 cm. long, the larger bracts lanceolate-obovate, 4–8 mm. long, patelliform-glandular; ♂ calyx 1.3–1.6 mm. in diameter, eglandular or with few distal glands, 3-lobed, the lobes broadly ovate; stamens 12–14, the filaments 0.8–1 mm. long; developing ovary smooth, copiously glandular, the styles 2, divaricate, 1.2–1.5 mm. long.

DISTRIBUTION: Endemic and apparently limited to Viti Levu, occurring at elevations of 300–970 m. in forest or on edges of forest. The species is a slender tree up to 10 m. in height, the inflorescence-parts (branches, bracts, calyces, and styles) being dark red or crimson. Local names are *ndavo* and *ndavolutu.* The type is *im Thurn 134,* cited below.

VITI LEVU: Mba: Nandarivatu and vicinity, *im Thurn 134* (K TYPE), *Tothill 737* (K), *Gillespie 3986* (Bish, GH, US); southern slopes of Mt. Ndelainathovu, on the escarpment west of Nandarivatu, *Smith 4951* (A, US); Nandronga & Navosa: Vicinity of Nandrau, *Degener 14911* (A, NY); Rewa: Mt. Korombamba, *Gillespie 2379* (Bish, K, NY); Naitasiri?:

Prince's Road, *Meebold 21364* (NY). Fiji, without definite locality: *Parks 20895* (Bish).

Although mature fruits are not yet available, *M. magna*, a sharply marked and spectacular species, seems to fall into § *Adenoceras* in the Pax & Hoffmann system, although it might also be sought in § *Stipulosae*. The latter hardly seems worth separating from § *Adenoceras*, if it depends entirely upon the size of the stipules, which are said to be 5–15 cm. long in the Samoan *M. stipulosa* (the only species of § *Stipulosae*) as opposed to 1 cm. in § *Adenoceras*. However, such species as *M. seemannii*, admitted into § *Adenoceras*, have stipules up to 4 cm. in length. The several sheets of *M. stipulosa* available to me, including an isotype, unfortunately do not show stipules, but at any rate *M. magna* is readily distinguished from the Samoan plant by its glabrous inflorescences and strongly elevated veinlets on the lower leaf-surfaces.

4. **Macaranga** (§ *Adenoceras*) **graeffeana** Pax & Hoffm. in Notizbl. Bot. Gart. Berlin **10**: 384. 1928.

Macaranga graeffeana, described subsequent to Pax & Hoffmann's treatment of the genus in the Pflanzenreich, has not been well understood, practically no specimens in herbaria having been referred to it. The type is a Graeffe specimen from Viti Levu, described without fruit and supposedly related to *M. seemannii* and *M. vitiensis*. The original description agrees very closely with several available collections from southern Viti Levu, these differing from *M. seemannii* in their essentially glabrous inflorescences and from *M. vitiensis* in obvious leaf-proportions. As Graeffe's collections come in large part from this same region of Viti Levu, I have little hesitation in referring Pax & Hoffmann's name to the entity here discussed.

The fruit of typical *M. graeffeana*, as here construed, is usually sparsely tuberculate with processes 0.2–0.7 mm. long, but occasional fruits are quite devoid of tubercles. As all intergrades exist between the smooth and tuberculate states, in plants which are otherwise quite identical, and sometimes even on the same plant, one cannot feel that the tuberculate character is entirely reliable. Although the species probably belongs in § *Adenoceras*, it would be excluded from that section by the tuberculate fruits if Pax & Hoffmann's system should be literally followed.

In reconsidering my own species *M. crenata*, I must conclude that it falls into a reasonable concept of *M. graeffeana*, although its fruits are smooth nearly without exception, while its leaves are comparatively small and more obviously toothed. I now refer *M. crenata* to varietal status and suggest as a third variety a taxon with unusually large leaves and more obvious indument than typical.

Key to the varieties

Leaf-blades broadly ovate or deltoid-ovate, (8–) 12–30 × (6–) 8–23 cm., the petiole usually attached 2–4 cm. from lower margin, the margin entire to crenate-undulate; petioles (6–) 8–21 cm. long; fruits sparsely tuberculate, the processes 0.2–0.7 mm. long, rarely lacking; plant often with slight indument on vegetative parts and inflorescence.

Stipules 1–3.5 cm. long, 5–10 mm. broad, glabrous or sparsely puberulent (rarely long-pilose) and usually glabrate; branchlets and petioles glabrous or soon glabrate; leaf-blades usually 12–24 × 8–15 cm. .... 4a. var. *graeffeana.*

Stipules 2.5–5 cm. long, 12–20 mm. broad, copiously puberulent without; branchlets and petioles soft-pilose, eventually glabrate; leaf-blades 15–30 × 13–23 cm. .... 4b. var. *major.*

Leaf-blades deltoid, 8–14 × 5–8 cm., narrowly peltate (petiole attached 1–1.5 cm. from lower margin), the margin conspicuously glandular-crenate-undulate; petioles 5–10 cm. long; fruits smooth, very rarely with a few minute conical tubercles; plant glabrous throughout ...... 4c. var. *crenata.*

4a. Macaranga graeffeana var. graeffeana

Macaranga graeffeana Pax & Hoffm. in Notizbl. Bot. Gart. Berlin **10**: 384. 1928.

Shrub or tree up to 15 m. high, the branchlets and petioles often sparsely spreading-pilose or puberulent when young (hairs 0.1–0.3 mm. long, rarely to 2 mm. long), soon glabrate; stipules oblong-lanceolate, 1–3.5 cm. long, 5–10 mm. broad, usually glabrous, sometimes sparsely puberulent and soon glabrate, rarely copiously spreading-pilose; petioles (6–) 8–16 (–21) cm. long, the leaf-blades broadly ovate or deltoid-ovate, (8–) 12–27 cm. long, (6–) 8–20 cm. broad, rounded or rounded-truncate at base and usually deeply (2–4 cm., rarely 1–6 cm.) peltate, acuminate at apex, glabrous above, glabrous beneath or with the nerves pilose like petioles and usually soon glabrate, obviously glandular beneath, the primary nerves 6–8; inflorescences 3–9 cm. long, glabrous throughout or the branches sparsely puberulent with hairs 0.1–0.2 mm. long, the larger bracts obovate-lanceolate, 3–8 mm. long, patelliform-glandular; ♂ calyx 1–1.2 mm. in diameter, glabrous (rarely with a few hairs when young), scattered-glandular distally, 3-lobed nearly to middle; stamens 5–10, the filaments 0.7–1.2 mm. long; ♀ calyx glabrous or very sparsely puberulent and glabrate; fruits 3.5–5 mm. long, 6–8 mm. broad, usually sparsely tuberculate (processes 0.2–0.7 mm. long), rarely essentially or quite smooth, copiously glandular, the styles 2, divaricate, 1.5–2.5 mm. long.

Distribution: Fiji, thus far known only from Viti Levu and Vanua Levu, occurring at elevations of 100–1150 m. in dense forest or in forest patches or on open hillsides. The known specimens are from large shrubs or small trees 3–15 m. high, the young inflorescences being reddish, the flowers yellowish, and the fruits yellow-green. Recorded local names are: *ndavo* (upland Viti Levu), *vouotu* (Mathuata), and *tavotavo* (Thakaundrove). The type is *Graeffe 651*, from Viti Levu without further data, presumably lost in the destruction of the Berlin herbarium; no duplicate has been seen.

Viti Levu: Mba: Vicinity of Nandarivatu, *Gillespie 3970* (Bish), *3988* (Bish, GH); southern slopes of Mt. Ndelainathovu, on the escarpment west of Nandarivatu, *Smith 4928* (A, US); Namosi: Summit of Mt. Naitarandamu, *Gillespie 3234* (Bish, GH), *3293* (Bish, GH, NY); summit of Mt. Vakarongasiu, *Gillespie 3285* (Bish, GH, K, NY, US); vicinity of Namosi, *Gillespie 2625*

(Bish); Naitasiri: Banks of the Wainimala at "Navusa," *Horne* (K); Rewa: Mt. Korombamba, *Gillespie 2212* (Bish, GH, K, NY, US), *2367* (Bish, GH, K, NY). VANUA LEVU: Mathuata: Wainikoro, *Greenwood 706* (K); Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, *Smith 6812* (A, US); Thakaundrove: Mt. Mariko, *Smith 421* (Bish, GH, K, NY, US).

The cited material is quite constant in its basic characters with the exception of two numbers. *Gillespie 3285* is aberrant in having the primary nerves of the leaf copiously pilose with hairs as much as 1 mm. long. My no. *421*, from Mt. Mariko, obviously comes from two different plants; the fruiting specimens are glabrous and similar to material from Viti Levu, but the specimens with staminate inflorescences have the stipules, petioles, and primary nerves coarsely pilose with scattered spreading hairs up to 1.5 mm. long. While these two numbers are not entirely typical of var. *graeffeana*, they differ from it less markedly than the two entities treated below as distinct varieties.

4b. **Macaranga graeffeana** var. **major** var. nov.

Arbor, ramulis petiolisque copiose puberulis (pilis 0.2–0.5 mm. raro ad 1 mm. longis) demum subglabratis; stipulis oblongo-lanceolatis 2.5–5 cm. longis 12–20 mm. latis, extus copiose puberulis, intus subglabratis; petiolis 11–18 cm. longis, foliorum laminis late ovatis, 15–30 cm. longis, 13–23 cm. latis, basi rotundato-truncatis et late (2–4 cm.) peltatis, apice abrupte acuminatis, margine undulato-crenulatis, supra glabris vel costa inconspicue puberula, subtus nervis primariis 7 vel 8 ut petiolo pilosis glabratis, copiose glandulosis; inflorescentiis ♀ et infructescentiis 3–11 cm. longis, ramulis inconspicue puberulis glabratis, bracteis dentatis 5–8 mm. longis patelliformi-glandulosis, calyce haud puberulo pauciglanduloso; fructibus copiose glandulosis tuberculatis, processis oblongo-conicis obtusis 0.2–0.4 mm. longis, stylis 2 divaricatis 1.5–2.5 mm. longis.

VITI LEVU: Mba: Vuninatambua, near Navai, alt. 750–900 m., March 21, 1941, *Degener 14874* (A TYPE, Bish, K, NY, US) (*ndavo*; forest tree); Nauwanga, south of Nandarivatu, alt. 750–900 m., *Degener 14809* (A, Bish, K, NY) (*ndavo*; forest tree).

The two collections here described as *M. graeffeana* var. *major*, both from north-central Viti Levu, differ from typical material of the species in their larger and copiously puberulent stipules, their larger leaf-blades, and the more obvious and more persistent indument of their branchlets and petioles.

4c. **Macaranga graeffeana** var. **crenata** (A. C. Sm.) comb. nov.

Macaranga crenata A. C. Sm. in Bishop Mus. Bull. **141:** 86. *fig. 44.* 1936.

Tree to 10 m. high, glabrous throughout (or the inflorescences with a few spreading hairs at base of flower-clusters); stipules lanceolate, 1–3 cm. long, 5–8 mm. broad; petioles 4–10 cm. long, the leaf-blades deltoid, 8–14 cm. long, 5–8 cm. broad, rounded-truncate at base and narrowly

(1–1.5 cm.) peltate, slenderly acuminate at apex, conspicuously glandular-crenate-undulate at margin, scattered-glandular beneath, the primary nerves 5–7; ♂ inflorescences 3–5 cm. long, the bracts obovate-lanceolate, short-stipitate, 2.5–6 mm. long, patelliform-glandular, the calyx 1–1.2 mm. in diameter, 3-lobed, with scattered or apical sessile glands; stamens 5–7, the filaments 0.8–1 mm. long; infructescences 1.5–3 cm. long, the fruits 4–4.5 mm. long, about 7 mm. broad, densely glandular, smooth or rarely with a few (1 or 2 on occasional fruits) minute conical tubercles, the styles 2, divaricate, 1–1.5 mm. long.

DISTRIBUTION: Thus far known from only two collections, from Viti Levu and Vanua Levu, at elevations of 650–1195 m., occurring in crest thickets. The plants are trees 9 or 10 m. high; the type bears fruits and no. *4197* staminate inflorescences, which have a rich pink calyx and white anthers. A local name (no. *530*) was recorded as *kitimoku*.

VITI LEVU: Mba: Summit of Mt. Koroyanitu, high point of Mt. Evans Range, *Smith 4197* (A, US). VANUA LEVU: Thakaundrove–Mathuata boundary: Crest of Korotini Range, between Navitho Pass and Mt. Ndelaikoro, *Smith 530* (Bish TYPE, GH, K, NY, US).

The staminate specimen cited above agrees very well with the type of this taxon and indicates that it may be limited to exposed crests and ridges. Although the entity is fairly well marked by its deltoid, conspicuously crenate, and narrowly peltate leaf-blades, its completely glabrous habit, and its smooth fruits, it does not seem specifically different from *M. graeffeana*. Close examination indicates that an occasional fruit has one or two minute tubercles, this fact providing another point of similarity with typical *M. graeffeana*.

5. **Macaranga** (§ *Adenoceras*) **marikoensis** sp. nov.

Arbor gracilis ad 7 m. alta, ramulis, stipulis, petiolisque glabris, ramulis lenticellatis; stipulis papyraceis vel submembranaceis oblongo-lanceolatis, 5–7 cm. longis, 12–18 mm. latis; petiolis 15–19 cm. longis, foliorum laminis subcoriaceis in sicco fuscis late ovatis vel suborbicularibus, 13–17 cm. longis, 12–16.5 cm. latis, basi rotundatis vel subtruncatis et late (3–4.5 cm.) peltatis, margine copiose calloso-crenulatis (crenationibus 2 vel 3 per centimetrum), apice abrupte cuspidatis (apice ipso circiter 5 mm. longo obtuso), supra glabris, subtus nervis pilis ad 0.1 mm. longis parce puberulis mox glabratis et copiose luteo-glandulosis, nervis primariis 8–10, nervis secundariis numerosis cum primariis supra leviter elevatis subtus prominentibus, rete venularum intricato utrinque subprominulo; infructescentiis 7–12 cm. longis ubique glabris vel pedicellis brevibus parce puberulis, bracteis caducis; fructibus magnis, 6–7 mm. longis, 9–11 mm. latis, copiose glandulosis, levibus vel interdum tuberculis conicis paucis 0.1–0.4 mm. longis inconspicue ornatis, stylis 2 divaricatis 2–3 mm. longis.

VANUA LEVU: Thakaundrove: Mt. Mariko, alt. 600–866 m., Nov. 14, 1933, *Smith 447* (Bish, GH, K, NY, US 1676109 TYPE) (*rote*; slender tree 7 m. high, in dense forest).

The entity here described can scarcely be referred to any known species; its relationship is doubtless with *M. graeffeana*, which it suggests in its basic characters and the presence of occasional tubercles on the fruits. However, *M. marikoensis* differs from the earlier species in its large stipules and its much larger fruits, as well as in its suborbicular and short-cuspidate leaf-blades, of which the nerves are more numerous and more prominent. Another specimen from Mt. Mariko, *Smith 421*, is definitely not referable to the new species; it has the small fruits and ovate leaves of *M. graeffeana*, under which I have discussed it as a somewhat atypical representative.

6. **Macaranga vitiensis** Pax & Hoffm. in Pflanzenr. 63 [IV. 147. VII]: 337. 1914.

Macaranga sanguinea Gillespie in Bishop Mus. Bull. **91**: 17. *fig. 19.* 1932.

Large shrub or small tree, the young branchlets and petioles spreading-pilose with pale hairs 0.2–0.7 mm. long and usually soon glabrate; stipules lanceolate, 1.5–7 cm. long, 5–15 mm. broad, copiously spreading-pilose without (hairs 0.5–1 mm. long) or rarely essentially glabrous, glabrous or soon glabrate within; petioles 5–23 cm. long, the leaf-blades ovate- or deltoid-lanceolate, 13–55 cm. long, 4–20 cm. broad, rounded-truncate or subcordate at base and usually obviously (1–6 cm.) peltate, rarely deeply cordate and epeltate (probably a juvenile stage), gradually acuminate at apex, undulate at margin, glabrous on both sides or with a few scattered hairs 0.3–0.7 mm. long on nerves beneath, scattered-glandular beneath, the primary nerves 6–8, the secondary nerves arising from costa numerous, slightly curved; inflorescences slender, 3–10 cm. long, essentially glabrous (or with a few minute scattered hairs on branches and bracts), the bracts lanceolate-obovate, stipitate, 3–10 mm. long, patelliform-glandular; ♂ calyx cupuliform, 0.7–1 mm. long, deeply 3-lobed, with copious dorsal or subapical glands; stamens 3–6, the filaments 0.6–1 mm. long; ♀ calyx sometimes minutely pilose but soon glabrate; fruits copiously tuberculate, the processes conical or oblong, obtuse or subacute, 0.5–1.5 mm. long, the styles 2, divaricate, 1.5–3 mm. long.

DISTRIBUTION: Endemic, apparently limited to a small area in southern Viti Levu, where it is often recorded as abundant, at elevations up to 200 m. The species is said to be a large shrub or few-branched tree up to 5 m. in height, occurring in forest; the flowers are greenish, the fruits yellow-green with brown tubercles, and the styles reddish brown. A local name is *ndavo*.

As type of *M. vitiensis*, Pax & Hoffmann cite a specimen collected by "Leon" in Fiji, without further locality. I find no record of a collector with this name having worked in the region, and the amusing hypothesis occurs to me that they may have misread the word "Levu." It can be observed, for instance, that some of the Graeffe specimens (at least in the British Museum) were distributed with no data but the hand-written inscription "Viti Levu." I have examined several such sheets with the present matter in mind, and the word "Levu" (in Graeffe's hand?) can readily be taken for "Leon." The type of *M. vitiensis*, in the Berlin herbarium, has presumably been destroyed, and so my suggestion cannot be verified, but it seems not unlikely that this type was a Graeffe specimen from Viti Levu; he is known to have collected in the southern forests of that island, where this species is frequent. The type of *M. sanguinea* is *Gillespie 3625.4*, cited below.

VITI LEVU: Serua: Vicinity of Ngaloa, *Degener 15068* (A, NY), *15182* (A, Bish, K, NY, US); Naitasiri: Vicinity of Nasinu, *Gillespie 3566* (Bish, GH, US), *3567* (Bish, GH), *3625.4* (Bish TYPE of *M. sanguinea*, GH, K, NY), *3642.1* (Bish), *Greenwood 1123* (A, US); vicinity of Tamavua, *Gillespie 2087* (Bish), *2092* (Bish, GH); Suva Pumping Station, *Degener & Ordonez 13764* (A, K, NY); Rewa: Mt. Korombamba, *Parks 20143* (Bish), *Gillespie 2271* (A, Bish, GH), *H. B. R. Parham 75* (BM), *Vaughan 3324* (BM); Lami, *Meebold 16902* (K); "Central Road, Suva," *Tothill 561* (K), *696* (K), *758* (K); vicinity of Suva, *Meebold 8162* (K), *16901* (Bish). Fiji, without definite locality: *Horne 1044* (GH, K), *Yeoward 26 bis* (K).

On the basis of the original description of *M. vitiensis*, I can only conclude that this name must replace *M. sanguinea*. The leaf-shape alone (the blades being usually substantially more than twice as long as broad) distinguishes this entity from any other *Macaranga* in Fiji. Gillespie apparently did not consider *M. vitiensis*, since it was placed by Pax & Hoffmann in § *Adenoceras*, among the species with smooth fruits, whereas *M. sanguinea* has conspicuously tuberculate fruits; the type of *M. vitiensis* was a staminate plant and could not have been accurately placed in the Pax & Hoffmann system. Gillespie is quite correct in stating that his species cannot be placed in any existing section; the combination of tuberculate fruits, patelliform-glandular bracts, and palmate venation is not accounted for in Pax & Hoffmann's table (in op. cit. 302). I do not propose a new section for this species, because sectional criteria in the genus need careful revision; it may be that § *Adenoceras* will be extended to include forms with tuberculate fruits, such as the present species and *M. graeffeana*, which above I refer to § *Adenoceras* on the grounds that its fruits are sometimes essentially smooth and sometimes tuberculate.

7. **Macaranga** (§ *Eumappa*) **harveyana** (Muell. Arg.) Muell. Arg. in DC. Prodr. **15** (2): 998. 1866; Seem. Fl. Vit. 228. 1867; Drake, Fl. Polyn. Fr. 186. 1893; Hemsl. in Jour. Linn. Soc. Bot. **30**: 192. 1894; Pax in Bot. Jahrb. **25**: 646. 1898; Burkill in Jour. Linn. Soc. Bot. **35**: 54. 1901; Pax & Hoffm. in Pflanzenr. **63** [IV. 147. VII]: 357. 1914.

Mappa harveyana Muell. Arg. in Flora **47**: 467. 1864.
Tanarius harveyanus Kuntze, Rev. Gen. Pl. **2**: 620. 1891.
Macaranga harveyana var. *glabrata* Pax & Hoffm. in Pflanzenr. **63** [IV. 147. VII]: 357. 1914.

Tree to 10 m. high, the branchlets and petioles glabrous (in Fijian specimens); stipules oblong-lanceolate, submembranaceous or papyraceous, 1.5–2.5 cm. long, 5–7 mm. broad, copiously spreading-pilose on both sides with hairs to 0.3 mm. long, sometimes glabrate; petioles 8–25 cm. long, the leaf-blades broadly ovate, 9–24 cm. long, 6–19 cm. broad, rounded at base and deeply (1.5–5 cm.) peltate, slenderly acuminate at apex, inconspicuously crenulate at margin, with 7–10 primary nerves, puberulent on the nerves above with hairs 0.1–0.3 mm. long and sometimes minutely stellate-puberulent on surface, otherwise glabrous, similarly pilose beneath or with a few scattered longer hairs, dispersed-glandular; inflorescences 5–14 cm. long, copiously puberulent or tomentellous (on branchlets, bracts, and calyces) with hairs 0.2–0.5 mm. long; bracts not patelliform-glandular, those of ♂ inflorescences ovate-deltoid, 2–4 mm. long, entire, those of ♀ inflorescences often deltoid-lanceolate, 10–12 mm. long, copiously fimbriate-dentate; ♂ calyx 0.7–1 mm. long, deeply 3-lobed nearly to base, with a few distal glands; stamens (4–) 6–9, the filaments 0.5–0.7 mm. long; ♀ calyx tubular, 2–3 mm. long, with narrow lobes; fruits with several or many long flattened subulate processes, these subacute, 3–8 mm. long, minutely puberulent; styles 3, ascending to spreading, copiously papillose, 3–4 mm. long in flower, up to 10 mm. long in fruit.

DISTRIBUTION: Fiji, Samoa, Tonga, and apparently eastward to the Society Islands; the type is *Harvey* (K, staminate and fruiting sheets), from Vavau or Lifuka, Tonga. In Fiji the species is definitely known only from Viti Levu and Taveuni, where it occurs sparingly at low elevations, up to 400 m., as a tree up to 10 m. in height.

VITI LEVU: Serua: Waimbale, near Namboutini, *Degener 15476* (A, Bish, K, NY, US); Namosi: Vicinity of Namosi, *Gillespie 2885* (Bish, GH). TAVEUNI: Vicinity of Waiyevo, *Gillespie 4708* (Bish, GH). Fiji, without definite locality: *U. S. Expl. Exped.* (GH, US 66263 & 66264), *Horne 472* (GH, K).

Macaranga harveyana and *M. secunda* are the only representatives of § *Eumappa* occurring in our region; they are readily distinguished from the other Fijian species by the presence of long processes on the fruits and by the absence of patelliform glands on the inflorescence-bracts. The distribution of *M. harveyana* seems to extend from Fiji to the Societies, as stated by Pax and Hoffmann, on the basis of available material. The type of the species falls into Pax & Hoffmann's var. *glabrata*, which is therefore a superfluous name, to be replaced by var. *harveyana* if infraspecific taxa are deemed desirable. The available Fijian material is fairly typical, but variation within the species cannot be evaluated without examining more Polynesian specimens. In addition to the type I have seen the following Polynesian specimens (all US) that seem to belong here: Tonga: *U. S. Expl. Exped.*; Samoa: *U. S. Expl. Exped.*, *Rechinger 837*, *Vaupel 259*, *Christophersen 585*, *Christophersen & Hume 2448*, *Setchell 253*; Rarotonga, Cook Islands: *Parks & Parks 22304*; Tahiti: *U. S. Expl. Exped.* A specimen from Niue, *Yuncker 9618*, has the characteristic styles of the species but has pilose branchlets and petioles, suggestive of those of *M. secunda*; this may represent *M. harveyana* var. *puberula* Pax & Hoffm., typified by a Lister specimen from Tonga that I have not seen.

In the Tongan and Samoan specimens with satisfactory ♂ flowers, the stamens are 6–9 in number, but it should be noted that a Fijian specimen, *Gillespie 2885*, usually has only 4 stamens, this reduced number being more typical of *M. secunda*.

8. **Macaranga** (§ *Eumappa*) **secunda** Muell. Arg. in DC. Prodr. 15 (2): 996. 1866; Seem. Fl. Vit. 228. 1867; Pax & Hoffm. in Pflanzenr. 63 [IV. 147. VII]: 354. 1914.

Tanarius secundus Kuntze, Rev. Gen. Pl. 2: 620. 1891.

Tree to 17 m. high, the branchlets and petioles copiously puberulent with spreading hairs 0.1–0.3 mm. long or occasionally to 1.5 mm. long, at length subglabrate; stipules papyraceous, lanceolate, 1.5–2.5 cm. long, 4–7 mm. broad, copiously spreading-puberulent on both sides, subglabrate; petioles 5–18 cm. long, the leaf-blades broadly ovate, 12–20 cm. long, 7–14 cm. broad, rounded at base and deeply (2–5 cm.) peltate, long-acuminate at apex, obscurely crenulate at margin, with 8–10 primary nerves, puberulent on nerves on both sides (hairs 0.1–0.2 mm. long) and sometimes minutely stellate-pilose on surface, the nerves beneath occasionally with a few longer hairs, the glands scattered, inconspicuous; inflorescences 4–10 cm. long, copiously puberulent (on branchlets, bracts, and calyces) with hairs 0.1–0.2 mm. long; bracts of ♂ inflorescences ovate-deltoid, 4–10 mm. long, copiously fimbriate, not patelliform-glandular, the larger ones stipitate; ♀ bracts presumably similar but not seen; ♂ calyx infundibular, 0.5–0.6 mm. long, 3-lobed nearly to base, eventually subglabrate; stamens 3–5, the filaments 0.5–0.7 mm. long; ♀ calyx persistently densely puberulent; fruits with several or few flattened subulate processes, these 1.5–3 mm. long, puberulent; styles 2, divaricate, 1.5–2.5 mm. long.

Distribution: Endemic, and thus far known from a few collections from Viti Levu, Ovalau, and Vanua Levu, occurring at elevations up to 350 m. in forest. Sparse data indicate the species as a tree 8–17 m. high, with the local names of *lutulutu* (in Ra) and *ovotu* (in Mbua). The type is an Exploring Expedition specimen, of which duplicates are cited below.

Viti Levu: Ra: Mataimeravula, vicinity of Rewasa, near Vaileka, *Degener 15339* (Bish, GH, K, NY, US). Ovalau: *U. S. Expl. Exped.* (type coll., GH, US 1944716), *Seemann 395* (GH [as *359*], K). Vanua Levu: Mbua: Southern portion of Seatovo Range, *Smith 1519* (Bish, GH, K, NY, US). Fiji, without definite locality: *Yeoward* (K).

Macaranga secunda is distinguishable from *M. harveyana* on the basis of its quite different fruits (with shorter processes and with two short divaricate styles) and the dentate bracts of its staminate inflorescence. In *M. harveyana* these bracts are smaller and entire, but the character is not entirely satisfactory, as occasional bracts of this small type also occur in *M. secunda*, usually toward the apices of inflorescences; furthermore the character is not applicable to the pistillate inflorescences, where the larger dentate bracts occur in both species. In vegetative characters the two species are difficult to separate, although the Fijian material of *M. harveyana* seems to have glabrous branchlets and petioles (this character not holding for certain Tongan specimens of *M. harveyana*), while the corresponding parts of *M. secunda* are copiously puberulent. Pax & Hoffmann cite *Seemann 395* as the only Fijian specimen of *M. harveyana* seen by them, but this specimen has the puberulent characteristics of *M.*

secunda and has the type of fruit I believe to represent that species; at any rate such a fruit effectively removes the Seemann specimen from *M. harveyana*. Howevei, the occurrence of true *M. harveyana* in Fiji is indicated by the several specimens I have cited under it, notably *Horne 472*, which has a fruit similar to that of Harvey's Tongan type.

Nomen nudum

MACARANGA MAUDSLAYI Horne, A Year in Fiji, 264, nomen. 1881; Baker in Jour. Linn. Soc. Bot. **20**: 371, nomen. 1883; Pax & Hoffm. in Pflanzenr. **63** [IV. 147. VII]: 394, nomen. 1914.

No description has been published for this binomial, and I have not noted the name on any Horne specimens at Kew; therefore the name cannot at present be referred to its proper synonymy.

Excluded species

Mappa leptostachya Muell. Arg. in Linnaea **34**: 198. 1865 = *Macaranga leptostachya* Muell. Arg. in DC. Prodr. **15** (2): 1007. 1866 = *Tanarius leptostachyus* Kuntze, Rev. Gen. Pl. **2**: 620. 1891 = **Cleidion leptostachyum** (Muell. Arg.) Pax & Hoffm. in Pflanzenr. **63** [IV. 147. VII]: 293. 1914.

The further synonymy of *Cleidion leptostachyum*, discussed by Croizat in Occ. Pap. Bishop Mus. **18**: 71. 1944, includes *Cleidion vieillardi* var. *viticnsis* Muell. Arg. (in DC. Prodr. **15** [2]: 986. 1866) and *Cleidion degeneri* Croizat (in Sargentia **1**: 51. 1942).

Mappa macrophylla A. Gray ex Seem. in Bonplandia **9**: 258, nomen. 1861 = *Macaranga macrophylla* Muell. Arg. in DC. Prodr. **15** (2): 1001. 1866 = *Tanarius macrophyllus* Kuntze, Rev. Gen. Pl. **2**: 620. 1891 = **Endospermum macrophyllum** (Muell. Arg.) Pax & Hoffm. in Pflanzenr. **63** [IV. 147. VII]: 418. 1914.

ACALYPHA L.

The taxonomic difficulties inherent in *Acalypha* throughout its vast range are realized by all who have attempted identifications in the genus; Croizat (in Occ. Pap. Bishop Mus. **18**: 69–71. 1944) has discussed the Fijian species and has concluded that Mueller and Pax & Hoffmann applied too narrow a specific concept in their considerations of these species. With this conclusion one must definitely agree. Croizat acknowledges the specific identity of *A. boehmerioides*, *A. grandis*, *A. rivularis*, and presumably *A. wilkesiana*, although the last is not discussed. The remaining six species (and their varieties) accredited to Fiji are combined by Croizat under *A. insulana*, with the implication that varietal categories might later prove useful.

Examination of a considerable accumulation of herbarium material of the *A. insulana* complex convinces me that natural populations, marked by reasonable discontinuities, exist in Fiji. These populations are certainly neither very stable nor readily definable, and probably they are inter-fertile, but I am loath to identify the various extreme forms as *A. insulana* without further stipulation. Characters pertaining to leaf-size and shape and to inflorescence-details appear too variable to be taxonomically very useful. However, degree and type of indument are comparatively stable, and on this basis one can recognize two primary patterns, here accepted as the species *A. insulana* and *A. repanda*. Within each of these, populations of reasonable constancy can be observed, here designated as varieties. Apart from the species mentioned above, a very distinct novelty is here described as *A. amplexicaulis*.

With the exception of *A. boehmerioides*, an introduced species, all the taxa occurring in Fiji fall into Series III.H (*Pantogynae-Pleurogynae*) of subgenus *Euacalypha* (now to be known as subgenus *Acalypha*) in the system of Pax & Hoffmann (in Pflanzenr. **85** [IV. 147. XVI]: 13. 1924). In that treatment one of the Fijian species, *A. laevifolia*, is placed in Series III.G (*Oligogynae*), which has bisexual inflorescences. However, type material of *A. laevifolia* seems to have unisexual inflorescences, although rarely (as also in *A. amplexicaulis*) one or two sterile bracts of a pistillate type occur toward the base of the staminate inflorescence; this, however, does not indicate that the inflorescences are bisexual. All of the indigenous Fijian species appear to have unisexual inflorescences and to be characteristically monoecious; usually both staminate and pistillate inflorescences occur on the same plant, but in herbarium specimens one frequently receives the impression that the plants are dioecious. The occurrence or lack of stalked glands on the pistillate bracts does not seem to be significant in the Fijian population.

Key to the species

Inflorescences bisexual, the distal flowers ♂; low annuals, the leaves with slender petioles 1–6 cm. long and submembranaceous ovate blades usually 3–7 cm. long. . . . . 1. *A. boehmerioides*.

Inflorescences unisexual; ♀ spikes cylindric, the bracts dentate; shrubs or trees.

Leaf-blades comparatively broad, less than twice as long as broad, palmate-nerved, the 2 or 4 basal lateral nerves conspicuous, spreading, the distal pair of these with several spreading tertiary nerves on the basal side, the costa with spreading lateral nerves.

Petioles usually 6–12 (rarely 4–25) cm. long, not flattened at apex, the leaf-blades often cordate at base, sometimes rounded or obtuse. . . . . 2. *A. grandis*.

Petioles 1–5 cm. long, often flattened and broadened at base of blade, the leaf-blades usually broadly obtuse at base (or subcordate in f. *circinata*), often reddish- or purple-maculate. . . . . . 3. *A. wilkesiana*.

Leaf-blades variously shaped, 2 or more times as long as broad, pinnate-nerved, the basal secondaries not prominent nor with obvious basally directed tertiary nerves.

Leaves obviously petiolate, not amplexicaul.

Leaf-blades narrowly obovate-lanceolate or subspatulate, 10–31 × 2–5.5 cm. (5–6 times as long as broad), gradually narrowed to an abruptly truncate or subcordate base, the petioles 0.5–3.5 cm. long. . . . . 4. *A. rivularis*.

Leaf-blades lanceolate to ovate or elliptic, 2–4 times as long as broad, subcordate to acute at base but not gradually narrowed and abruptly truncate, the petioles (0.5–) 1–7 cm. long.

Indument of young branchlets usually copious, spreading-pilose, the hairs 0.2–1.2 mm. long and usually concealing the surface of distal internodes; petioles pilose like young branchlets, the hairs 0.3–1.2 mm. long; leaf-blades often spreading-pilose on both surfaces or at least with an obvious indument on costa of lower surface; rachis of ♂ and ♀ inflorescence usually copiously puberulent or spreading-pilose, the ♂ perianth strigose-puberulent; ♀ bracts usually spreading-pilose, rarely glabrate, the ovary and fruit copiously strigose or spreading-pilose with hairs 0.2–0.5 mm. long (essentially glabrous only in var. *subvillosa*). . . 5. *A. insulana.*

Indument of young branchlets comparatively close, strigose or puberulent, the hairs 0.05–0.2 mm. long, often not obscuring the surface of distal internodes; petioles pilose like young branchlets, usually soon glabrate; leaf-blades essentially glabrous above and often beneath, sometimes spreading-pilose on costa or barbellate in nerve-axils beneath, rachis of ♂ and ♀ inflorescence often glabrous, sometimes puberulent or spreading-pilose, the ♂ perianth puberulent or glabrous; ♀ bracts often glabrous, sometimes strigose, the ovary and fruit strigose-puberulent (hairs 0.1–0.3 mm. long) or glabrous. . . . . 6. *A. repanda.*

Leaves appearing subsessile, the petioles 1–4 mm. long, the blades deeply cordate at base and amplexicaul. . . . . 7. *A. amplexicaulis.*

1. **Acalypha boehmerioides** Miq. Fl. Ind. Bat. Suppl. **1**: 459. 1860; Muell. Arg. in DC. Prodr. **15** (2): 871. 1866; Seem. Fl. Vit. 226. 1867; Pax & Hoffm. in Pflanzenr. **85** [IV. 147. XVI]: 96. 1924.

Acalypha hispida sensu Benth. in Hook. Lond. Jour. Bot. **2**: 232. 1843, non Burm.

DISTRIBUTION: A widespread species throughout parts of the Old World tropics, growing sparsely in Fiji as a weed. The type was collected on Bangka, east of Sumatra, presumably by W. S. Kurz under the fictitious name of "J. Amann" (cf. van Steenis-Kruseman in Fl. Males. I. **1**: 305. 1950, for discussion of Kurz's Bangka collection). The Pacific material is referred to var. *genuina* in the Pflanzenreich, but this will become var. *boehmerioides* if infraspecific taxa are maintained.

VITI LEVU: *Seemann 389* (BM, GH, K); Rewa: Nukulau Island, *Barclay* (K), *5449* (BM). Fiji, without definite locality: *U. S. Expl. Exped.* (US 66219).

2. **Acalypha grandis** Benth. in Hook. Lond. Jour. Bot. **2**: 232. 1843; Seem. Fl. Vit. 224. 1867.

Acalypha grandis var. *genuina* Muell. Arg. in Linnaea **34**: 10. 1865, in DC. Prodr. **15** (2): 806. 1866; Pax & Hoffm. in Pflanzenr. **85** [IV. 147. XVI]: 150. 1924.

Acalypha consimilis Muell. Arg. in DC. Prodr. **15** (2): 807. 1866; Seem. Fl. Vit. 225. 1867.

Ricinocarpus consimilis Kuntze, Rev. Gen. Pl. **2**: 617. 1891.

Ricinocarpus grandis Kuntze, Rev. Gen. Pl. **2**: 618. 1891.

Distribution: In the Pflanzenreich this species is assigned a wide distribution in Malaysia and the Pacific; in Fiji it has been collected on several of the smaller islands and doubtless it also occurs along the coasts of the large islands. It is typically found in coastal or lowland thickets, usually near sea-level but sometimes up to 200 m. elevation, as a shrub or small tree 1.5–5 m. high, with reddish to lavender styles; a local name of *kalatimbuthi* was applied to it on Vanua Mbalavu. Our specimens belong to "var. *genuina*," which becomes var. *grandis* under present nomenclatural procedure. As cotypes, Bentham cites Fijian collections of Hinds and Barclay, cited below, and also a Barclay specimen from Amboina. The type of *A. consimilis* is an Exploring Expedition specimen from Fiji, of which duplicates are here cited; the reduction of this entity to synonymy by Pax & Hoffmann seems unquestionable.

Viti Levu: Rewa: Nukulau Island, *Barclay* (BM, K cotype), *3452* (BM), *Tothill 748* (K). Vanua Levu: Mathuata or Thakaundrove: Undu Point, *Tothill 691* (Bish, K). Moala: *Bryan 296* (Bish). Matuku: *Bryan 289* (Bish). Vanua Mbalavu: Central volcanic section, near Lomaloma, *Smith 1407* (Bish, K, NY). Thikombia: *Tothill 705* (Bish, K). Lakemba: *Tothill 704* (K). Kambara: *Moore 48* (US), *Tothill 706* (K). Fiji, without definite locality: *Hinds* (K cotype), *U. S. Expl. Exped.* (type coll. of *A. consimilis*, GH, US 1944713), *U. S. Expl. Exped.* (GH, US 66220).

3. **Acalypha wilkesiana** Muell. Arg. in DC. Prodr. **15** (2): 817. 1866.

Distribution: According to the Pflanzenreich treatment, *A. wilkesiana* has a wide distribution as a cultivated plant, and apparently it is known only in cultivation in Fiji. The type is an Exploring Expedition specimen from Fiji, of which duplicates are here cited. Several horticultural forms have been recognized, of which only f. *circinata*, in addition to the typical form, occurs in Fiji. As cotypes of f. *circinata*, Mueller cites specimens of Seemann and the Exploring Expedition, but I have not located any Seemann collection representing this form. In Fiji the species is a shrub, cultivated under the name of *kalambuthi ndamundamu* (*kalambuthi* being generic for *Acalypha* and the adjective referring to the reddish leaves). In Ra, according to Degener, both the local forms are known as *ruru* and the leaves are used medicinally.

Key to the forms

Leaf-blades ovate or ovate-elliptic, (6–) 12–25 cm. long, (4–) 9–19 cm. broad, broadly obtuse or sometimes rounded at base, obtusely cuspidate at apex. .... 3a. f. *wilkesiana*.

Leaf-blades suborbicular or reniform or broadly ovate, 3–11 cm. long and broad, subcordate at base, often rounded at apex, somewhat flabellinerved. .... 3b. f. *circinata*.

3a. **Acalypha wilkesiana f. wilkesiana**

Acalypha wilkesiana Muell. Arg. in DC. Prodr. **15** (2): 817. 1866; Seem. Fl. Vit. 225. *pl. 58*. 1867; Pax & Hoffm. in Pflanzenr. **85** [IV. 147. XVI]: 153. 1924; Degener, Fl. Haw. **2**: Fam. 190. *fig.* 1934.

Acalypha tricolor Hort. ex Seem. Fl. Vit. 225, as synonym. 1867.

Ricinocarpus wilkesianus Kuntze, Rev. Gen. Pl. **2**: 618. 1891.

Viti Levu: Ra: Rewasa, near Vaileka, *Degener 15445* (A); Namosi: Nanggara Island, *H. B. R. Parham 276* (BM). Taveuni: Somosomo, *Seemann*

392 in part (BM, GH, K). Fiji, without definite locality: *U. S. Expl. Exped.* (TYPE COLL., GH., K, US 1944717 and 1944718).

3b. **Acalypha wilkesiana f. circinata** Muell. Arg. in DC. Prodr. **15** (2): 817. 1866; Pax & Hoffm. in Pflanzenr. **85** [IV. 147. XVI]: 154. 1924.

Acalypha circinata A. Gray ex Seem. Fl. Vit. 225, as synonym. 1867.

VITI LEVU: Ra: Rewasa, near Vaileka, *Degener 15444* (A, NY). OVALAU, at least in part: *U. S. Expl. Exped.* (COTYPE COLL., GH, K, US 66221).

4. **Acalypha rivularis** Seem. in Bonplandia **9**: 258, nomen. 1861; Seem. ex Muell. Arg. in Flora **47**: 439. 1864; Muell. Arg. in Linnaea **34**: 14. 1865, in DC. Prodr. **15** (2): 817. 1866; Seem. Fl. Vit. 225. 1867; Pax & Hoffm. in Pflanzenr. **85** [IV. 147. XVI]: 168. 1924.

Ricinocarpus rivularis Kuntze, Rev. Gen. Pl. 2: 618. 1891.

DISTRIBUTION: This sharply marked species is apparently endemic, being thus far known only from Viti Levu and Vanua Levu, at elevations from near sea-level up to 850 m. It is a shrub up to 2 m. in height, characteristically growing on the edges of rivers and streams where the land is inundated during freshets, sometimes with its branches and leaves trailing in the water. The long narrow leaves frequently have red nerves; the perianth-segments and stamens of staminate flowers are greenish white, or the anthers may be reddish, while the styles of pistillate flowers are usually red. Recorded local names are *kandakanda* (Navua and Namosi regions), *sotiura* or *sosotiura* (Nandrau and Navai regions), and *sasariwai* (in Mbua). The type is *Seemann 391*, cited below.

VITI LEVU: Near "Nandonga," *Horne 641* (K); Mba: Vicinity of Nandarivatu, *Degener 14286* (A, Bish, K, NY, US); valley of Nggaliwana Creek, north of the sawmill at Navai, *Smith 5382* (A, US); Nandronga & Navosa: Nandrau, *Degener 14921* (A, K, NY); Serua: Navua River at Namata, *Gillespie 3380* (Bish, GH); Serua or Namosi: "Navua and Namosi Rivers," *Seemann 391* (BM, GH, K TYPE); Namosi: Near Namuamua, on Wainikoroluva River, *Gillespie 2960* (Bish, GH); vicinity of Namosi, *Gillespie 2521* (Bish, GH, NY), *2874* (Bish, K); Naitasiri: Banks of Rewa River, *Milne 292* (K); Viria and vicinity, *Parks 20423* (Bish), *20455* (Bish); Tamavua district, *H. B. R. Parham 282* (BM); Suva Pumping Station, *Degener & Ordonez 13780* (A, Bish, K, NY, US). VANUA LEVU: Mbua: Upper Ndama River valley, *Smith 1591* (Bish, GH, K, NY, US).

5. **Acalypha insulana** Muell. Arg. in Flora **47**: 439. 1864.

Under the original publication of *A. insulana*, Mueller did not designate a type, but he proposed three varieties, *stipularis*, *pubescens*, and *glabrescens*, as varieties α, β, and γ respectively. Later, in the Prodromus, varieties *flavicans* and *villosa* were added and the order of treatment was changed. It is imperative that one of Mueller's original varieties be designated as the type variety of *A. insulana*. In the present treatment the varieties *stipularis* and *pubescens* are taken as pertaining to the same taxon, but var. *glabrescens* is treated as a synonym of *A. repanda*. Since var.

stipularis is var. *a* in Mueller's original treatment, it may justifiably be taken as the type variety of his concept; under current nomenclatural procedure the varietal epithet is to be replaced by repetition of the specific epithet. Mueller's first publication of these various names (in Flora **47.** 1864) was in a paper entitled "Neue Euphorbiaceen des Herbarium Hooker in Kew," and therefore the Kew specimens are to be taken as the actual types (or cotypes, when more than one collection was cited).

LOCAL NAMES: *Kalambuthi* and *kalatimbuthi* are used throughout Fiji to designate the genus as a whole, but perhaps they are more specifically applied to *A. insulana* and *A. repanda* than to the more obviously differentiated species.

KEY TO THE VARIETIES

Ovary and fruit obviously pilose; indument of young branchlets and petioles copious; leaf-blades often pilose on blade of lower surface as well as on costa.

Upper surface of leaf-blades sparsely pilose or glabrous, the indument less obvious than on lower surface. . . . . 5a. var. *insulana.*

Both surfaces of leaf-blades very copiously spreading-pilose with hairs 0.3–1.2 mm. long, these especially dense on costa; leaf-blades lanceolate to ovate, 7–25 × 2–10.5 cm., rounded or subcordate at base. . . . . 5b. var. *flavicans.*

Ovary and fruit glabrous; indument of young branchlets and petioles comparatively sparse, the hairs scattered, 0.5–1.2 mm. long; leaf-blades lanceolate, up to 14 × 4.5 cm., the indument usually limited to long hairs on costa and in nerve-axils of lower surface . . . . 5c. var. *subvillosa.*

5a. Acalypha insulana var. insulana

Acalypha insulana Muell. Arg. in Flora **47**: 439. 1864, in DC. Prodr. **15** (2): 818. 1866; Seem. Fl. Vit. 225. 1867; Pax & Hoffm. in Pflanzenr. **85** [IV. 147. XVI]: 165. 1924; Croizat in Occ. Pap. Bishop Mus. **18**: 70. 1944.

Acalypha insulana var. *stipularis* Muell. Arg. in Flora **47**: 439. 1864, in Linnaea **34**: 14, as *A. insula* var. *s.* 1865, in DC. Prodr. **15** (2): 818. 1866; Seem. Fl. Vit. 225. 1867; Pax & Hoffm. in Pflanzenr. **85** [IV. 147. XVI]: 166. 1924.

Acalypha insulana var. *pubescens* Muell. Arg. in Flora **47**: 439. 1864, in Linnaea **34**: 14, as *A. insula* var. *p.* 1865, in DC. Prodr. **15** (2): 818. 1866; Seem. Fl. Vit. 225. 1867; Pax & Hoffm. in Pflanzenr. **85** [IV. 147. XVI]: 166. 1924.

Acalypha insulana var. *villosa* Muell. Arg. in DC. Prodr. **15** (2): 818. 1866; Seem. Fl. Vit. 225. 1867; Pax & Hoffm. in Pflanzenr. **85** [IV. 147. XVI]: 166. 1924.

Acalypha latifolia Muell. Arg. in DC. Prodr. **15** (2): 817. 1866; Seem. Fl. Vit. 225. 1867; Pax & Hoffm. in Pflanzenr. **85** [IV. 147. XVI]: 167. 1924.

Acalypha stipularis Engl. in Bot. Jahrb. **7**: 462. 1886.

Ricinocarpus insulanus Kuntze, Rev. Gen. Pl. **2**: 618. 1891.

Ricinocarpus latifolius Kuntze, Rev. Gen. Pl. **2**: 618. 1891.

DISTRIBUTION: The typical variety of *A. insulana,* at least as here interpreted to include var. *pubescens,* is accredited to New Guinea as well as to Fiji by Pax

& Hoffmann. The limits of the range of neither the species nor the variety can at this time be stated, but it seems likely that *A. insulana* in its typical form occurs throughout the island-groups from Fiji to New Guinea, and perhaps farther in each direction. Fortunately for nomenclatural purposes, all the type collections involved are Fijian. In our region this variety is characteristic of lowland thickets, woods, and dry forests, occurring most commonly near sea-level but sometimes up to 600 m. elevation. It is a shrub or rarely a tree, 1–7 m. in height, with greenish yellow staminate flowers and with styles that are at first white, becoming red.

Type material of the three varieties here combined under var. *insulana* is cited below. Two of the specimens involved in this typification are *Seemann 392* and *393*, which are composed of material from different plants and are therefore always cited "in part." Cotype collections of the three varieties were originally designated as follows: var. *stipularis*, *Harvey*, *Seemann 392* and *393*, both in part; var. *pubescens*, *Seemann 393* in part, *Milne 169* and *265*; var. *villosa*, *Vieillard 52* in the herbarium of Lenormand [University of Caen, France], *U. S. Exploring Expedition*. The type of *A. latifolia* is an Exploring Expedition specimen; this differs from more typical material in its sparser indument and in having its leaf-blades obovate-elliptic and obtuse to subacute at base, but its basic characters are those of *A. insulana*.

VITI LEVU: "Wainiloa River," *Horne* (K); without detailed locality, *H. B. R. Parham 245a* (BM), *397* (BM); Mba: General vicinity of Lautoka, *Degener & Ordonez 13722* (A, Bish, K, NY, US), *Degener 14989* (A, Bish, K, NY, US), *Greenwood 235A* (A); slopes of the escarpment north of Nandarivatu, *Smith 6067* (A, US); Nandronga & Navosa: Singatoka, *Greenwood* (Coll. *H. Phillips*) *775* (K). OVALAU: *U. S. Expl. Exped.* (COTYPE COLL. of *A. insulana* var. *villosa*, GH, US 66222), *U. S. Expl. Exped.* in part (GH, US 66223), *Milne 265* (K COTYPE of *A. insulana* var. *pubescens*); Lovoni Valley, *Horne 172* (K); vicinity of Levuka, *Parks 20499* (Bish), *Gillespie 4534* (Bish). KANDAVU: Namalata Isthmus region, *Smith 27* (Bish, GH, K, NY, US), 190 (Bish, GH, K, NY, US); hills above Namalata and Ngaloa Bays, *Smith 106* (Bish, GH, K, NY, US). VANUA LEVU: *U. S. Expl. Exped.* (GH); Mathuata: Southern base of Mathuata Range, north of Natua, *Smith 6786* (A, US); Mt. Numbuiloa, east of Lambasa, *Smith 6538* (A, US); Thakaundrove: Hills south of Nakula Valley, *Smith 335* (Bish, K, NY). TAVEUNI: Vicinity of Waiyevo, *Gillespie 4624* (Bish, GH, NY); vicinity of Wairiki, *Gillespie 4640* (Bish, GH, K). KORO: Eastern slope of main ridge, *Smith 1001* (Bish, K, NY). NGAU: *Milne 169* in part (K COTYPE of *A. insulana* var. *pubescens*). KAMBARA: Limestone formation: *Smith 1252* (Bish, GH, K, NY, US). Fiji, without definite locality: *Harvey* (BM, GH, K COTYPE of *A. insulana* var. *stipularis*), *U. S. Expl. Exped.* (TYPE COLL. of *A. latifolia*, GH), *U. S. Expl. Exped.* (US 66224), *Seemann 392 in part* (BM, GH, K COTYPE of *A. insulana* var. *stipularis*), *393* in part (BM, GH, K COTYPE of *A. insulana* var. *stipularis*), *393* in part (BM, GH, K COTYPE of *A. insulana* var. *pubescens*), *Horne* (K), *65* (K).

5b. **Acalypha insulana** var. **flavicans** Muell. Arg. in DC. Prodr. 15 (2): 818. 1866; Seem. Fl. Vit. 225. 1867; Pax & Hoffm. in Pflanzenr. 85 [IV. 147. XVI]: 166. 1924.

DISTRIBUTION: Known from a few scattered localities in Fiji at low elevation (up to 500 m.), occurring as a shrub in thin forest, with pink styles (*Smith 6803*, the only specimen with data). The type is an Exploring Expedition specimen from Ovalau.

VITI LEVU: Namosi: Vicinity of Namosi, *Gillespie 2830* (Bish). OVALAU: *U. S. Expl. Exped.* (TYPE COLL. GH, US 66225); vicinity of Levuka, *Gillespie 4402* (Bish, GH). VANUA LEVU: Mathuata: Southern base of Mathuata Range, north of Natua, *Smith 6803* (A, US).

The very densely long-pilose upper surfaces of the leaf-blades distinguish this taxon from the typical variety, but its value as a discrete entity is open to question.

5c. **Acalypha insulana** var. **subvillosa** (Muell. Arg.) comb. nov.

Acalypha anisodonta Muell. Arg. in DC. Prodr. **15** (2): 818. 1866; Seem. Fl. Vit. 226. 1867; Pax & Hoffm. in Pflanzenr. **85** [IV. 147. XVI]: 167. 1924.

Acalypha anisodonta var. *subvillosa* Muell. Arg. in DC. Prodr. **15** (2): 819. 1866; Seem. Fl. Vit. 226. 1867; Pax & Hoffm. in Pflanzenr. **85** [IV. 147. XVI]: 167. 1924.

Ricinocarpus anisodontus Kuntze, Rev. Gen. Pl. **2**: 617. 1891.

DISTRIBUTION: Known with certainty only from Ovalau, Fiji. In proposing the species *A. anisodonta*, Mueller did not designate a type of the binomial, but his variety α was var. *subvillosa*, based on an Exploring Expedition specimen from Ovalau. The disposition of the binomial therefore depends upon the placing of var. *subvillosa*. Mueller's second variety, var. *subsericea*, appears to me essentially similar to typical specimens of *A. repanda*, discussed below.

OVALAU: *U. S. Expl. Exped.* (TYPE COLL., GH), *Milne 256* (K).

The variety has the long spreading hairs on the branchlets that are typical of *A. insulana* var. *insulana*, but they are comparatively scattered, while the indument on other parts of the plant, notably the ovary, is very sparse or lacking. It seems likely that this taxon represents a hybrid form between *A. insulana* var. *insulana* and *A. repanda*. Another specimen that may also belong here, although its indument is even more sparse than that of the type, is *Greenwood 1079* (A, US) (Viti Levu: Mba: Mt. Evans Range, alt. about 1050 m.).

6. **Acalypha repanda** Muell. Arg. in Flora **47**: 439. 1864.

The entity here recognized as *A. repanda* differs primarily from *A. insulana* in its much closer and usually sparser indument. While the division of this entire population (*A. insulana* sensu Croizat in Occ. Pap. Bishop Mus. **18**: 70. 1944) into two parts may seem arbitrary, there is seldom doubt as to the position of material. In *A. insulana*, as here defined, the hairs of the young branchlets and petioles are conspicuous and spreading, frequently exceeding 0.5 mm. in length; in *A. repanda*, on the contrary, the indument of the young branchlets and petioles, if present at all, is very close, with often appressed hairs of insignificant length (up to 0.2 mm.). The pubescence of other parts of the plant (leaf-blades, inflorescences, perianth, ovary, etc.) correspondingly tends to be longer and denser in *A. insulana* than in *A. repanda*. The extremes of this complex as to indument, e. g. *A. insulana* var. *flavicans* and *A. denudata*, are so diverse that one hesitates to place them in the same species if any other expedient can be found. The treatment here proposed, unsatisfactory as it is, at least permits the recognition of two major groups of forms.

Acalypha repanda is essentially as variable in leaf-form and size as *A. insulana*, but it is here rather arbitrarily divided into two varieties, based primarily upon leaf-size and degree of pubescence.

LOCAL NAME: *Kalambuthi* is used throughout Fiji for this species.

KEY TO THE VARIETIES

Petioles 1–6.5 (–8) cm. long, the blades 9–23 × 3–10 cm. or rarely larger, usually with 8–12 pairs of secondaries, the apex up to 20 mm. long; young branchlets and sometimes petioles usually puberulent or very closely tomentellous, the surfaces often obscured by the indument; ovary and young fruits often copiously strigose with hairs 0.1–0.4 mm. long (fruits at length subglabrate) . . . . 6a. var. *repanda*.

Petioles 0.5–3.5 cm. long, the blades (4–) 5–14 × 1.5–6 cm., with 6–10 pairs of secondaries, the apex 5–15 mm. long; young branchlets and petioles obscurely puberulent or strigose (hairs not obscuring the surfaces), soon glabrate; ovary and fruits sparsely strigose-puberulent with hairs 0.1–0.2 mm. long or glabrous . . . . 6b. var. *denudata*.

6a. Acalypha repanda var. repanda

Acalypha repanda Muell. Arg. in Flora **47**: 439. 1864, in Linnaea **34**: 14. 1865, in DC. Prodr. **15** (2): 819. 1866; Seem. Fl. Vit. 226. 1867; Pax & Hoffm. in Pflanzenr. **85** [IV. 147. XVI]: 167. 1924.

Acalypha insulana var. *glabrescens* Muell. Arg. in Flora **47**: 439. 1864, in DC. Prodr. **15** (2): 818. 1866; Seem. Fl. Vit. 226. 1867; Pax & Hoffm. in Pflanzenr. **85** [IV. 147. XVI]: 166. 1924.

Acalypha anisodonta var. *subsericea* Muell. Arg. in DC. Prodr. **15** (2): 819. 1866; Seem. Fl. Vit. 226. 1867; Pax & Hoffm. in Pflanzenr. **85** [IV. 147. XVI]: 167. 1924.

Ricinocarpus repandus Kuntze, Rev. Gen. Pl. **2**: 618. 1891.

Acalypha insulana var. *stipularis* sensu Gibbs in Jour. Linn. Soc. Bot. **39**: 169. 1909, non Muell. Arg.

DISTRIBUTION: As here interpreted, the typical variety of *A. repanda* has a range of Samoa to New Guinea, or at least this is the range attributed by Pax & Hoffmann to *A. insulana* var. *glabrescens*, which variety as to its nomenclaturally typical element is here considered a synonym of *A. repanda*. In Fiji this variety occurs from sea-level up to an elevation of 1150 m., in thickets, woods, or various types of forest. The specimens are recorded as shrubs or small trees, up to 5 m. in height; the staminate perianth is yellowish green to red, and the styles become red. I have noted individuals growing side by side (my nos. *5132* and *5133*) with yellowish and red perianths respectively, although no other differences can be detected.

Type material of the entities here combined, cited below, was originally designated as follows: *A. repanda*, *Harvey* in herb. Kew; *A. insulana* var. *glabrescens*, *Seemann 393* in part, *Milne*, and *Wilkes* (i. e. U. S. Exploring Expedition), all in herb. Kew; *A. anisodonta* var. *subsericea*, *U. S. Exploring Expedition* (holotype presumably in De Candolle Herbarium).

VITI LEVU: Mba: General vicinity of Lautoka, *Greenwood 234* (K), *235* (K), *1092* (A), *Degener & Ordonez 13721* (A, Bish, K, NY, US); vicinity of Nandarivatu, *Gillespie 4371* (A, Bish, US); Nauwanga, *Degener 14482* (A, Bish, K, NY, US), *14626* (A, Bish, K, NY, US), *14690* (A, Bish, K, NY, US); near Navai, *Gibbs 787* (GM); Ngglaiwana Creek near Nambuyasa, *Gillespie 4138* (A, Bish); western and southern slopes of Mt. Tomanivi, *Smith 5132* (A, US), *5133* (A, US), *5746* (A, US); vicinity of Tumbenasolo, *Smith 4613* (A, US); Nandronga & Navosa: *H. B. R. Parham 245b* (BM); Singatoka River at Nandrau, *Horne 1001* (K); northern portion of Rairaimatuku Plateau, *Smith 5425* (A, US); Serua: Mbuyombuyo, near Namboutini, *Tabualewa 15564* (A, Bish, K, NY, US); Namosi: Vicinity of Namosi, *Gillespie 2517* (Bish); Naitasiri: Waindina River basin, *MacDaniels 1033* (Bish); Waindra Creek, *Tothill 728* (K); 9 miles from Suva, *Meebold 17037* (K); Kalambo, *Tothill 735* (K); Nasinu, *Tothill 749* (K). OVALAU: *U. S. Expl. Exped.* (TYPE COLL. of *A. anisodonta* var. *subsericea*, GH); vicinity of Levuka, *Gillespie 4464.5* (Bish). KANDAVU: *Tothill 692* (K); Mt. Mbuke Levu, *Smith 211* (Bish, GH, K, NY, US). VANUA LEVU: Thakaundrove-Mathuata boundary: Crest of Korotini Range, *Smith 543* (Bish, GH, K, NY, US); Thakaundrove: Southern slope of Korotini Range, *Smith 516* (Bish, GH, K, NY, US): Savu Savu Bay region, *Degener & Ordonez 13953* (A, NY), *14025* (A, Bish, K, NY, US). TAVEUNI: Somosomo, *U. S. Expl. Exped.* (COTYPE COLL. of *A. insulana* var. *glabrescens*, GH). NAIRAI: *Milne 179* (K COTYPE of *A. insulana* var. *glabrescens*), *182* (K COTYPE of *A. insulana* var. *glabrescens*). NGAU: *Milne 169* in part (K). MATUKU: *Milne 129* (K COTYPE of *A. insulana* var. *glabrescens*). Fiji, without definite locality: *Harvey* (BM, GH, K TYPE of *A. repanda*), *Milne 46* (K), *417* (K COTYPE of *A. insulana* var. *glabrescens*), *Seemann 393* in part (BM, K COTYPE of *A. insulana* var. *glabrescens*), *Horne* (GH), *90a* (K), *145* (K), *331* (K), *Yeoward 12* (K), *Gillespie 2529* (A, Bish).

Type material of the three entities here combined under *A. repanda* var. *repanda* does not seem significantly to differ. The indument on the branchlets and petioles of *A. insulana* var. *glabrescens* is perhaps slightly the densest and most persistent, but the hairs composing it are minute as contrasted with those of *A. insulana*. Type collections of *A. repanda* and *A. anisodonta* var. *subsericea*, scarcely distinguishable from one another, have in contrast a fugacious indument, long petioles, and lanceolate leaf-blades that are rounded or subcordate at base.

Some of the upland specimens cited above, from the interiors of the large islands, differ from typical lowland *A. repanda* in their more robust branchlets, somewhat shorter petioles, and thicker leaf-blades with more obvious marginal crenations and a tendency toward being acute at base. However, no basic characters seem to separate these from typical material, all the mentioned characters being highly variable.

6b. **Acalypha repanda** var. **denudata** (Muell. Arg.) comb. nov.

Acalypha denudata Muell. Arg. in DC. Prodr. **15** (2): 819. 1866; Seem. Fl. Vit. 226. 1867; Pax & Hoffm. in Pflanzenr. **85** [IV. 147. XVI]: 167. 1924.
Acalypha laevifolia Muell. Arg. in DC. Prodr. **15** (2): 853. 1866; Seem. Fl. Vit. 226. 1867; Pax & Hoffm. in Pflanzenr. **85** [IV. 147. XVI]: 112. 1924.
Ricinocarpus denudatus Kuntze, Rev. Gen. Pl. **2**: 617. 1891.
Ricinocarpus laevifolius Kuntze, Rev. Gen. Pl. **2**: 618. 1891.

Acalypha insulana var. *glabrescens* sensu Gibbs in Jour. Linn. Soc. Bot. **39:** 169. 1909, non Muell. Arg.

Acalypha repanda sensu Gibbs in Jour. Linn. Soc. Bot. **39:** 170. 1909, non Muell. Arg.

DISTRIBUTION: The smaller-leaved and earlier glabrate variety of *A. repanda*, here designated as var. *denudata*, has been recorded (as the two species concerned in the synonymy) only from Fiji. It occurs on several of the islands at elevations up to 1120 m., on open hillsides or in woods or various types of forest. The specimens were taken from compact or slender shrubs or trees 1–5 m. high, the staminate perianth being greenish white to pale yellow or pink-tinged and the styles pale pink to red. This variety is characteristic of the comparatively dry hills of Mathuata Province, and it also occurs freely in the uplands of Viti Levu.

Two species are concerned in the synonymy listed above, each without varieties and each typified by a single Exploring Expedition collection. Although Mueller did not mention localities for these collections, data on the available duplicates show that they both came from Vanua Levu.

VITI LEVU: *Graeffe 30* (BM); Mba: Mt. Evans Range, *Greenwood 1242* (US); Korovou, east of Tavua, *Degener 14955* (A, Bish, K, NY, US); slopes of the escarpment north of Nandarivatu, *Gibbs 709* (BM), *Tothill 733* (K), *Smith 6036* (A, US); vicinity of Nandarivatu, *Gibbs 589 bis* (BM), *590* (BM, K), *656* (K), *Parks 20558* (Bish), *Gillespie 3715* (Bish, GH, NY), *Tothill 746* (K), *Degener & Ordonez 15541* (A, Bish, K, NY, US), *Vaughan 3385* (BM); slopes and summit of Mt. Nanggaranambuluta [Lomalangi], *Gillespie 3395* (Bish), *4339* (Bish, GH, K, NY), *Degener & Ordonez 15546* (A, Bish, K, NY, US), *Smith 5679* (A, US), *6314* (A, US); ridge between Mt. Nanggaranambuluta and Mt. Namama, *Smith 5005* (A, US); Serua: Navua River at Namata Rapids, *Gillespie 2949* (Bish); Namosi: Mt. Naitarandamu, *Gillespie 3365* (Bish); Nanggarawai village on Wainikoroluva River, *Gillespie 3224* (Bish, GH); vicinity of Namosi, *Gillespie 2839* (A, Bish, GH), *2868* (A, Bish); between Namuamua and Namosi, *Gillespie 2955* (Bish, GH), *3057* (Bish, GH, K, US); Rewa: Vicinity of Suva, *Meebold 17066* (Bish). OVALAU: Vicinity of Levuka, *Parks 20488* (Bish), *20490* (Bish). WAKAYA (?): *Milne 324* (K). VANUA LEVU: *U. S. Expl. Exped.* (TYPE COLL. of *A. laevifolia*, GH, US 1944715); Mathuata: *U. S. Expl. Exped.* (TYPE COLL. of *A. denudata*, GH, US 1944714); Seanggangga Plateau, vicinity of Natua, *Smith 6751* (A, US); slopes and summit of Mt. Numbuiloa, east of Lambasa, *Smith 6371* (A, US), *6528* (A, US), *6544* (A, US), *6547* (A, US).

The two concepts which are here combined as a variety of *A. repanda* are separable from one another only in matters of minute degree; *A. denudata* is characteristically (as occurring in Mathuata) entirely glabrous as to its inflorescence-rachis, perianth, and ovary, whereas *A. laevifolia* usually has these parts strigose or faintly puberulent. In some cases it is difficult to separate the cited specimens from var. *repanda*, but in general the two varieties I propose to retain under *A. repanda* are reasonably recognizable.

7. **Acalypha amplexicaulis** sp. nov.

Frutex monoicus ad 2 m. altus partibus juvenilibus et interdum bracteis

♀ parce pilosis exceptis ubique glaber, stipulis lanceolatis 4–5 mm. longis caducis, ramulis gracilibus teretibus pallide brunneis; foliis valde amplexicaulibus, petiolis leviter canaliculatis 1–4 mm. longis, laminis chartaceis in sicco supra viridibus subtus nervis subrubris, lanceolatis, 7–15 cm. longis, 2–4 cm. latis, basi sinu ad 1.5 cm. profunde cordatis et auriculatis, ad apicem acutum vel calloso-mucronulatum gradatim angustatis, margine crenulatis (crenationibus 1 vel 2 per centimetrum saepe incrassatis), pinnatinerviis, costa supra elevata subtus prominente, nervis secundariis utrinsecus 8–12 utrinque elevatis, 3–5 paribus infimis e basi laminae radiatis, aliis patentibus curvatis, rete venularum supra plano vel immerso subtus prominulo; inflorescentiis unisexualibus axillaribus solitariis gracilibus, superne ♀, inferne ♂; inflorescentiis ♂ sub anthesi 7–13 cm. longis, pedunculo ad 4 cm. longo, rhachi inferne bracteas ♀ steriles 1 vel 2 interdum gerente, bracteis ♂ deltoideis subacutis 2–3 mm. longis, internodiis sub anthesi 3–5 mm. longis, floribus ad 10 in fasciculis aggregatis sed mox caducis, pedicellis gracilibus circiter 0.5 mm. longis; perianthii lobis deltoideis ad 0.8 mm. longis, staminibus 8, filamentis et antherae loculis pendulis circiter 0.3 mm. longis; inflorescentiis ♀ quam ♂ paullo brevioribus longe pedunculatis, internodiis spicarum longis, bracteis reniformibus 4–6 mm. latis interdum distaliter parce pilosis (pilis ad 0.4 mm. longis) plerumque glabris glandulas stipitatas numerosas margine vel intus marginem versus saepe gerentibus, 7–11-denticulatis, dentibus subacutis apice rubro-callosis; sepalis 3 deltoideis acutis 0.7–0.8 mm. longis, ovario glabro, stylis ad 5 mm. longis pinnatim 8–10-lacinulatis.

VITI LEVU: Mba: Northern portion of Mt. Evans Range, between Mt. Vatuyanitu and Mt. Natondra, alt. 700–900 m., May 9, 1947, *Smith 4300* (A TYPE, US) (*timbothe*; shrub 2 m. high, in crest thickets).

The new species is unique in our region for its deeply cordate and amplexicaul subsessile leaves, and it is further characterized by its strikingly glabrous habit. In Pax & Hoffmann's key it seems closest to *A. denudata* (here treated as *A. repanda* var. *denudata*), which is perhaps its closest relative, but the distinguishing foliar characters of *A. amplexicaulis* are very pronounced.

ENDOSPERMUM Benth.

Endospermum robbieanum A. C. Sm. in Bishop Mus. Bull. **141**: 82. *fig. 42*. 1936.

VANUA LEVU: Mathuata: Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, alt. 100–200 m., *Smith 6716* (A, US) (freely branched tree 10 m. high, in patches of forest in open rolling country).

The second known collection of the species, obtained not far from the type locality (Wainunu River region near south coast of Vanua Levu), agrees excellently in foliage with the type; its leaf-blades are inclined to be rounded or even faintly subcordate at base. Number *6716* bears staminate inflorescences, which are here described:

Staminate inflorescences axillary toward apices of branchlets, paniculate, at anthesis 6–8 cm. long, the peduncle 1–1.5 cm. long, the lowermost lateral branches about 1.5 cm. long; indument of peduncle, rachis, and branches copious, fulvous, the hairs many-branched from base, 0.2–0.4 mm. long; bracts broadly deltoid, obtuse, the largest about 2.5 × 4 mm., the ultimate bracteoles about 1 mm. long; flowers subsessile in glomerules of 2–4 or solitary in axils of bracteoles; calyx submembranaceous, cupuliform, at anthesis 2–2.5 mm. long and slightly broader, subentire at apex, copiously and minutely tomentellous without, glabrous within; disk carnose, irregularly angled; stamens 13–17, adnate to column usually in 2 series, exserted at anthesis, the filaments minute, the anthers 0.7–1 mm. in diameter.

DEPARTMENT OF BOTANY,
U. S. NATIONAL MUSEUM,
SMITHSONIAN INSTITUTION.

THE ARNOLD ARBORETUM DURING THE FISCAL YEAR ENDED JUNE 30, 1952

Horticulture. — As a result of the trip that the horticulturist made to Europe last spring, nearly 500 species and varieties of woody plants have been received from various places visited by him. Some of these are new to horticulture in North America, others are new to the collections of the Arnold Arboretum, and some, not new, have disappeared from our collections at some previous time. One of the interesting shipments was of 32 varieties of *Ribes*, *Philadelphus*, *Deutzia* and *Weigela* from the Proeftuin te Boskoop in Boskoop, Holland. These clones represent what the Dutch have finally agreed on as the true named clone for these varieties. They will be grown here and checked with what we have to see if they agree.

During the spring approximately 255 species and varieties have been added to living collections at the Arboretum. This includes a spring planting list of 384 plants. Also a substantial beginning has been made towards the replanting of Peter's Hill, of about 55 different varieties of crab apples which were planted there this spring as the forerunner to making this an enlarged crab apple planting, 17 of them Dr. Sax's new hybrids.

A three-hundred foot wisteria arbor was erected from white cedar wood this last winter, adjacent to the shrub collection and along the Arborway wall. This was made necessary by the increased land requirements of the Bussey Institution, on whose land the wisteria arbor was formerly located.

The collections of the Arboretum are now recorded on 106 maps. Of these 40 were rechecked last year and 18 were redrawn. Approximately 900 display labels were made and 600 machine labels were made.

Over 1,000 black and white photographs were taken, developed and enlarged to prints 5″ × 7″. This includes about 800 taken by the horticulturist while in Europe. The remainder were taken by Mr. Howard, who also was responsible for the developing and printing of the entire lot. He also made several hundred post cards, pictures of valued specimens here in the Arboretum. About 300 color pictures were taken by Mr. Howard and about 800 by the horticulturist in Europe, all of which have increased our files materially.

Two display cases have been made and equipped with fluorescent lighting to show large Echtachrome transparencies of interesting Arboretum scenes. All the pictures for these cases were taken by Mr. Howard. Each case has 20–25 large color pictures and it is hoped two more cases will be made in order to illustrate the four seasons in the Arnold Arboretum. Such a display is ideal for showing "out of season" visitors some of the beauties of the Arboretum when the plants are at their best.

During the fiscal year 328 shipments of plant materials, including 982 species and varieties, have been sent to cooperating institutions or individuals in sixteen countries. The Arboretum received 1194 species and varieties. Most of these were obtained from England and Holland as the result of Dr. Wyman's trip to Europe last year. Many were also received as seeds from Argentina and Japan. A total of 12,857 plants were successfully propagated; 153 by air layering, 9,906 by cuttings, and 2,447 by grafting or budding. Well over 600 different numbers or pans of seed were sown.

The regular number of bulletins have been published. The one on air layering has created wide interest. A résumé of this work was also published in the Journal of the Royal Horticultural Society. "Trees for American Gardens," written by the horticulturist, was published by Macmillan and Company of New York in November 1951.

Mr. Richard Fillmore left the Arboretum for a more lucrative position in commercial work, and was succeeded by Mr. Lewis Lipp as chief propagator. One of Mr. Lipp's first steps was to invite members of the Federated Garden Clubs to assist in the propagation work and to learn more about the various methods of propagation. The response was gratifying, and the program is off to a good start.

Case Estates at Weston. — A small tree demonstration plot was started last year and now contains 60 different kinds of small trees. The object is to display here in this one area some of the better small trees including both those which are generally known and unknown, so they can be compared closely for growth and habit one with the other. This has great educational value for street tree superintendents as well as those interested in planting the home grounds. In the *Ground Cover Demonstration Plot* we now have growing 125 different kinds of ground covers.

The two saran cloth houses again proved their worth during the dry summer of 1951. Plants grown in these, and hardened off properly in the early fall, seem to do far better than plants grown in the open nursery where water is difficult to obtain. It is in one of these cloth houses that we have the 239 plants which are being grown under Post Entry Quarantine regulations with the permit from the U.S.D.A. Also in the same house are the majority of plants, cuttings and grafts which have been obtained from Europe this past winter.

Much of the seed germination work of the Arboretum is being done this year — as last — at Weston. Included in the plants being tried this year are seeds collected from certain specific places in northern Honshu, Japan and also from the higher altitudes and colder, drier spots of Argentina. Some of these undoubtedly will not yield anything new or hardier, but, because they have been specifically collected in certain areas, some packets may yield plants of increased hardiness, and if this is the case it will make the entire project very worth while.

A young orchard of 38 *Malus sikkimensis* has been set out this year for the purpose of growing seeds of this rare crab apple to be used in the production of dwarfing understocks for commercial apple growers. Once the stock is widely distributed in this country, this group of trees will undoubtedly be discarded.

Approximately 82 clones of the Glenn Dale Hybrid azaleas were growing in the saran cloth houses last summer, as a test for hardiness. Because of premature cold spells prior to November 1, 1951, all clones but about a dozen were actually killed, thus proving that these plants, on the whole, are not hardy here in New England.

Experimental Horticulture. — The production of polyploid plants often results in larger flowers and more sturdy growth. Dr. Sax has found that when the artificially induced tetraploids are crossed with diploids, the resulting triploids are often even larger and more vigorous than the tetraploids. A new giant triploid *Forsythia* has been propagated for distribution, and has been named the "Farrand Forsythia" in honor of our consulting landscape gardener, Mrs. Beatrix Farrand.

Transgressive segregation in the second generation progeny of a Lonicera species hybrid has produced a promising compact low-growing bush honeysuckle. More hybrids have been obtained by crossing *Malus Sargenti* with other ornamental apple species. Most of these resemble the Sargent Crab in growth habit, but are more vigorous with larger flowers.

The use of tree lilac rootstocks as rootstocks for *Syringa vulgaris* seems to be successful in producing a tree form of the common lilac. Dwarfing rootstocks to produce small ornamental trees are being developed for apples, hawthorns, peaches and plums.

Comparative Morphology. — In the Herbarium of the Arnold Arboretum, there are collections of many strange and aberrant genera from Northern Australia, New Guinea, and adjacent areas northward into China and Japan. Professor Bailey's investigations of a succession of these genera in collaboration with Dr. A. C. Smith and others indicate that they are relics of an ancient, diversified, woody, dicotyledonous flora. A majority of them are characterized by their retention of relatively primitive internal structures. Intensive investigations of adequate collections of them promise to throw a flood of new light upon the morphological characteristics of ancestral dicotyledons and in time upon the great mystery of the origin of the flowering plants or angiosperms. During the year, Professor Bailey has made comprehensive studies of *Calyptosepalum* from Sumatra, *Nouhuysia* and *Idenburgia* from New Guinea and a new relic tree collected by Dr. Smith in Fiji. *Nouhuysia* and *Idenburgia* prove to be congeneric and Dr. Smith's plant appears to be closely related to *Calyptosepalum* which clearly does not belong in the Santalaceae. Ing. Domingo Cozzo, a Guggenheim Fellow from Argentina, is spending a year in residence in order to work with material in the slide and wood collections. Mr. Chi Ling Chen, a candidate for the doctorate, has initiated a comprehensive investigation of accumulated collections of the Sapotaceae. Professor Rhoda Garrison of Wellesley College is devoting a year to investigation of the structure and development of buds in *Magnolia, Liriodendron, Akebia* and *Pterocarya*.

The Herbarium. — During the year 6,274 specimens were mounted and inserted into the herbarium, making a total of 664,989 sheets. Incoming specimens totalled 16,236, over half of which (8,919) were received on the basis of exchange. Nearly 5,000 specimens were obtained by purchase or subsidy, and close to 2,500 were recorded as gifts. Of the total number, 6,797 specimens were Asiatic in origin, 5,906 came from the Pacific Islands and Australia, 1,020 represented European species, 563 were African, and only 1,850 originated in North America. The larger and more interesting incoming exchanges included 2,994 Malaysian specimens from the British Museum, London, 1,714 Indonesian specimens from the Herbarium Bogoriense, Bogor (Java), and 944 Soviet specimens from the V. L. Komarov Botanical Institute of the Academy of Sciences, U. S. S. R., at Leningrad. By purchase 1,287 Japanese specimens were obtained from Prof. H. Hara of Tokyo.

Outgoing specimens numbered 41,177, sent mostly as exchange to twenty-eight institutions. Of these, 5,306 specimens were sent to eleven American institutions and over 30,000 specimens to seventeen foreign institutions. Also, 5,257 mounted specimens were transferred to the Gray Herbarium. Herbarium sheets totalling 3,756 specimens were loaned by the Arboretum to workers at twenty-three institutions. Of these, twenty-six loans comprising 3,531 specimens were sent to sixteen American institutions, while twelve loans totalling 225 specimens were sent to seven foreign institutions. The thirty-four incoming loans from fifteen institutions for study by our staff members totalled 3,245 specimens. Of these, twenty-three loans totalling 2,882 specimens came from nine American institutions, and eleven loans totalling 363 specimens from six foreign institutions.

A grant of $5,000 from the Guggenheim Foundation enabled Dr. Merrill to spend six months working in Europe. Most of his time was spent at the British Museum, where he selected for the Arboretum a large number of available duplicates of the Carr New Guinea collection. He also visited the herbaria at Kew, Edinburgh, Leiden, and Brussels, obtaining critical notes on 1800 types. At Brussels he studied various authentic Roxburgh specimens in the hitherto little-known collection of that author preserved in the Martius herbarium. About fifty per cent of the approximately 1,350 specimens turned out to be isotypes. Also during the year he completed his manuscript, "William Jack's Genera and Species of Malaysian Plants." Prof. Johnston continued his work in the Asiatic Boraginaceae, completing his study of *Lithospermum* and its related genera. The pollen of the family was intensively studied and showed new and interesting characters which could be used in delimiting species. The last part of the year was spent working in the British herbaria. Dr. Kobuski continued his work on the Asiatic Theaceae and initiated work on *Adinandra* for the *Flora Malesiana*. Dr. Perry pursued her studies of the Papuasian flora, completing work on *Elatostema* and beginning the study of the Euphorbiaceae. Dr. Hu contributed two "Notes on the Flora of China," and continued her study of the genus *Philadelphus*.

The Library. — The library now has 48,098 bound volumes on its shelves, this represents an increase of 370 volumes; some were gifts, others were purchased or received in exchange for our publications. There were 197 pamphlets catalogued and filed; these were all gifts of the authors. Our pamphlet collection now numbers 15,064. Four-hundred-twenty catalogue cards were prepared, typed and filed in the main catalogue and 2,023 cards were added to the Gray Herbarium species cards.

Many inquiries of a bibliographical or biographical nature were answered as were many requests for photostats, microfilms and photo prints. About 1100 photographs were added to the collection, these mainly photographs of plants growing in the Arboretum, but many were taken by our Horticulturist on his European travels.

Four-hundred-ninety-seven books were loaned to or borrowed from other libraries.

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KARL SAX,
Director.

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1951–1952

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